Senate Graduate and Research Council

Open Session

March 17, 2025

10:30 a.m. - 1:00 p.m.

Needles Hall

NH 3318 / Virtual option

Waterloo Campus

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UNIVERSITY OF WATERLOO | Senate

2025 03 17 Senate Graduate and Research Council Meeting Book

AGENDA

	Governance Resources		
	Link to Governance Resources		
	1. Conflict of Interest		
	1.1 Conflict of Interest		4
10:30 a.m.	Consent Agenda Motion to approve or receive for information the items on the consent agenda, listed as items 2-5 below.		
	2. Minutes of January 27, 2025 Meeting		
	2.1 2025-01-27 SGRC Minutes	Decision (SGRC)	5
	3. Human Research Ethics Board [Julie Joza]		
	3.1 HREB Membership Renewal	Decision (SGRC)	8
	4. Curricular Submissions		
	4.1 Faculty of Engineering [Siva Sivoththaman]	Decision (SGRC)	9
	4.2 Faculty of Mathematics [Brian Ingalls]	Decision (SGRC)	15
	5. Update to Rules for Major Modifications – Program Name Changes		
	5.1 Memo: Update to Rules for Major Modifications – Program Name Changes [Angela Christelis]	Information	26
	Regular Agenda		
	6. Business Arising from the Minutes	Oral/Input	
10:35 a.m.	7. Chair's Remarks [Dean and Woudsma]	Information	
10:40 a.m.	8. Draft Terms of Reference for SGRC Restructuring	Discussion	
	8.1 SGRC Restructuring Report		28
	8.2 SGRC Restructuring - Draft Proposal		30
11:25 a.m.	9. Renewal of Centres & Institutes Motion: To approve the report to renew the Centre for Accounting Research and Education on behalf of Senate, as presented.		
	9.1 Guidelines for Centre/Institute Renewal	Information	42
	9.2 School of Accounting and Finance, Centre for Accounting Research and Education [Blake Phillips]	Decision (SGRC)	43
11:40 a.m.	10. Curricular Submissions		
	10.1 Faculty of Arts [Anna Esselment] Motion: To recommend that Senate approve the major	Decision (SEN-R)	96

	modifications to the PhD in Psychology, MA in English - Critical Media Studies, and MA in English - Critical Media Studies (Co-op), as presented.		
	10.2 Faculty of Engineering [Siva Sivoththaman] Motion: To recommend that Senate approve the new specialization in Future Cities for the MEng in Civil Engineering, and the new collaborative programs MEng - Civil Engineering - Health Technologies (Co-op), MEng - Electrical and Computer Engineering - Health Technologies (Co-op), and MEng - Systems Design Engineering - Health Technologies (Co-op), as presented.	Decision (SEN-R)	138
	10.3 Faculty of Environment [Peter Deadman] Motion: To recommend that Senate approve the major modifications to the Master of Climate Change (MCC), as presented.	Decision (SEN-R)	244
12:05 p.m.	11. Other Business	Oral/Input	
12:10 p.m.	12. CREATE LOI Adjudication Note: This item will move to NH 3308 for discussion. Only those members involved in the adjudication process are required to remain.	Discussion	
	13. Adjournment The next meeting will be April 7th, 2025	Oral/Input	

Excerpt from Senate Bylaw 1

8. Declarations of conflict of interest

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 GRADUATE & RESEARCH COUNCIL
Minutes of the January 27, 2025 Meeting

Present: Steven Bednarski, Sue Ann Campbell, Ashley Day (secretary), Peter Deadman, Charmaine Dean (chair), Mrittika Dreesha, Bernard Duncker, Anna Esselment, Ana Ferrer, Alison Hitchens, Abhishesh Homagain, Brian Ingalls, Julie Joza, Brian Laird, Joseph Meleshko, Ian Milligan, Marina Mourtzakis, Nicholas Pellegrino, Martin Ross, Marianne Simm, Siva Sivoththaman, Shirley Tang, Clarence Woudsma, Alfred Yu

Resources/Guests: Christine Barbeau, Laura Deakin, Maysah Eid, Adrian Gerlich, Mike Grivicic, Amir Khajepour, Justin Wan, Carrie MacKinnon Molson, Mary Power, Mirko Vucicevich

Absent: David Clausi, Robert de Loe, Neela Hassan, Carlee Ann Montgomery

Organization of Meeting: Charmaine Dean took the chair and Ashley Day acted as secretary. The secretary advised that quorum was present. The agenda was approved without formal motion.

1. CONFLICT OF INTEREST
No conflicts of interest were declared.

CONSENT AGENDA
Council heard a motion to approve or receive for information the items of the consent agenda. Milligan and Bednarski. Carried

2. MINUTES OF THE NOVEMBER 18, 2024 MEETING
Council approved the minutes of the meeting as distributed.

3. GRADUATE AWARDS
Council approved items (a)–(d) and received items (e)-(g) for information.

4. CLINICAL RESEARCH ETHICS BOARD
Council approved the new member for CREB.

5. CURRICULAR SUBMISSIONS
Council approved items 5.1-5.5 on behalf of Senate.

REGULAR AGENDA

6. BUSINESS ARISING FROM THE MINUTES
There was no business arising from the minutes.

7. CHAIR'S REMARKS
The chair welcomed Alfred Yu, Assistant Vice-President, Research and International, and Director Research Partnerships as a new member of SGRC.

Dean provided an update on the restructuring of SGRC. As previously mentioned, the Secretariat, with Dean, Dunker and Woudsma have formed a working group to conduct further research and more in-depth environmental scans into comparators of the Senate Graduate and Research Council across the U15, including direct conversations with U15 members. The working group has also been refining a proposal and draft terms of reference based on the environmental scan and best governance practices in the sector. An engagement session is currently being planned for SGRC members to provide feedback and input into the proposal. The March 17th SGRC will be extended into the lunch hour to accommodate the discussion. Any recommendations from this council will need to be heard and approved by Senate. At this time, September 1, 2025 is the likely effective date for any implementation.

Dean spoke to a number of tri-agency updates. There is discussion to create a capstone organization to bring together the three granting agencies, with plans to move forward after the fall economic statement. Progress has been delayed due to the ongoing talks of a federal election and will resume once a new government is in place. The three agencies are committed to improving collaboration across their areas, and a document outlining this will be shared with the community. A new tri-agency grant management system is being developed, which will impact the common CV format, transitioning to

a more narrative-based style. The joint committee framework for adjudicating student scholarships across all three agencies is near completion.

Woudsma spoke to the recent information on caps for enrolment and the implications for Waterloo. Colleges can now apply to the Ministry of Colleges and Universities (MCU) for applied master's programs. Conestoga is putting two programs forward, including a Master of Applied Computer Science. Waterloo has provided a letter to the MCU regarding the colleges' applications.

8. WATERLOO CENTRE FOR AUTOMOTIVE RESEARCH (WatCAR) RENEWAL

Khajepour, on behalf of WatCAR, gave a brief presentation and overview of the centre. The centre aims to position itself for changes in the industry and align with future funding opportunities. The council discussed the presentation and the renewal of the centre in camera.

A motion was heard to approve the report to renew the Waterloo Centre for Automotive Research on behalf of Senate, as presented. Campbell and Tang. Carried**.**

9. CENTRE FOR ADVANCED MATERIALS JOINING (CAMJ) RENEWAL

Gerlich, on behalf of CAMJ, presented a summary of the centre and its state of the art facilities. The overview included a highlight of the research collaborators, the strategy for the future of the centre, and the objectives related to facilities and student recruitment were discussed. The council then discussed the presentation and the renewal of the centre in camera.

A motion was heard to approve the report to renew the Centre for Advanced Materials Joining on behalf of Senate, as presented. Sivoththaman and Ferrer. Carried.

The Chair remarked that a document to guide SGRC on renewals will be brought forward for discussion at an upcoming meeting.

10. SENATE COURSE OUTLINE REPORT

Deakin and Power, with Barbeau and Vucicevich, spoke to the report and recommendations from the Course Outline Working Group. The working group was tasked with generating recommendations to improve the current course outline tool. The three recommendations proposed will allow for the inclusion of learning material costs in the course outline template, update the required list of basic elements in course outlines, and update the boilerplate text required in course outlines for accessibility and mental health supports. Deakin and Power clarified that boiler plate language related to policy can be pulled into the outline by instructors. The council noted appreciation of the choice of language related to generative AI while maintaining consistency across Faculties and its relevance to capstone considerations. Chair Dean asked that any additional questions or feedback can be shared with Mike Grivicic in the Secretariat.

Overall, the committee was in agreement with the recommendations and the Chair remarked that the item will be presented at Senate Undergraduate Council on January 28th, 2025 for recommendation to Senate.

11. CURRICULAR SUBMISSIONS

11.1 Faculty of Engineering

Sivoththaman spoke to the three proposed programs, Master of Engineering (MEng) in Chemical Engineering - Health Technologies, Master of Engineering (MEng) in Mechanical and Mechatronics Engineering - Health Technologies, and Master of Management Science (MMSc) - Health Technologies. The new programs would be based on the home department of each degree. Engineering currently has four researched based collaborative programs at the graduate level. The proposed programs will align well with the CREATE grant proposal process and there is strong alignment between research expertise and learning.

Wan commented that terminology and descriptions will need to be adjusted for the graduate academic calendar to include the list of courses.

A motion was heard to recommend that Senate approve the proposed new academic programs of MEng in Chemical Engineering - Health Technologies; MEng in Mechanical and Mechatronics Engineering - Health Technologies; MMSc - Health Technologies as presented; and, that the effective date be either May 1, 2025 or September 1, 2025. Sivoththaman and Hitchens. Carried

11.2 Faculty of Environment

Deadman introduced the major modifications for the Faculty of Environment. The School of Planning is joining the Collaborative Water Program (CWP) and is proposing a new Water program for the Doctor of Philosophy (PhD) in Planning. The dissolution of the Joint Geography program previously offered with Wilfrid Laurier University has resulted in a number of changes to the MA, MES, MSc, and PhD in Geography. The Faculty is also proposing to add a course work study option in MES in Sustainability Management program.

A motion was heard to recommend that Senate approve the following major modifications to the Doctor of Philosophy (PhD) in Planning – Water, MA in Geography, MES in Geography, MSc in Geography, PhD in Geography, MES in Sustainability Management effective 1 May 2025, as presented. Deadman and Ferrer. Carried.

11.3 Faculty of Health

Laird presented the rationale for removing the Aging and Health field from the PhD in Public Health Sciences. Laird then spoke to the proposed program changes for Master of Health Informatics (MHI). The program name is being updated to "Master of Health Informatics and Analytics" to reflect evolving industry demands and allowing for two new specializations, Health Informatics and Advanced Analytics, to addresses the need for expertise in these areas.

A motion was heard to recommend that Senate approve the following major modifications to the PhD in Public Health Sciences and Master of Health Informatics (MHI), effective 1 May 2025, as presented. Laird and Deadman. Carried

11.4 Faculty of Science

Ross presented the proposed revisions to the PhD and MSc in Biology Graduate Research Fields. The Graduate Research Fields do not reflect the current department following numerous retirements over the past 15 years and the changing names of disciplines.

A motion was heard to recommend that Senate approve the following major modifications to the PhD and MSc in Biology Graduate research fields, effective 1 May 2025, as presented. Ross and Dunker. Carried

12. OTHER BUSINESS

There was no further business.

13. ADJOURNMENT

With no further business, the meeting adjourned. The next meeting will be held on Monday, March 17, 2025 at 10:30 a.m. in NH 3318.

January 31, 2024

Ashley Day
Governance Officer
Secretariat

Memorandum

To: **Members, Senate Graduate and Research Council (SGRC)**

From: **Julie Joza, Director, Research Ethics**

Date: **February 24, 2025**

Subject: **Membership on Waterloo's Research Ethics Boards**

This memo outlines membership updates that will be taking place on Waterloo's Research Ethics Boards. This update is for consideration and approval by the Senate Graduate and Research Council.

Human Research Ethics Board (HREB)

Membership Renewal

Edwin Laryea, PhD, is a community member and looking to renew for a second term to February 28, 2028. Edwin began his term on HREB in February 2022. Edwin is an avid member of HREB representing the community perspective and championing inclusive research. He has spoken about his experiences and perspectives as a REB member at the 2023 and 2024 Canadian Association for Research Ethics Board (CAREB) conference during a workshop session and as a panelist. Edwin has also presented on inclusive research and will be keynote speaker at the 2025 CAREB conference. Edwin recently joined the Panel on Research Ethics as a community representative.

Reminder: SGRC members who wish to learn more about the qualifications or academic background and interests of the individual being nominated to the REB are encouraged to contact Julie Joza, Director, Research Ethics at jajoza@uwaterloo.ca. Julie will be pleased to discuss with SGRC members in advance of the meeting the information they may need to help support their decision to recommend the nomination of the individual in becoming a member of the REB. On behalf of the SGRC, the research ethics office retains a copy of each member's CV and expression of interest in being a REB member.

SGRC - Consent Agenda - Faculty of Engineering - March 17, 2025

Meeting Information

Agenda Page Title

SGRC - Consent Agenda - Faculty of Engineering - March 17, 2025

Career Level

Graduate

Faculty/Unit

Date

03/17/2025

Time

Location

Summary

Course Changes:

Electrical and Computer Engineering: 8 new courses and 4 course revisions

Programs & Plan Changes:

Nanotechnology: Re-labelling the Nanotechnology program courses

Other Business

Attachment(s)

- NANO Motion 19 - Motion 1 - graduate_studies_program_revision_template - Reviewed by GSPA.docx

Course Proposals

Course Proposal Details

Courses: Retire

No proposals have been added.

Courses: New

Code	Title	Type	Workflow Step
ECE 657B	Neural Networks and Deep Learning	Course	SGRC, Senate Graduate and Research Council (SGRC) | Under Review
ECE 687	Robot Dynamics & Control	Course	SGRC, Senate Graduate and Research Council (SGRC) | Under Review
ECE 732	Advanced VLSI Devices	Course	SGRC, Senate Graduate and Research Council (SGRC) | Under Review
ECE 733	Quantum Machine Learning	Course	SGRC, Senate Graduate and Research Council (SGRC) | Under Review
ECE 757A	Embodied Intelligence	Course	SGRC, Senate Graduate and Research Council (SGRC) | Under Review
ECE 774	Radio and Wireless Systems	Course	SGRC, Senate Graduate and Research Council (SGRC) | Under Review
ECE 787	Social Robotics	Course	SGRC, Senate Graduate and Research Council (SGRC) | Under Review
ECE 789	Model Predictive Control	Course	SGRC, Senate Graduate and Research Council (SGRC) | Under Review

Courses: Changes

Code	Title	Type	Workflow Step
ECE 638	Biosensing: Fundamentals and Applications	Course	SGRC, Senate Graduate and Research Council (SGRC) | Under Review
ECE 657	Introduction to Machine Learning	Course	SGRC, Senate Graduate and Research Council (SGRC) | Under Review
ECE 657A	Introduction to Artificial Intelligence	Course	SGRC, Senate Graduate and Research Council (SGRC) | Under Review
ECE 752	Foundations of Multi-agent Systems	Course	SGRC, Senate Graduate and Research Council (SGRC) | Under Review

Programs & Plans Proposals

Programs & Plans Proposal Details

Programs & Plans: Retire

No proposals have been added.

Programs & Plans: Major Modifications

No proposals have been added.

Programs & Plans: Minor Modifications

No proposals have been added.

Regulations Proposals

Regulations Proposal Details

Regulations: Retire

No proposals have been added.

Regulations: New

No proposals have been added.

Regulations: Changes

No proposals have been added.

Graduate Studies
Program Revision Template

Prior to form submission, review the content revision instructions and information regarding major/minor modifications. For questions about the form submission, contact Trevor Clews, Graduate Studies and Postdoctoral Affairs (GSPA).

Faculty: Engineering & Science

Program: Collaborative Programs in Nanotechnology:

1) Master of Applied Science (MASc) in Chemical Engineering - Nanotechnology

2) Doctor of Philosophy (PhD) in Chemical Engineering - Nanotechnology

3) Master of Applied Science (MASc) in Electrical and Computer Engineering - Nanotechnology

4) Doctor of Philosophy (PhD) in Electrical and Computer Engineering - Nanotechnology

5) Master of Applied Science (MASc) in Mechanical and Mechatronics Engineering - Nanotechnology

6) Doctor of Philosophy (PhD) in Mechanical and Mechatronics Engineering - Nanotechnology

7) Master of Applied Science (MASc) in Systems Design Engineering - Nanotechnology

8) Doctor of Philosophy (PhD) in Systems Design Engineering - Nanotechnology

9) Master of Science (MSc) in Chemistry - Nanotechnology

10) Doctor of Philosophy (PhD) in Chemistry - Nanotechnology

11) Master of Science (MSc) in Physics - Nanotechnolog

12) Doctor of Philosophy (PhD) in Physics - Nanotechnology

Program contact name(s): Mustafa Yavuz, Program Director | Annette Dietrich, Administrative Coordinator

Form completed by: Annette Dietrich

Description of proposed changes:
Note: changes to courses and milestones also require the completion/submission of the SGRC Graduate Studies Course/Milestone Form.

Re-labelling the Nanotechnology program courses.

Is this a major modification to the program? No

Rationale for change(s):

The Nanotechnology program courses are being re-labelled in all GSAC program pages for all participating departments, to better reflect the intended nature of the courses for the completion of program requirements.

Proposed effective date: Term: Spring Year: 2025

Current Graduate Studies Academic Calendar (GSAC) page (include the link to the web page where the changes are to be made):

https://uwaterloo.ca/graduate-studies-academic-calendar/engineering/department-chemical-engineering/master-applied-science-masc-chemical-engineering-nanotechnology

https://uwaterloo.ca/graduate-studies-academic-calendar/engineering/department-chemical-engineering/doctor-philosophy-phd-chemical-engineering-nanotechnology

https://uwaterloo.ca/graduate-studies-academic-calendar/engineering/department-electrical-and-computer-engineering/master-applied-science-masc-electrical-and-computer-engineering-nanotechnology

https://uwaterloo.ca/graduate-studies-academic-calendar/engineering/department-electrical-and-computer-engineering/doctor-philosophy-phd-electrical-and-computer-engineering-nanotechnology

https://uwaterloo.ca/graduate-studies-academic-calendar/engineering/department-mechanical-and-mechatronics-engineering/master-applied-science-masc-mechanical-and-mechatronics-engineering-nanotechnology

https://uwaterloo.ca/graduate-studies-academic-calendar/engineering/department-mechanical-and-mechatronics-engineering/doctor-philosophy-phd-mechanical-and-mechatronics-engineering-nanotechnology

https://uwaterloo.ca/graduate-studies-academic-calendar/engineering/department-systems-design-engineering/master-applied-science-masc-systems-design-engineering-nanotechnology

https://uwaterloo.ca/graduate-studies-academic-calendar/engineering/department-systems-design-engineering/doctor-philosophy-phd-systems-design-engineering-nanotechnology

https://uwaterloo.ca/graduate-studies-academic-calendar/science/department-chemistry/master-science-msc-chemistry-nanotechnology

https://uwaterloo.ca/graduate-studies-academic-calendar/science/department-chemistry/doctor-philosophy-phd-chemistry-nanotechnology

https://uwaterloo.ca/graduate-studies-academic-calendar/science/department-physics-and-astronomy/master-science-msc-physics-nanotechnology

https://uwaterloo.ca/graduate-studies-academic-calendar/science/department-physics-and-astronomy/doctor-philosophy-phd-physics-nanotechnology

Current Graduate Studies Academic Calendar content:	**Proposed Graduate Studies Academic Calendar content**:

Degree requirements
 	
• **Courses**
  ○ Nanotechnology ~~core~~ courses:
  ▪ NANO 601 Characterization of Nanomaterials
  ▪ NANO 602 Structure and Spectroscopy of Nanoscale Materials
  ▪ NANO 603 Nanocomposites
  ▪ NANO 604 Nanomechanics and Molecular Dynamics Simulations
  ▪ NANO 605/SYDE 683 Design of MEMS & NEMS
  ▪ NANO 606/SYDE 682 Advanced MicroElectroMechanical Systems: Physics, Design & Fabrication
  ▪ NANO 707 From Atoms to Crystals, Quantum Wells, Wires and Dots
	Degree requirements
	
	• **Courses**
	  ○ Nanotechnology elective courses:
	  ▪ NANO 601 Characterization of Nanomaterials
	  ▪ NANO 602 Structure and Spectroscopy of Nanoscale Materials
	  ▪ NANO 603 Nanocomposites
	  ▪ NANO 604 Nanomechanics and Molecular Dynamics Simulations
	  ▪ NANO 605/SYDE 683 Design of MEMS & NEMS
	  ▪ NANO 606/SYDE 682 Advanced MicroElectroMechanical Systems: Physics, Design & Fabrication
	  ▪ NANO 707 From Atoms to Crystals, Quantum Wells, Wires and Dots

How will students currently registered in the program be impacted by these changes?

Currently registered students will not be impacted by the changes.

Department/School approval date (mm/dd/yy): CHEM Nov 2024, PHYS Sept 2024, CHE May 2024, MME Aug 2024, SYDE May 2024.
Reviewed by GSPA (for GSPA use only) ☒ date (mm/dd/yy): 01/24/25
Faculty approval date (mm/dd/yy):
Senate Graduate & Research Council (SGRC) approval date (mm/dd/yy):
Senate approval date (mm/dd/yy) (if applicable):

Mathematics submissions to SGRC for March 17, 2025

Motion 1: Calendar changes to Computer Science

1.1 Course revisions to CS 638: update the course description and remove the MDSAI program from the prerequisites

1.2 Create courses:
CS653 Software and Systems Security
CS 659 Privacy, Crypto, Data Security

1.3 Inactivate course:
CS 658 Computer Security and Privacy

Motion 2: Calendar changes to Data Science

Program revision to update the registration options to allow for direct entry into the full-time option of the Master of Data Science and Artificial Intelligence (MDSAI) program

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These have been approved by the Mathematics Faculty Council on Tuesday, February 25, 2025

UNIVERSITY OF WATERLOO

Senate Graduate & Research Council
Graduate Studies Course/Milestone Form

Prior to form submission, review the content revision instructions. For questions about the form submission, contact Trevor Clews, Graduate Studies and Postdoctoral Affairs (GSPA).

Faculty: Mathematics

Effective date: Term: Spring Year: 2025

Milestone

Note: milestone changes also require the completion/submission of the Graduate Studies Program Revision Template.

☐ New: Choose an item.

☐ Inactivate: Choose an item.

☐ Revise: from Choose an item. to Choose an item.

Course

Note: some course changes also require the completion/submission of the Graduate Studies Program Revision Template.

☐ New: Complete all course elements below

☐ Inactivate: Complete the following course elements:
Course subject code, Course number, Course ID, Course title

☒ Revise: Complete all course elements below to reflect the proposed change(s) and identify the course elements being revised (*e.g. Course description, Course title*):

Updating the course description and removing the MDSAI programs from the prerequisites.

Course elements (complete as indicated above. Review the glossary of terms for details on course elements)

Course subject code: CS

Course number: 638

Course ID: 014936

Course title (max. 100 characters including spaces): Principles of Data Management and Use

Course short title (max. 30 characters including spaces): Principles of Data Mgmt & Use

Grading basis: Numerical

Course credit weight: 0.50

Course consent required: Not required

Course description:

Current course description: A user-oriented approach to the management of large collections of data. Relational database technology, relational algebra, SQL, database views, transactions, data modelling methodology, entity-relationship models. Introduction to several current topics in database research, such as warehousing, data mining, managing data streams, data cleaning, data integration, and distributed/parallel databases. Master of Health Informatics and Master of Data Science and Artificial Intelligence students only.

Proposed course description: A user-oriented approach to data management focusing on database principles, how to design a database, how to access data in the database and some recent technology for big data processing and the NoSQL movement. Relational database technology, relational algebra, SQL, database views, transactions, data modeling methodology, entity-relationship models. Introduction to several current topics in database research, such as warehousing, data mining, big data processing, NoSQL systems. Master of Health Informatics and Master of Health Informatics and Analytics students only.

Meet type(s): Lecture Choose an item. Choose an item. Choose an item.

Primary meet type: Lecture

Delivery mode: On-campus

Requisites: Enrolled in Master of Health Informatics (MHI) or Master of Health Informatics and Analytics (MHIA)

Special topics course: Yes ☐ No ☒

Cross-listed course: Yes ☐ No ☒

Course subject code(s) and number(s) to be cross-listed with and approval status:

Sections combined/held with:

Rationale for request:

Coverage of topics that are more relevant to today's data management landscape than some of the older topics that used to be covered.

Form completed by: Denise Shantz
Department/School approval date (mm/dd/yy): 11/13/24.
Reviewed by GSPA (for GSPA use only) ☒ date (mm/dd/yy): 10/22/24
Faculty approval date (mm/dd/yy): 02/25/25
Senate Graduate & Research Council (SGRC) approval date (mm/dd/yy):

UNIVERSITY OF WATERLOO

Senate Graduate & Research Council
Graduate Studies Course/Milestone Form

Prior to form submission, review the content revision instructions. For questions about the form submission, contact Trevor Clews, Graduate Studies and Postdoctoral Affairs (GSPA).

Faculty: Mathematics

Effective date: Term: Fall Year: 2025

Milestone
Note: milestone changes also require the completion/submission of the Graduate Studies Program Revision Template.

☐ New: Choose an item.

☐ Inactivate: Choose an item.

☐ Revise: from Choose an item. to Choose an item.

Course
Note: some course changes also require the completion/submission of the Graduate Studies Program Revision Template.

☒ New: Complete all course elements below

☐ Inactivate: Complete the following course elements:
Course subject code, Course number, Course ID, Course title

☐ Revise: Complete all course elements below to reflect the proposed change(s) and identify the course elements being revised (*e.g. Course description, Course title*):

Course elements (complete as indicated above. Review the glossary of terms for details on course elements)

Course subject code: CS

Course number: 653

Course ID:

Course title (max. 100 characters including spaces): Software and Systems Security

Course short title (max. 30 characters including spaces): Software and Systems Security

Grading basis: Numerical

Course credit weight: 0.50

Course consent required: Not required

Course description: Introduction to security issues in modern software, operating systems, and other computing platforms (e.g., mobile and cloud environments). Causes of security breaches and methods to help detect, isolate, and prevent them. Specific topics include comparing security and privacy, program security, operating system security, mobile security, hardware security, administrating security, and legal and ethical issues. Knowledge of

operating systems equivalent to that obtained from CS 350 is assumed.

Meet type(s): Lecture Choose an item. Choose an item. Choose an item.

Primary meet type: Lecture

Delivery mode: On-campus

Requisites:

Special topics course: Yes ☐ No ☒

Cross-listed course: Yes ☐ No ☒

Course subject code(s) and number(s) to be cross-listed with and approval status:

Sections combined/held with: Held with CS 453

Rationale for request: This course covers about half of the material currently taught in CS 658 – Computer Security and Privacy, which will be replaced with this course and CS 659 – Privacy, Cryptography, Network and Data Security. The two new courses will go into more depth and breadth than CS 658. This course and CS 659 will also be core courses of the Master of Cybersecurity and Privacy program currently under development in the Faculty of Mathematics.

Form completed by: Urs Hengartner
Department/School approval date (mm/dd/yy): 2/08/23
Reviewed by GSPA (for GSPA use only) ☒ date (mm/dd/yy): 02/07/23
Faculty approval date (mm/dd/yy): 02/25/25
Senate Graduate & Research Council (SGRC) approval date (mm/dd/yy):

UNIVERSITY OF WATERLOO

Senate Graduate & Research Council
Graduate Studies Course/Milestone Form

Prior to form submission, review the content revision instructions. For questions about the form submission, contact Trevor Clews, Graduate Studies and Postdoctoral Affairs (GSPA).

Faculty: Mathematics

Effective date: Term: Fall Year: 2025

Milestone

Note: milestone changes also require the completion/submission of the Graduate Studies Program Revision Template.

☐ New: Choose an item.

☐ Inactivate: Choose an item.

☐ Revise: from Choose an item. to Choose an item.

Course

Note: some course changes also require the completion/submission of the Graduate Studies Program Revision Template.

☒ New: Complete all course elements below

☐ Inactivate: Complete the following course elements:
Course subject code, Course number, Course ID, Course title

☐ Revise: Complete all course elements below to reflect the proposed change(s) and identify the course elements being revised (*e.g. Course description, Course title*):

Course elements (complete as indicated above. Review the glossary of terms for details on course elements)

Course subject code: CS

Course number: 659

Course ID:

Course title (max. 100 characters including spaces): Privacy, Cryptography, Network and Data Security

Course short title (max. 30 characters including spaces): Privacy, Crypto, Data Security

Grading basis: Numerical

Course credit weight: 0.50

Course consent required: Not required

Course description: Introduction to privacy and security using cryptography and related techniques in networks, distributed systems, and data science. The course examines how data and metadata can be protected at rest, in transit, and during computation. For at-rest protection, specific topics include the basics of cryptography and relevant ethics/policy concepts. For in-transit protection, specific topics include network defenses, authentication,

and secure and anonymous communication protocols. For during-computation protection, specific topics include data inference, differential privacy, homomorphic encryption, multi-party computations, and related protocols. Knowledge of distributed systems and computer networks equivalent to that obtained from CS 454 and CS 456 is assumed.

Meet type(s): Lecture Choose an item. Choose an item. Choose an item.

Primary meet type: Lecture

Delivery mode: On-campus

Requisites:

Special topics course: Yes ☐ No ☒

Cross-listed course: Yes ☐ No ☒

Course subject code(s) and number(s) to be cross-listed with and approval status:

Sections combined/held with: Held with CS 459

Rationale for request: This course covers about half of the material currently taught in CS 658 – Computer Security and Privacy, which will be replaced with this course and CS 653 – Software and Systems Security. The two new courses will go into more depth and breadth than CS 658. This course and CS 653 will also be core courses of the Master of Cybersecurity and Privacy program currently under development in the Faculty of Mathematics.

Form completed by: Urs Hengartner
Department/School approval date (mm/dd/yy): 2/08/23
Reviewed by GSPA (for GSPA use only) ☒ date (mm/dd/yy): 02/07/23
Faculty approval date (mm/dd/yy): 02/25/25
Senate Graduate & Research Council (SGRC) approval date (mm/dd/yy):

UNIVERSITY OF WATERLOO

Senate Graduate & Research Council
Graduate Studies Course/Milestone Form

Prior to form submission, review the content revision instructions. For questions about the form submission, contact Trevor Clews, Graduate Studies and Postdoctoral Affairs (GSPA).

Faculty: Mathematics

Effective date: Term: Spring Year: 2025

Milestone

Note: milestone changes also require the completion/submission of the Graduate Studies Program Revision Template.

☐ New: Choose an item.

☐ Inactivate: Choose an item.

☐ Revise: from Choose an item. to Choose an item.

Course

Note: some course changes also require the completion/submission of the Graduate Studies Program Revision Template.

☐ New: Complete all course elements below

☒ Inactivate: Complete the following course elements:
Course subject code, Course number, Course ID, Course title

☐ Revise: Complete all course elements below to reflect the proposed change(s) and identify the course elements being revised (*e.g. Course description, Course title*):

Course elements (complete as indicated above. Review the glossary of terms for details on course elements)

Course subject code: CS

Course number: 658

Course ID: 000611

Course title (max. 100 characters including spaces): Computer Security and Privacy

Course short title (max. 30 characters including spaces): Computer Security and Privacy

Grading basis: Numerical

Course credit weight: 0.50

Course consent required: Not required

Course description: Security and privacy issues in various aspects of computing. Specific topics include: comparing security and privacy, program security, writing secure programs, controls against program threats, operating system security, formal security models, network security, Internet application security and privacy, privacy-enhancing technologies, database security and privacy, inference data mining, security policies, physical

security, economics of security, and legal and ethical issues. (Note: Knowledge of operating systems equivalent to that obtained from CS 350 is assumed.)

Meet type(s): Lecture Lab Choose an item. Choose an item.

Primary meet type: Lecture

Delivery mode: On-campus

Requisites:

Special topics course: Yes ☐ No ☒

Cross-listed course: Yes ☐ No ☒

Course subject code(s) and number(s) to be cross-listed with and approval status:

Sections combined/held with: Held with CS 458

Rationale for request: This course will be replaced by CS 653 and CS 659. CS 653 and CS 659 will go into more depth and breadth than CS 658 and are core courses of the Master of Cybersecurity and Privacy program currently under development in the Faculty of Mathematics.

Form completed by: Bernard Wong
Department/School approval date (mm/dd/yy): 02/08/23
Reviewed by GSPA (for GSPA use only) ☒ date (mm/dd/yy): 02/02/23
Faculty approval date (mm/dd/yy): 02/25/25
Senate Graduate & Research Council (SGRC) approval date (mm/dd/yy):

Graduate Studies
Program Revision Template

Prior to form submission, review the content revision instructions and information regarding major/minor modifications. For questions about the form submission, contact Trevor Clews, Graduate Studies and Postdoctoral Affairs (GSPA).

Faculty: Mathematics

Program: Master of Data Science and Artificial Intelligence (MDSAI)

Program contact name(s): Mu Zhu, Marie Kahkejian

Form completed by: Mu Zhu, Marie Kahkejian

Description of proposed changes:
Note: changes to courses and milestones also require the completion/submission of the SGRC Graduate Studies Course/Milestone Form.

Updating the registration options to allow for direct entry into the full-time option of the program in the Fall term.

Is this a major modification to the program? No

Rationale for change(s):

This change will provide the program m with the opportunity to admit applicants to the MDSAI non-co-op option as either part-time or full-time in the Fall term. It will provide the program with an opportunity for growth in the MDSAI non-co-op program as the program currently does not allow applicants to apply full-time in any term.

Proposed effective date: Term: Spring Year: 2025

Current Graduate Studies Academic Calendar (GSAC) page (include the link to the web page where the changes are to be made):

https://uwaterloo.ca/academic-calendar/graduate-studies/catalog#/programs/SJ4ax1AAsh

Current Graduate Studies Academic Calendar content:	**Proposed Graduate Studies Academic Calendar content**:
Admit term(s) Fall Winter Spring **Registration option(s)** Full-time Part-time **Registration options information** Note: direct ~~entry into~~ the Master of Data Science and Artificial Intelligence (MDSAI) program ~~is~~ only	**Admit term(s)** Fall Winter Spring **Registration option(s)** Full-time Part-time **Registration options information** • Note: Direct entries for the Winter and Spring term, into the Master of Data Science and

Current Graduate Studies Academic Calendar content:	**Proposed Graduate Studies Academic Calendar content**:
available through the part-time option. Part-time students starting in Winter or Spring will need to consider course sequencing options since some courses are not offered every term.	Artificial Intelligence (MDSAI) program, <u>are</u> only available through the part-time option. Part-time students starting in Winter or Spring will need to consider course sequencing options since some courses are not offered every term.

How will students currently registered in the program be impacted by these changes?

Current students that are in the MDSAI non-co-op option, currently enrolled as part-time and would not be impacted by this change as they were admitted directly into the MDSAI part-time option that was available at the time of admission.

Department/School approval date (mm/dd/yy): 12/19/24
Reviewed by GSPA (for GSPA use only) ☒ date (mm/dd/yy): 06/25/24
Faculty approval date (mm/dd/yy): 02/25/25
Senate Graduate & Research Council (SGRC) approval date (mm/dd/yy):
Senate approval date (mm/dd/yy) (if applicable):

To: Associate Deans, Undergraduate; Associate Deans, Graduate

From: Angela Christelis, Director, Academic Quality Enhancement

Date: February 2025

Subject: Update to Rules for Major Modifications – Program Name Changes

Note: This email is for information

Dear Associate Deans,

I am writing to inform you of a small change to our rules for classifying major modifications, specifically regarding program name changes. This adjustment has been made to better align with the Quality Council's framework for major modifications.

Rationale:
We have revised the classification criteria for program name changes to ensure consistency with the Quality Council's guidelines. Moving forward, some program name changes that were previously classified as major modifications will now be considered minor modifications.

New Rule for Major Modifications – Program Name Changes:
A program name change will be classified as a **major modification** only if it meets one or more of the following criteria:

1. **Changes to the learning outcomes** – The new name reflects a shift in the program's focus or content, resulting in revised learning outcomes.
2. **Changes to the degree nomenclature** – The new name alters the degree title (e.g., changing from a Bachelor of Arts to a Bachelor of Science).
3. **Marketability concerns** – The proposed name is similar to that of another program, potentially causing confusion or impeding the program's marketability.

All other program name changes will now be classified as **minor modifications**.

This change aims to streamline the modification process while maintaining alignment with the Quality Council’s framework. If you have any questions or require further clarification, please don’t hesitate to reach out.

UNIVERSITY OF WATERLOO | Senate

For Discussion **Open Session**

To:	Senate Graduate and Research Council
Presenter(s):	Charmaine Dean, Vice-President, Research & International
	Clarence Woudsma, Interim Co-Associate Vice-President, Graduate Studies and Postdoctoral Affairs
	Genevieve Gauthier-Chalifour, University Secretary
Date of Meeting:	March 17, 2025
Agenda Item:	**8.1 SGRC Restructuring - Draft Proposal**

For Discussion / Summary

In 2022, a proposal was presented to the Secretariat to revert the Senate Graduate and Research Council (SGRC) to its pre-2003 structure, effectively splitting it back into two separate councils. In June of 2022, Senate completed its formal Senate Governance review and highlighted several key findings related to SGRC:

- SGRC should allocate more time to strategic discussions
- Importance of continuing efforts to fully integrate research and graduate studies.
- SGRC's discussions have predominantly focused on graduate studies matters, with limited time for research-related topics.
- There was divided opinion on whether to maintain SGRC as a merged entity or separate the two councils.

In Fall 2023, the Secretariat conducted an environmental scan of U15 Senate committees that have related Graduate Studies and/or Research focused committees/councils. Initial research indicated that Waterloo is the only institution of the U15 to have a joint Graduate Studies and Research Council.

In Fall 2024 the Secretariat, in consultation with the council co-chairs, conducted additional research and drafted a proposed path forward for consideration. Additional research found that standalone research committees/councils focused on five core responsibilities: oversight of research centres, policy development and recommendations, receiving reports from the VP Research, strategy/planning, and funding/grants.

The proposal, found in 8.2, incorporates the best practices found from the environmental scan and considers the culture and current governance structures of the University. It is proposed that the Senate Graduate and Research Council be restructured into two distinct governance bodies: the Senate Graduate Council and the Senate Research and Innovation Council. The two councils will have distinct oversight responsibilities, membership and a prescribed annual joint meeting. Careful consideration has been given in crafting the proposed terms of reference to alignment with Waterloo at 100, the Report of the Provost's Advisory Committee on Building a Resilient University of Waterloo, and efficient, effective governance practices. (See item 8.2: SGRC Restructuring - Draft Proposal)

Jurisdictional Information

The proposal for restructuring is being presented to the Senate Graduate and Research Council (SGRC) at its meeting on March 17, 2025, for discussion and feedback. The proposal largely reflects feedback received to-date from many members of SGRC, which has been crucial in shaping the final proposal. At the April SGRC meeting, a final proposal, incorporating feedback from the March meeting, will be submitted for a formal motion to recommend that the Senate Executive Committee, and ultimately Senate, approve the restructuring recommendations.

As the Senate requires two readings to amend Bylaw 2 (i.e. to remove current references to the SGRC), the motion would be presented at the May and June Senate meetings. Ultimately, any approved recommendations are proposed for implementation in the next Senate meeting cycle commencing September 1, 2025.

Governance Path

Secretariat, Office of the VPRI, GSPA (Discussion of proposal): January 2025

President and Provost (Discussion of concept; preliminary draft): January/March 2025

Dean’s Council Plus (Discussion and feedback on proposal): March 5, 2025

SGRC (Discussion and feedback on proposal): March 17, 2025 (prospective)

Documentation Provided

8.2 SGRC Restructuring - Draft Proposal

UNIVERSITY OF WATERLOO | Senate

Senate Graduate and Research Council: Restructuring Proposal

March 2025

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1. Overview

The Senate Graduate and Research Council (SGRC) is tasked with addressing matters related to the academic quality of graduate studies and research activities at the university. Formed in 2003 by the merger of the original Senate Graduate Council (SGC) and the Senate Research Council (SRC), the merger aimed to further integrate graduate studies and research activities on campus.

In Spring 2022, a proposal was presented to the Secretariat to revert SGRC to its pre-2003 structure, effectively splitting it back into two separate councils. In June of 2022, Senate completed its formal Senate Governance review and highlighted several key findings related to SGRC:

- **Strategic Discussions**: SGRC should allocate more time to strategic discussions, focusing on institutional goals and priorities.
- **Integration of Research and Graduate Studies**: There was an emphasis on the importance of continuing efforts to fully integrate research and graduate studies.
- **Scope of Discussions**: The SGRC's discussions have predominantly focused on graduate studies matters, with limited time for research-related topics.
- **Mixed Feedback**: There was divided opinion on whether to maintain SGRC as a merged entity or separate the two councils.

While several options have been proposed to improve the structure of SGRC, a solution that balances good governance, institutional collaboration, and inclusive membership engagement has not yet been formally adopted by the Senate. The ongoing work of the Senate Governance Review aims to find a path forward that aligns with the university's strategic goals while ensuring effective oversight of graduate studies and research.

A working group convened in the Fall of 2024 to conduct additional research and draft a proposed path forward for consideration. The working group consisted of Charmaine Dean (VP Research and International), Clarence Woudsma (Interim Co-AVP, GSPA), Bernie Duncker (AVP, Research and International), and members of the Secretariat (Gen Gauthier-Chalifour, Mike Grivicic, Tim Weber-Kraljevski, and Ashley Day).

2. Environmental Scan

In Fall 2023, the Secretariat conducted an environmental scan of U15 Senate committees that have related Graduate Studies and/or Research focused committees/councils. Initial research indicated that Waterloo is the only institution of the U15 to have a joint Graduate Studies and Research Council.

Standalone Graduate Studies Committees

- Five of the U15 have standalone Graduate Studies Committees (Calgary and McMaster) or multiple standalone Graduate Studies Committees (Manitoba, Montreal, Ottawa).
- For those without a standalone Graduate Studies Committee, it is often combined with Undergraduate Studies.

Standalone Research Councils

- Eight of the U15 have standalone Research Councils/Subcommittees of Senate/Senate equivalent (UBC, Calgary, Laval, Manitoba, Montreal, Queen's, Saskatchewan, and Western).
- Three U15 have standalone Research committees that are separate from their Senate/Senate equivalent (Alberta, Ottawa, Toronto [Faculty level])

U15 without a standalone Research Council

- Those without a standalone Research Committee often have the VP Research and International equivalent as a member on a Graduate Studies Committee.
- If a Senate Research Council is not present, an operational research body often exists within the Research Office or as an advisory body to the VP Research.

2.1 U15 Comparators

In October 2024, the Secretariat conducted further research on specific U15 institutions to gain a deeper understanding of their governance structure, and efficacy of any graduate studies or research committees/councils. Seven institutions were contacted with a short questionnaire and follow-up conversation with respondents. Institutions included: McGill, University of Toronto, Dalhousie, University of Calgary, University of Ottawa, University of Alberta and Western.

Summary of Findings

Research Committees: Overall, four out of seven institutions had Senate Subcommittees with a sole research focus. These committees meet infrequently, on average of 4 times per year. with an average of 15 members. The three institutions that did not have research focused subcommittees (Alberta, U of T, Ottawa), had operational committees within various research centres or had advisory bodies to the VP Research. Of note is the response from the University of Toronto which has a VP role specific to Graduate Research and Education.

Graduate Studies & Curriculum: Approving and recommending graduate curricular is under the mandate of SGRC. Of the institutions polled, five out the seven had Graduate Studies committees of Senate with a similar mandate. The University of Toronto does not have a specific Graduate Studies Committee but does have a Graduate Education Council within the School of Graduate Studies that oversees this work. No issues arose from the inquiry to indicate this structure was not effective.

Efficacy: The majority of institutions did not indicate specific issues or dissatisfaction with their current committee structures. However, one institution did note that the research committee often faced a lack of decision items (Calgary). It was also noted that the Chair often had a major impact keeping members engaged with topics of interest. It is noted that many institutions relied heavily on their Research Strategic Plans to promote collaboration.

Overall Findings: Smaller research committees that meet 4 times per year may be the most effective approach to ensure the mandate is met, and not over engaging its members which often serve on other committees. Graduate Studies committees remain focused on curriculum as part of their mandate; beyond regular reports for information, many lacked strategic discussion items on their agendas (noting perhaps strategic discussions were more often found in advisory or non-Senate related bodies).

3. Proposed Terms of Reference

3.1 Proposed Senate Research and Innovation Council Terms of Reference

Senate Research and Innovation Council	
4.1	There shall be a council of the university, appointed by and responsible to Senate, called the Research and Innovation Council.
4.2	**Membership** The membership of this council shall consist of the following: 4.2.1 Ex-officio • President and Vice-Chancellor • Vice-President, Academic and Provost • Vice-President, Research and International, who shall chair the council • Associate Vice-President, Graduate Studies and Postdoctoral Affairs • Associate Vice-President, Research and International • Associate Vice-President, Research Oversight and Analysis • Associate Vice-President, Global Futures [prospective] • Associate Vice-President, Commercialization and Entrepreneurship • University Librarian or designate • The Dean of each Faculty or designate, who shall normally be an associate dean responsible for research 4.2.2 Appointed by Senate[1] • One (1) associate dean responsible for graduate studies • Two (2) heads of a research center/institute that is governed under Policy 44 • Four (4) members holding regular faculty appointments • Six (6) Faculty Senators, one from each Faculty • One (1) faculty member from the Affiliated and Federated Institutions of Waterloo • Two (2) students, one graduate and one undergraduate • One (1) postdoctoral scholar For members appointed under section 4.2.2, the aim is to have broad and inclusive representation from all Faculties.

[1]In accordance with regular Senate nominating processes

	4.2.3 Resources (non-voting) • Director(s) from the Office of the Vice-President Research and International, as appointed by the Vice-President • University Secretary or designate
4.3	**Responsibilities of the Senate Research and Innovation Council** The Council shall have the following responsibilities: 4.3.1 ~~Receive, consider, study and review briefs on any aspect of research from members of the university. The council may thereon advise the vice-president, research and international on any matters relating to research.~~ Provide advice and guidance on strategic matters relating to research at the University, including strategic research plans, annual report of the Vice-President Research and International, advancing institutional priorities related to research, and identifying emergent needs and areas for consideration related to university research. 4.3.2 ~~Make recommendations to Senate with respect to the governance, direction and management of, or any changes in rules, regulations or policies for research in the university.~~ Review and make recommendations to Senate as appropriate, on institutional ~~regulation and~~ policy related to university research. 4.3.3 Consider, study and review all proposals for new centres and institutes, and the closure of centres and institutes, and make recommendations to Senate thereon. 4.3.4 On behalf of Senate, consider and approve renewals for centres and institutes, and report such renewals to Senate for information. Any matter of controversy that might arise may be referred to Senate. 4.3.5 ~~On behalf of Senate, consider and approve all proposals for new frameworks and changes to existing frameworks pertaining to the adjudication of research funding and proposals.~~ 4.3.6 The Committee shall review its terms of reference on an annual basis and make recommendations to Senate thereon. A comprehensive review shall be undertaken every five years.

4.4	**Meetings** 4.4.1 The council shall normally hold four (4) regular meetings each year, to be scheduled in the period from September to June. 4.4.2 Special meetings may be called by the chair of the council. 4.4.3 Joint meetings of this council and the Senate Graduate Council shall normally be held at least once annually to consider strategic matters of shared interest.

3.2 Proposed Senate Graduate Council Terms of Reference

Senate Graduate Council	
5.1	There shall be a council of the university, appointed by and responsible to Senate, called the Graduate Council.
5.2	**Membership** The membership of this council shall consist of the following: 5.2.1 Ex-officio • President and Vice-Chancellor • Vice-President, Academic and Provost • Associate Vice-President, Graduate Studies and Postdoctoral Affairs, who shall chair the council [Interim Co-AVP, Grad Studies] • Vice-President, Research and International • University Librarian or designate • The Dean of each Faculty or designate, who shall normally be an associate dean responsible for graduate studies • Associate Vice-President, Global Futures [prospective] 5.2.2 Appointed by Senate[2] • One (1) associate dean responsible for research • Six (6) Faculty Senators, one from each Faculty • Four (4) members holding regular faculty appointments • One (1) faculty member from the Affiliated and Federated Institutions of Waterloo • Two (2) graduate students, one of whom is the Graduate Student Association President or designate For members appointed under section 5.2.2, the aim is to have broad and inclusive representation from all Faculties. 5.2.3 Resources (non-voting) • Director, Student and Faculty Relations • Director, Quality Assurance and Continuous Improvement • Academic Officer, Graduate Studies and Postdoctoral Affairs • Director of Graduate Academic Services • University Secretary or designate

[2] In accordance with regular Senate nominating processes

5.3	**Responsibilities of the Senate Graduate Council** The Council shall have the following responsibilities: 5.3.1 Consistent with Senate's responsibilities for the establishment of educational policies, provide advice and guidance on matters related to graduate education and studies at the university. 5.3.2 Receive for information and make recommendations to Senate as appropriate with respect to governance, ~~and management of, or any changes in rules,~~ regulations, policies, and matters relating to graduate education and studies at the university. ~~5.3.3. Receive for information and make recommendations to Senate as appropriate on matters relating to graduate studies at the University.~~ 5.3.4 Consider, study and review all proposals for new graduate programs, the deletion of graduate programs, and/or major modifications to existing graduate programs, and make recommendations to Senate thereon. 5.3.5 On behalf of Senate, consider and approve all new graduate courses, the deletion of graduate courses, and proposed minor modifications to existing graduate courses and programs, and provide Senate with a brief summary of council's deliberations in this regard. Any matter of controversy that might arise may be referred to Senate. 5.3.6 On behalf of Senate, consider and approve all new graduate scholarships and awards, and proposed changes to existing graduate scholarships and awards. Any matter of controversy that might arise may be referred to Senate. 5.3.7 The Committee shall review its terms of reference on an annual basis and make recommendations to Senate thereon. A comprehensive review shall be undertaken every five years.
5.4	**Meetings** 5.4.1 The council shall normally hold four (4) regular meetings during each year, to be scheduled in the period from September to June. 5.4.2 Special meetings may be called by the chair of the council. 5.4.3 Joint meetings of this council and the Senate Research and Innovation Council shall normally be held at least once annually to consider strategic matters of shared interest.

Appendix A: Current SGRC Terms of Reference

Graduate & Research Council Membership

The membership of this council shall consist of the following:

Ex Officio

i. The president of the university.
ii. The vice-president, academic & provost.
iii. The vice-president, research and international, who shall co-chair this council.
iv. The associate vice-president, graduate studies and postdoctoral affairs, who shall co-chair this council.
v. An assistant vice-president, graduate studies and postdoctoral affairs appointed on the recommendation of the associate vice-president, graduate studies and postdoctoral affairs
vi. The associate vice-president, interdisciplinary research.
vii. The associate vice-president, research oversight and analysis
viii. The associate dean for graduate studies from each Faculty
ix. The associate dean for research from each Faculty
x. The director of research ethics
xi. The director, research partnerships
xii. The director, graduate academic services
xiii. The university librarian or designate
xiv. The president of the Graduate Student Association

Elected / Appointed

i. One faculty member from the affiliated and federated institutions of Waterloo, who shall serve for a term of two years
ii. One graduate student from each faculty, each of whom shall serve for a term of two years.

Powers and Duties of the Graduate & Research Council

The Graduate & Research Council shall consider all questions relating to the academic quality of graduate studies and research activity within the university and, without intending to restrict the generality of the foregoing, the Graduate & Research Council shall,

1. Make recommendations to Senate with respect to the governance, direction and management of, or any changes in rules, regulations or policies for graduate studies and research in the university.
2. Advise the vice-president, academic & provost on all matters relating to graduate studies and research.
3. Receive, consider, study and review briefs on any aspect of graduate studies and research from members of the university.
4. Make recommendations to Senate with respect to any financial matter pertaining to graduate studies and research.
5. Consider, study and review all proposals for new graduate programs, the deletion of graduate programs, major changes to existing graduate programs, arrange for internal appraisals as the council shall see fit, and make recommendations to Senate thereon.
6. On behalf of Senate, consider and approve all new graduate courses, the deletion of graduate courses, and proposed minor changes to existing graduate courses and programs, and provide Senate with a brief summary of council's deliberations in this regard. Any matter of controversy that might arise may be referred to Senate.
7. Consider, study and review all proposals for new centres and institutes, and the closure of centres and institutes, and make recommendations to Senate thereon.
8. On behalf of Senate, consider and approve renewals for centres and institutes, and report such renewals to Senate for information. Any matter of controversy that might arise may be referred to Senate.
9. On behalf of Senate, consider and approve all new graduate scholarships and awards. Any matter of controversy that might arise may be referred to Senate.

Questions to be considered by SGRC members as they review the Centre/Institute renewal report:

- How successful has the Centre/Institute been in achieving its objectives during the period since its last approval?

- What value has the_ Centre/Institute added to the University community that wouldn't have existed otherwise? What novel research activities, initiatives and outputs has it fostered?

- How effectively has the Centre/Institute contributed to the educational mission of the institution through collaboration with Departments/Schools?

- To what extent have Graduate Students been involved in and benefitted from the activities and initiatives of the Centre/Institute?

- Has the Centre/Institute been successful in engaging external partners (e.g. industry, community, government)?

- Does the Centre/Institute have a robust governance structure?

- How strong is the 5-year plan, including future research directions and development strategies?

- What is the state of the Centre/Institute finances? How realistic is the projected budget for the next five years in terms of secured resources and the activities to be supported?

- How satisfied is leadership (e.g. Dept Chairs, Faculty Deans) and the membership of the Centre/Institute in terms of its current operations. How supportive are they for a further 5-year term?

Centre for Accounting Research and Education (CARE)

2024 Centre Renewal Report

UNIVERSITY OF WATERLOO

SCHOOL OF ACCOUNTING AND FINANCE

December 2024

Prepared by:

Dr. Blake Phillips, Director, School of Accounting and Finance & CARE

Dr. Kenneth Klassen, Deputy Director, Scholarship, School of Accounting and Finance

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1. Introduction

a. Centre for Accounting Research and Education (CARE) request for renewal

We are pleased to submit our report on the Centre for Accounting Research and Education (CARE) for the period of January 1, 2019 to December 31, 2024. Over this period, CARE has continued to excel in its mission to advance accounting research and education, meeting its original objectives set by Senate on December 15, 1980. Based on this success, we recommend that CARE be renewed for an additional five-year term to continue its significant contributions to the field of accounting and finance.

I assumed the roles of Director of the School of Accounting and Finance and Director of CARE in September 2022 and will serve through August 2026. As the CARE, I have overseen CARE's continued growth in research and academic impact. I succeeded Steve Fortin, who led the Centre from 2018 to 2022. CARE has benefited from a legacy of strong leadership, with previous Directors including esteemed academics such as Howard Armitage, James Barnett, Alister Mason and Tom Scott.

CARE plays a pivotal role in advancing accounting and finance research and education, aligning with SAF's strategic priorities. It supports innovative research projects, fosters collaboration between academia and industry and ensures the SAF curriculum remains cutting-edge and relevant to the professions our students aspire to join. CARE's focus is on knowledge creation and mobilization while enhancing student learning and has specific long-term emphases in information integrity and ethical accounting and auditing practices, taxation, sustainability reporting, and performance management. These activities directly contribute to SAF's mission of preparing graduates for leadership roles in an evolving business landscape.

CARE seeks renewal for an additional five years to build on its achievements. We are confident that under CARE's leadership team, the Centre's plans to enhance the scope of its research centres, expand its global research footprint and continue addressing critical areas such as sustainability, ethics and the technological transformation of financial reporting will come to fruition. By doing so, CARE will ensure that the SAF remains at the forefront of advancing knowledge in accounting and finance, shaping both academic thought and industry practices.

Blake Phillips, PhD
Director, School of Accounting and Finance, and the Centre for Accounting Research and Education

b. Executive Summary

The Centre for Accounting Research and Education (CARE) at the University of Waterloo's School of Accounting and Finance (SAF) has been a vital force in advancing research, thought leadership and education in the fields of accounting and finance since its establishment in 1980. Originally part of the University's strategy to promote world-class research in accounting, CARE has grown into a dynamic hub of interdisciplinary collaboration, bridging academia, industry and policy-making bodies. Through its ongoing work, CARE remains committed to fostering impactful research, promoting ethical business practices and supporting the professional development of students and faculty.

CARE's mission is to advance knowledge that prepares future leaders to navigate the complexities of an evolving global economy, while also promoting ethical standards and integrity within the profession.

CARE faculty have published over 159 peer-reviewed research papers, contributing to the global discourse on topics ranging from taxation and sustainability to ethics and digital transformation in financial reporting. Over the six years of this report, CARE has also secured funding for interdisciplinary research projects and PhD students, connecting scholars across fields to address the pressing issues facing today's accounting and finance industries. Twenty PhD students have benefited from support from CARE. In addition to its research output, CARE has hosted numerous workshops and symposia, which have facilitated knowledge exchange between academics and leading industry practitioners, further enhancing the practical impact of its research, forming global partnership and supporting both faculty and student research initiatives.

This environment has allowed for critical advancements in areas such as taxation, ethics, information systems assurance and sustainability. CARE is structured to include four key research centres, each of which focuses on addressing contemporary challenges in accounting and finance. Below is an overview of each of the four main centres within CARE.

1. **Centre for Accounting Ethics**

   This centre focuses on researching and teaching ethics for accountants by both exploring ethical issues in contemporary business and in equipping current and future professionals to make ethical decisions within financial environments.

2. **Waterloo Centre for Taxation in a Global Economy**

   This centre focuses on researching and teaching taxation. As the largest group of tax scholars in English-speaking Canada, the tax centre takes a leadership role in both tax research, and tax teaching and pedagogy in Canada.

3. **University of Waterloo Centre for Information Integrity and Information Systems Assurance**

   Understanding and addressing the impacts of technological advances on financial systems, and the assurance services provided by the accounting profession are key foci of this centre. With the rapid emergence of new technologies, this centre focuses heavily on engaging with the practice community.

4. **CPA Ontario Centre for Sustainability Reporting and Performance Management**

   This centre focuses on corporations' reporting challenges, both internally in performance management and control systems, and externally in the area of sustainability reporting decisions and uses.

Financially, CARE has managed an operating budget of approximately $1.6 million over the six-year period, relying solely on consistent support from corporate sponsors and alumni donations. These funds have enabled CARE to continue supporting research costs, organizing professional development events and supporting SAF PhD students, without using any operating funds from the University of Waterloo

The CARE's financial stability has also allowed it to maintain strong global partnerships and collaborate with industry leaders, ensuring that its research has practical, real-world applications.

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2. Activities

a. Vision and Mission

The Centre for Accounting Research and Education (CARE) aims to:

- Advance the overall mission of the University of Waterloo, with a specific focus on supporting the goals of the School of Accounting and Finance.
- Showcase the University of Waterloo's commitment to excellence in both fundamental and applied research, as well as in accounting and finance education.
- Foster interdisciplinary collaboration, encouraging research between accounting and finance scholars and faculty from other disciplines at the University of Waterloo to address complex, cross-disciplinary challenges.
- Serve as a central hub for fundraising efforts, supporting CARE's array of initiatives and activities with specific focus on strategic growth areas within accounting and finance.

A major goal of the School of Accounting and Finance and CARE is research excellence. CARE has served an important role as a source of funds to support research at the School. CARE provides direct funding to School faculty members, organizes speaker symposia and funds visiting scholars and will continue to do so.

b. Four Centres within CARE

There are four key research centres that are part of CARE, each of which focuses on addressing contemporary challenges in accounting and finance. Each of these four centres have been in operation for an extended period and represent key foci of the CARE activities.

1. **Centre for Accounting Ethics:** Established in 1991, Centre for Accounting Ethics is dedicated to enhancing the teaching and research of ethics within the accounting profession. The centre aims to equip future professional accountants with the ethical judgment required to uphold professional standards, addressing the increasing importance of ethics in today's business environment.

   Main Activities

   - **Research Support and Development:** Funds ethics research and PhD students interested in ethics research.
   - **Bi-Annual Ethics Symposium:** Brings together leading academics, practitioners and students to explore critical issues at the intersection of ethics, accounting, and business. Over two days, the symposium explores the intersection of academic research and professional practice.
   - **Annual CAAA Ethics workshop:** Conducted in partnership with the Canadian Academic Accounting Association (CAAA), this annual conference has run for 27 years as of June 2023, and garners engaging discussions and insights into the evolving ethical landscape faced by today's accountants.

Leadership

Director: Krista Fiolleau

Advisory Council: Efrim Boritz, Darren Charters, Alec Cram, Tisha King, Giselle Obendorf, Seda Oz and Linda Thorne (York University)

Notable Accomplishments

- During the six years of this report, the centre has hosted three ethics symposia. Topics of these symposia include The Impact of Technology on Ethics, Professionalism and Judgement in Accounting, The Impact of the Pandemic, Specifically COVID 19, on Ethics, Professionalism and Judgement in Accounting and Financial Reporting and Ethics in Accounting.
- In the spring of 2024, we held our 27th Ethics workshop at the CAAA Annual conference. These sessions allow accounting academics the opportunity to discuss research and teaching on ethics topics with other academics and experts.

Student Development and Engagement:

- Organize and provide support for undergraduate teams in ethics competitions (since 2020), including the Chartered Financial Analysts (CFA) Ethics competition and Insurance Corporation of British Columbia (ICBC). SAF's Student teams have performed exceedingly well in recent years, qualifying as finalist in the 2020,2021 and 2024 CFA National Rounds and second in the 2022 ICBC competition.
- The Bi-Annual Ethics Symposium includes a PhD student session, where PhD students from across Canada present their research. We have been fortunate to be able grow this initiative to financially support seven PhD students from seven different universities at our recent symposium.

2. **Waterloo Centre for Taxation in a Global Economy:** This centre was created in 2014 to bridge the gap between academic tax research and corporate tax policy in Canada. The current Centre is a continuation and expansion of the Deloitte Centre for Tax Education and Research, created in 1994. The centre's primary goals are to (1) support research that examines taxation in our global context and disseminates knowledge to policymakers, corporations and practitioners, enhancing tax practices in a rapidly globalizing world; and (2) lead the development and enhancement of tax education across Canada.

Main Activities

- **Research Support and Development:** Supports research including funding PhD students, research data, and faculty and student travel.
- **Annual Tax Research Policy Symposia:** Hosts an annual symposium addressing contemporary Canadian tax policy issues that includes participation from academics, practitioners and government officials.
- **Tax Educator Conferences:** Brings together Canadian university tax educators, industry professionals and young tax professionals to address trends and skills gaps in tax education nationally.
- **Young Tax Professionals Program:** Engages SAF students interested in taxation careers through technical sessions, networking events and a mentorship program.

- **Support for Graduate Tax Programs:** Facilitates courses in the Master of Accounting (MAcc) and Master of Taxation (MTax) programs, offering students practical, research-based experiences in tax planning and policy.
- **Collaborations with Practitioners and Academics:** Engages faculty from law, economics and finance departments, as well as industry experts, to foster interdisciplinary research and teaching in taxation.

Leadership:

Director: Kenneth Klassen

Associate Director: David Lin

Advisory Council: Representatives from each sponsor including CPA Canada, Canadian Tax Foundation, Deloitte, EY, Grant Thornton, KPMG and PwC.

Notable Accomplishments

- Together with the tax faculty at the University of Texas at Austin, the Tax Centre is the co-host of a biennial tax research symposium. In 2022, the fifth symposium was held in Toronto with approximately 100 faculty and PhD student tax scholars primarily from Canada and the United States, but also presenters and participants from Europe and Asia. This initiative generates considerable reputation within the academy and has been instrumental in recruiting three of our four tenure-stream faculty members, as well and many of our recent PhD students.
- During the six years of this report, four PhD students graduated with a concentration in taxation, three of whom accepted academic positions in Canada and the last in the United States. For comparison, there are less than 20 tax faculty in accounting departments across Canada with PhDs that specialize in taxation, including the four in the SAF.

SAF Program Expansion and Student Development:

- Expanded offerings in the MTax program, now accessible to students across Canada and providing real-time learning via virtual platforms.
- Engaged 80 students in the Young Tax Professionals program, with guest speakers from industry leaders such as RBC Tax Advisory Group and CPP Investments. Offers hands-on experiences, including a case competition focusing on legislative changes.
- Recently the Tax Centre launched a mentorship program pairing undergraduate students with alumni for career and professional guidance.

3. **University of Waterloo Centre for Information Integrity and Information Systems Assurance:** The University of Waterloo Centre for Information Integrity and Information Systems Assurance (UWCISA) was founded in 1998 with its mission to identify, address and communicate issues related to the impact of current and emerging technologies on both information integrity and information system assurance. These foci are critical areas as businesses increasingly rely on data and digital infrastructure. UWCISA (1) fosters research in several strategic areas including information systems assurance, external and internal audits, cybersecurity, data analytics, emerging technologies, and environmental, social and governance (ESG) assurance; (2) supports the development of innovative educational resources and knowledge transfer; and (3) promotes dialogue among educators, industry professionals, students, and other interested parties.

Main Activities

- **Research Support and Development:** Supports research including funding PhD students, research data, and faculty and student travel.
- **Biennial Research Symposia:** Hosts a biennial symposium addressing information integrity, information systems assurance, and related topics with participants from around the globe who come from academia, practice, and government.
- **Professional Development (PD) Workshops:** Offers PD workshops to students, academics, and practitioners on topics relevant to UWCISA's mission (e.g., generative AI prompt engineering) to address current trends and skills gaps in education related to emerging technologies, information integrity, information systems, assurance, etc.
- **UWCISA Blog:** Maintains a regular blog that disseminates knowledge on analytics, technology, security, and innovation in the world of accounting, audit, and business.
- **PhD and Academic Career Mentorship Program:** Engages SAF students interested in academic careers in audit, assurance, cybersecurity, or accounting information systems through research and teaching technical sessions, workshops, and events.
- **Student Competitions:** Engages SAF students in analytical and innovative thinking through two Information Systems Audit and Control Association-sponsored competitions that develop and showcase their data and decision-making competencies to panels of industry and academic experts.
- **Support for SAF Programs:** Develops and facilitates courses, textbooks, and curriculum in SAF's various undergraduate programs and its Master of Accounting program, offering students practical, research-based experiences and content.
- **Collaborations with Practitioners and Academics:** Contributes to thought leadership and engagement with the profession through member service on various boards, advisory groups, and task forces for organizations including CPA Canada, IIA, AICPA, Auditing and Assurance Standards Board, UW Cybersecurity and Privacy Institute, Waterloo.AI, Rutgers University, and several academic journals.

Leadership:

Executive Director: J. Efrim Boritz

Associate Directors: Tim Bauer, W. Alec Cram, Theophanis Stratopoulos, Adam Vitalis

Board of Directors: Executive director and associate directors, SAF Director, representatives from each sponsor of CPA Canada, ISACA, and IIA Canada and the Toronto Chapter, and other industry professionals including the Board Chair

Notable Accomplishments

- In 2020-2022, Efrim Boritz and Theo Stratopoulos served as senior editors of the *Journal of Information Systems* (*JIS*) with support from UWCISA.
- In 2023, Efrim Boritz was inducted into the Canadian Accounting Hall of Fame for his many research, teaching, and service contributions to the accounting profession over his 40 year career. He is the first SAF professor to receive this significant honour.
- In 2024, Tim Bauer and his co-authors Kerry Humphreys and Ken Trotman (UNSW Sydney) received the Auditing: A Journal of Practice & Theory Best Paper Award.

SAF Program Expansion and Student Development:

- Sponsored the development and implementation of a Data Analytics and Emerging Technologies (DA&T) curriculum in the Accounting and Financial Management (AFM) undergraduate program. The AFM program now includes four foundational courses in analytics and seven advanced courses in analytics and emerging technologies; many of these courses are popular with students across campus.
- Sponsored the development and implementation of the Digital Certificate in Predictive Analytics for CPAs in October 2021. This initiative was undertaken, in collaboration with WatSPEED, CPA Ontario, and SAF.
- Provided support to its members who serve as co-director (Sasan Saiy) and curriculum committee member (Adam Vitalis) of the Sustainability and Financial Management (SFM) program. SFM is a new undergraduate program as of 2022, where students build on their accounting and finance skills with faculty in SAF while gaining a deep understanding of sustainability issues from faculty in the School of Environment, Enterprise and Development (SEED).
- Hosts two annual case competitions, sponsored by the Information Systems Audit and Control Association (ISACA) Toronto Chapter, which engage students in data analytics, AI, and/or machine learning where they showcase their skills to guest panelists from academia and industry, including from organizations such as RBC, Google, and the Ontario Treasury Board Secretariat.

4. **CPA Ontario Centre for Sustainability Reporting and Performance Management:** The CPA Ontario Centre for Sustainability Reporting and Performance Management (CSPM) has two distinct focuses. The performance management portion of the centre was founded in 2017 under the leadership of now-retired Dr. Alan Webb. This ongoing aspect of the centre focuses on performance measurement, strategy implementation and management control system design. In 2021, the centre added an additional focus on all aspects of corporate sustainability reporting, including disclosure decisions and their impacts on the firm and other stakeholders.

   Main Activities

   - **Research Support and Development:** Supports research by providing funding to faculty and PhD students for the purchase of archival databases, providing seed funding for behavioural research experiments, research assistance, travel support, and knowledge development and dissemination through conference attendance.
   - **Knowledge Dissemination For Practitioners:** Supports the dissemination of research findings to practitioners through industry papers, summary versions of published papers, and research summary videos.
   - **Annual Sustainability Conference:** Hosts an annual conference targeted to a joint academic-practitioner audience related to current issues in corporate sustainability reporting.
   - **Biennial Performance Management Field Research Symposium:** Hosts a biennial research symposium addressing contemporary practice relevant performance management issues.
   - **Performance Management Mentorship Program:** Enhances educational experiences by sharing insights with senior SAF students who participate in our performance management academic mentorship program each year.

- **Webinar Series:** Enhances educational experiences by producing and disseminating a regular webinar series with invited guest experts and a series of podcasts with expert practitioners in the field of performance management, both targeted to a joint audience of practitioners and academics.

Leadership:

Co-Directors: Elizabeth Demers (Sustainability Reporting) & Adam Presslee (Performance Management)

Associate Director: Nancy Vanden Bosch

Advisory Council: Sarah Keyes, CPA, CA (CEO, ESG Global Advisors Inc.), Jacqui Mulligan, CPA, CA (Vice President, Education, CPA Ontario), Anik Seth, CPA, CMA (CEO, Huex), Sarah Skinner, CPA, CA (Post-Secondary Institution (PSI) Relations Officer, CPA Ontario)

Notable Accomplishments

Sustainability Reporting

The sustainability side of CSPM has achieved significant milestones within its first two years. Key accomplishments include the following:

- An inaugural annual conference on corporate sustainability reporting attracted approximately 80 attendees in February 2024, including top scholars and professionals from Canada, the U.S. (e.g., Harvard, UNC, USC), and Europe (e.g., University of Zurich, Tilburg University). This event significantly elevated UW's profile in sustainability financial reporting research.
- Hosted three open-access webinars featuring Prof. Karthik Ramanna (Oxford University) on carbon accounting, Prof. Claudine Mangen (Concordia University) on "Disruptive Dames: Women's Transitions Into Organizational Leadership," and ESGTree representatives on sustainability reporting under new global standards.

Performance Management

- Over six years, three PhD students graduated who specialized in performance management, with two securing academic positions in Canada and one in Europe.
- The 4th Performance Management Field Research Symposium (2023) in Waterloo gathered about 60 faculty and PhD students from Canada and the U.S. It featured four working paper presentations, each with discussions led by topic experts.
- Hosted a practitioner event in Toronto focusing on motivating and managing remote workers. It featured speakers Megan Nimigon (Team Synergy), Dr. John Trougakos (University of Toronto), and Josh Zweig (LiveCA), attended by 48 practitioners.
- Successfully launched a Master of Accounting course, "Employees and Strategy Execution," with 35 graduate students enrolled.

Through these research centres, CARE has made a significant impact on both academia and industry, driving advancements in critical areas that influence global business practices. CARE's commitment to research excellence is reflected in the wide range of scholarly contributions made by its faculty, students and partners.

c. Future Evolution of CARE

CARE will continue to build on its strong foundation of advancing impactful research, fostering global partnerships and promoting excellence in accounting and finance education. CARE remains dedicated to supporting innovative projects through its four specialized sub-centres, driving advancements in critical areas such as sustainability reporting, taxation, ethics and information systems assurance. By maintaining its focus on interdisciplinary collaboration and industry engagement, CARE will further enhance its reputation as a hub for cutting-edge research and thought leadership.

A key priority for CARE will be to attract and maintain strategic partnerships with industry sponsors and academic collaborators, ensuring strong, ongoing financial support that does not require institutional operating funds. These partnerships will ensure we continue to access and leverage real-world insights that enrich and sustain CARE's impactful research and educational initiatives.

Through continued hosting of educational workshops, symposia and professional development opportunities, CARE will ensure that its contributions remain practical, relevant and aligned with the evolving needs of the accounting and finance professions. Under steady leadership and with ongoing support from its partners, CARE is well-positioned to sustain and amplify its role as a leader in shaping the future of accounting and finance.

3. Research Accomplishments

Researchers associated with the Centre for Accounting Research and Education (CARE) have been very productive over the last six years. CARE provides significant support to its researchers through direct funding of research costs; indirect support through funding for hosting, and travel to, conference and other research travel; support for PhD students; and support for the broader research environment of the SAF. A summary of the CARE finances can be found under Section 6.

a. Overall Scholarship of CARE Researchers

Scholarly activity varies across researcher, but publishing research papers in scholarly journals is important to the reputation of the School of Accounting and Finance. CARE provides strong support for this scholarly activity. Appendix C provides a full list of the 159 publications in refereed journals that have been authored by CARE scholars.

Publication rates vary considerably across disciples. To provide a calibration of this research output, we draw on the aggregation work by Brigham Young University (BYU). They aggregate all publications in the twelve leading accounting academic journals worldwide for all authors found therein. We acknowledge that all ranking processes have biases, and the BYU process notably omits many important journals, including cross-disciplinary journals and journals that are more appropriate to our finance scholars. As a consequence, only 50 papers of those listed in Appendix C are included. However, the BYU ranking[1] is comprehensive across all universities for publications within its scope, and these journals are widely accepted as important for promotion and tenure decisions of accounting scholars in many accounting faculty groups worldwide.

Focusing on the last six years, the BYU accounting rankings places the University of Waterloo at 17th in the world. The only Canadian university to rank more highly is the University of Toronto, with a rank of 8. Most universities in the top 25 are in the United States, with the other exceptions being Singapore Management University, ranked 7; the University of Hong Kong, ranked 10; and Monash University, ranked 13. The next most highly ranked Canadian universities—Laval University and Queen's University—are both ranked 103.

Beyond the number of papers, also important is the impact of our research on those outside academe, and in particular those in the practice of accounting and finance. BYU also includes rankings based on aggregate Altmetric scores for these same publications. According to its website, Altmetric.com, "Altmetric tracks and captures a range of online attention sources to published research across social media, news outlets, policy and more." While research published in other outlets is likely to be more accessible to non-academic audiences, the BYU-ranked academic accounting papers published by the CARE scholars leads the University of Waterloo to be ranked 8th in the world, slightly behind the University of Toronto, which is ranked 5. No other Canadian university is ranked in the top 50.

b. Honours Garnered by CARE Researchers

Individual researchers within CARE have also been recognized for their outstanding accomplishments through external awards and other recognition. These include the following scholars.

[1] https://www.byuaccounting.net/rankings/main/main.php. The twelve journals include the top 6 broad accounting journals, and 6 that focus on subdisciplines within accounting research, such as auditing or managerial accounting. Ranking cited above were for the years 2019 – 2024 inclusive, as retrieved on February 7, 2025.

Andrew Bauer

- Canada Research Chair in Taxation, Governance and Risk, renewed in 2023.

Tim Bauer

- Auditing: A Journal of Theory and Practice Best Paper Award, 2024
- Impact on Practice Award, American Accounting Association – Management Accounting Section, 2023

Efrim Boritz

- Canadian Accounting Hall of Fame, inducted in 2023

Wenqian Hu

- Emerging Scholar Award, American Accounting Association – Accounting Behavior and Organizations Section Research Conference, 2021

Kenneth Klassen

- Haim Falk Award for Distinguished Contribution to Accounting Thought, Canadian Academic Accounting Association, 2021
- Best Manuscript Award, American Accounting Association – American Taxation Association, 2020

Adam Presslee

- Notable Contribution to Literature Award, American Accounting Association – Management Accounting Section, 2024
- Best Journal of Management Accounting Research Paper, 2023
- Best Early Career Research Award, American Accounting Association – Management Accounting Section, 2019

Alan Webb

- Lifetime Contribution to Management Accounting Award, American Accounting Association – Management Accounting Section, 2024
- Best Paper Award, Journal of Management Accounting Research, 2023

c. Retiring Members Acknowledged

Several members of CARE retired during the reporting period. Three such individuals were awarded the honour of being Distinguished Professor Emeriti: Patricia O'Brien, Alan Webb and Christine Wiedman.

d. Centre for Accounting Ethics

Research Accomplishments

- The bi-annual ethics symposium partnered with the *Accounting and the Public Interest Journal* for 2024 and 2022. This resulted in the publication of two articles from the 2022 symposium and the publication of a symposium introduction. One paper is from an auditing profession's perspective, and considers how audit firms, professional accounting associations, and audit regulators responded to the pandemic, and the other is from a governmental perspective, and examines state taxation policies and pandemic lockdown strategies. Publications from the 2024 symposium are still under review.

- The 2019 symposium partnered with the *Journal of Business Ethics* resulting in the publication of three symposium papers and a thematic introduction. The first two papers examine technology in the tax setting finding that technology may encourage dishonesty. The third paper examines AI use in the audit context and stress the importance of professional accountants' ethical judgment.

e. Waterloo Centre for Taxation in a Global Economy

Research Accomplishments

- Published numerous high-impact tax research articles, contributing to Waterloo's global tax research BYU ranking of 19th, the highest among Canadian universities.

Notable Publications

"The effect of income shifting aggressiveness on corporate investment," Kenneth Klassen with Lisa De Simone (University of Texas at Austin) and Jeri Seidman (University of Virginia) published in the *Journal of Accounting and Economics*, 74(1), 2022. This paper continues 30 years of international tax research by Klassen. Through this research, the authors demonstrate that the typical link between the location of corporate investment and countries' investment environments does not exist for multinational corporations that aggressively shift their income for tax purposes. This finding is important to policy setters in Canada and elsewhere as they seek international investment to boost the local economy.

"Tax Avoidance at public corporations driven by shareholder taxes: Evidence from changes in shareholder dividend tax policy", Andrew Bauer with Dan Amiram (Tel Aviv University) and Mary Margaret Frank (University of North Carolina) published in *The Accounting Review*, 94(5), 2019. This study demonstrates that shareholder preferences influence a corporation's engagement in tax planning activities. Notably, corporations engage in less tax planning (report higher effective tax rates) when their home country offers dividend tax credits to shareholders for corporate tax paid and corporations increase their tax planning when those credit systems are eliminated. This evidence makes an important distinction that corporations are less interested in minimizing (corporate) taxable income and taxes as they are in maximizing (shareholder) after-tax cash flows. From a policy standpoint, the study demonstrates the value of using dividend tax credits for shareholders as a method to integrate corporate and individual taxes and to reduce double taxation.

f. University of Waterloo Centre for Information Integrity and Information Systems Assurance

Notable Accomplishments

- Published numerous high-impact accounting information systems (AIS) and assurance research articles, contributing to Waterloo's global AIS research BYU ranking of 12th, the highest among Canadian universities.

Research Publications

"Cataloguing the Marketplace of Assurance Services" Tim Bauer, Efrim Boritz, Krista Fiolleau, Brad Pomeroy, Adam Vitalis and Pei Wang, published in *Auditing: A Journal of Practice & Theory* 43(3), 2024. This paper explores the assurance services market beyond traditional financial audits, highlighting opportunities and challenges for CPA firms. It suggests that perceived

barriers to expanding these services may not be significant in practice. This paper resulted from a joint project of the centre and CPA Canada and informs the profession on this evolving area of the profession.

"Time Will Tell: A Case for an Idiographic Approach for Behavioral Cybersecurity Research" Alec Cram with John D'Arcy (University of Delaware) and Alex Benlian (Technische Universität Darmstadt), published in *MIS Quarterly* 48(1), 2024. This study advocates for using idiographic, within-person analysis in behavioral cybersecurity research, arguing it validates theories over time and offers unique insights into cybersecurity behaviors.

"Group Judgment and Decision Making in Auditing: Research in the Time of COVID-19 and Beyond" Tim Bauer with Kerry Humphreys (UNSW Sydney) and Ken Trotman (UNSW Sydney), published in *Auditing: A Journal of Practice & Theory* 41(1), 2022. Winner of the 2024 AJPT Best Paper Award, this paper reviews auditor interactions, proposes new research questions, and explores the impact of COVID-19 on audit practices.

"A dollar for a tree or a tree for a dollar? The behavioral effects of measurement basis on managers' CSR investment decision" Adam Vitalis with Bryan Church (Georgia Institute of Technology), Wei Jiang (Columbia Business School) and Jason Kuang (Georgia Institute of Technology), published in *The Accounting Review* 94(5), 2019. This study shows that managers' CSR investments are influenced by whether decisions are based on financial or nonfinancial measures, with nonfinancial measures leading to more pro-CSR investment.

g. CPA Ontario Centre for Sustainability Reporting and Performance Management

Notable Accomplishments

Sustainability Reporting

The sustainability side of CSPM has achieved significant milestones within its first two years. Key accomplishments include the following:

- Published numerous high-impact academic articles, gaining extensive global media coverage (e.g., *Financial Times*, *Wall Street Journal*) and featured on prestigious blogs like the Harvard Law School Forum on Corporate Governance. These works have been cited in U.S. SEC regulatory discussions.

Performance Management

- Several high-impact articles boosted Waterloo's global management accounting research BYU ranking to 4th, the highest among Canadian universities.

Notable Publications

Sustainability Reporting

"ESG Didn't Immunize Stocks During the COVID-19 Crisis, But Investments in Intangible Assets Did" by Elizabeth Demers, Jurian Hendrikse, Philip Joos and Baruch Lev (2021) published in the *Journal of Business, Finance and Accounting*. This study refuted claims that high ESG scores protected firms during the COVID market crash. It received significant global media attention (e.g., *Financial Times*, *Bloomberg*) and was cited in U.S. SEC policy discussions. It was awarded Wiley's "Top Cited Article 2021-2022."

Elizabeth Demers, Victor Ziaoqi Wang, and Kean Wu developed two related studies in 2024. "Measuring Corporate Human Capital Disclosures: Lexicon, Code, and Research Opportunities," published in the *Journal of Information Studies*, provides tools for analyzing human capital disclosures. "Corporate Human Capital Disclosures: Early Evidence from the SEC's Disclosure Mandate," a current paper under review, reveals the variability and lack of detailed guidance in U.S. SEC-mandated human capital disclosures, emphasizing issues like positivity bias and lack of numerical intensity. Both studies were widely cited, featured in influential blogs, and contributed to policy discussions.

Performance Management

"Motivating employees with goal-based prosocial rewards," by L. Berger, L. Guo, and A. Presslee, published in *Contemporary Accounting Research*. Organizations are using goal-based prosocial rewards, where employees donate rewards to charity, to motivate staff. The study finds that prosocial rewards lead to higher effort and a less curve-linear relationship between goal difficulty and effort compared to cash rewards. These findings highlight the advantages of prosocial rewards.

"Small sample field study: The effect of team-based recognition on employee engagement and effort," by A. Presslee, G. Richins, S. Saiy, and A. Webb; published in *Management Accounting Research*. Firms use recognition programs to motivate employees, but research on their effectiveness is limited. The authors predict team-based recognition improves engagement and effort. A 12-week study at six fast-food locations supports this, showing that team recognition boosts effort through engagement. These findings are relevant for compensation system designers in low-motivation environments.

Other CSPM-funded performance management publications over the past five years are found in the list of publications in Appendix C.

Notable awards for CSPM-funded performance management publications:

2024 Management Accounting Section of the American Accounting Association's Notable Contribution to Literature Award for "When and why tangible rewards can motivate greater effort than cash rewards: An analysis of four attribute differences," by Adam Presslee (SAF) and Willie Choi (University of Wisconsin-Madison).

2023 Best *Journal of Management Accounting Research Paper* for "Needs versus wants: Which motivates more effort?" by Adam Presslee (SAF), Alan Webb (SAF), Tim Mitchell (University of Massachusetts), Axel Schulz (La Trobe University).

2022 Canadian Academic Accounting Association's Lazaridis Institute Best Paper on Accounting Issues Relevant to Technology Firms Award for "Managerial Discretion in Incomplete Contracts" by Wenqian Hu (SAF).

2022 Best *Journal of Management Accounting Research Paper* for "I know something you don't know: The effect of relative performance information and individual performance incentives on knowledge sharing" by Krista Fiolleau (SAF), Leslie Berger (Wilfrid Laurier University), and Carolyn MacTavish (Wilfrid Laurier University).

h. Testimonials

Andrew Bauer, Associate Professor in taxation

> The Waterloo Centre for Taxation in a Global Economy has provided great support for my educational activities. It provides a network of colleagues in practice, and we are able to speak with those colleagues at least a few times a year (formally and informally) about issues that impact the classroom. My colleagues and I have had opportunities to share our ideas, especially around new cases we develop to have students use data in different tax scenarios, and many practitioners have taken the time to speak with us one on one to provide feedback or brainstorm on the future cases.

Tim Bauer, Associate Professor in assurance

> UWCISA has provided resources that have allowed me and others to attend conferences where we were able to disseminate our research and get invaluable feedback to improve that research, as well as learn from colleagues through their innovative research topics and methods. UWCISA has also provided partnerships with key organizations and personnel in practice, which has informed research ideas and provided expert professionals as survey or interview participants in research projects. Through UWCISA's financial and non-financial support, we have been able to offer a program to educate undergraduate and graduate accounting students about careers in academia performing teaching and research, generating a pipeline of potential future scholars who will continue the great tradition of teaching and research in accounting and assurance.

Efrim Boritz, Professor and UWCISA Director

> The UWCISA has enabled us to engage with assurance professionals to identify important trends, research opportunities and new course development needs to maintain the SAF's relevance and visibility. Our interactions with professional associations (CPA, ISACA and IIA) have enabled us obtain support for our activities aimed at providing thought leadership in both academic and practice spheres. UWCISA has also been able to obtain incremental funding for support of doctoral students, research projects, conference participation and student activities such as case competitions, essay contests and other initiatives which have strengthened our research, teaching and service contributions.

W. Alec Cram, Associate Professor in emerging technologies

> The UWCISA has provided research funding that has been instrumental in my research activities related to behavioural cybersecurity. Over the past several years, I have received funding that covered the cost of professional copy editing for an article that was being submitted to an academic journal. I also received funding that covered a portion of the costs for me to travel to the Hawaii International Conference on Systems Sciences to present two research papers. These activities would not have been possible without the help of the Centre.

Tisha King, Assistant Professor in ethics and taxation

> The Centre for Accounting Ethics enabled me to present my research on ethics and practice at the CAAA Ethics Workshop, fostering valuable collaborations with ethics professionals and academic researchers.
>
> The Centre for Taxation in a Global Economy has offered numerous opportunities for me to engage with academic researchers through in-depth paper discussions. These interactions

have enhanced my tax research knowledge, enriching both my scholarship and professional network.

Adam Presslee, Associate Professor in performance management

The CSPM (part of CARE) has provided me with the necessary funds to conduct the experiments reported in my last five academic publications. I owe much of my recent publication success to this financial support. I have also greatly benefited from the CSPM (and CPA Ontario) helping me share my research findings with practitioners and achieve my goal of informing practice with my research.

Julie Robson, Associate Professor – Teaching Stream in taxation

The UW Centre of Taxation in a Global Economy has greatly benefitted tax faculty teaching and tax curriculum at SAF. Personally, support for education related initiatives such as the Tax Educator Symposium and the Young Tax Professionals group has benefitted me as a tax educator in allowing me to stay current and connect with other tax faculty at other academic institutions. It has also benefited students in our program who are interested in a career working in taxation through promoting connections with tax faculty, UW alumni working in tax and mentorship opportunities.

Adam Vitalis, Associate Professor in assurance

UWCISA has played a key role in supporting my research through both funding and access to experimental and interview subjects. This support has directly contributed to two published papers and two additional ongoing projects. Additionally, the Centre funded conference travel, which enabled me to receive critical feedback that enhanced the quality and impact of these publications.

Pei Wang, PhD Student in performance management

As a Ph.D. student, I'm grateful for the great events CSPM has held in the past and the funding support for my research project. Those events have created great opportunities for me to connect with scholars from around the world, and the research funding has allowed me to collect experiment data to answer research questions that matter to managers' reward design decisions.

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4. Strategic Initiatives

a. Overarching Strategic Priorities of CARE

The fields of accounting and finance are rapidly evolving, driven by technological advances and shifting societal expectations. CARE is adopting a forward-looking approach with strategic initiatives aimed at shaping the future of the accounting and finance professions.

A key focus is enhancing collaboration between academia and industry, bridging research and practice to integrate emerging insights into real-world applications. This will also create valuable opportunities for students and professionals to engage with cutting-edge developments.

CARE and its sub-centres are focused on critical emerging areas like business technologies and sustainability. By prioritizing these trends, the Centre aims to equip professionals with the skills needed for a complex, dynamic environment.

Sustainability remains a core focus, with CARE leading research and initiatives that promote transparency and responsible financial practices and reporting As businesses face growing pressure to commit to sustainability, CARE will guide this transformation through thought leadership and innovative solutions.

These strategic initiatives position CARE as a leader in accounting and finance nationally and internationally, dedicated to fostering growth, innovation and sustainability.

b. Centre for Accounting Ethics

The Centre for Accounting Ethics intends to continue with its core activities. In addition to these, the centre intends to launch a fundraising campaign to increase our ability to support PhD students and ethics research. Current funds are insufficient for the centre to maintain our core, and there is an ever-present need for increased research and education in accounting ethics. As accounting professionals expand their work into new areas of assurance and reporting to meet the corporate ESG needs using increasingly complex and intricate technology, professional ethics remains critical. To meet these demands, our Centre will embark on a new funding campaign to expand our ability to fund ethics research, recruit PhD Students and disseminate research to the profession.

The expansion of our activities will start with the following:

1. Funding for two PhD students with a focus on Accounting Ethics.
2. A Call for papers for ethics education material, partnering with the *Journal Accounting Perspectives*.
3. Partnership with the professional associations such as CPA Ontario to provide input to their educational material.

c. Waterloo Centre for Taxation in a Global Economy

Like the broader accounting profession, the landscape for those specializing in tax is evolving rapidly. As advanced technologies automate routine tasks, tax professionals are being increasingly propelled into more complex roles at a faster pace. While this transformation has been in motion for many years, it is accelerating as technology continues to reshape the profession.

Furthermore, public scrutiny on corporate tax practices has intensified. Calls by shareholder groups and other stakeholders looking for greater transparency and for corporations to demonstrate that they are paying their fair share of taxes, have become common. Research in this area by centre members has begun to explore these emerging issues. This development has led to new interest in sustainability reporting within the tax profession as companies seek to respond to these demands.

In this evolving setting, the work of the Tax Centre is more important than ever. It is uniquely positioned to play a pivotal role in shaping the future of the tax profession by developing talent equipped to navigate these complex challenges, while advancing research that will have a global impact. This dynamic context motivates the centre to reimagine some of its long-standing initiatives, ensuring they remain responsive to the ever-changing needs of the tax profession.

Tax Policy Research Symposium Renewal

The annual Tax Policy Research Symposium has proven to be an effective platform for sharing academic research and insights on current Canadian tax policy topics with Canadian tax policy makers. While it has fulfilled a critical role in bridging the gap between academic research and those in tax policy and tax practice for the last 25 years, the centre plans to update this initiative to address the evolving landscape. Starting in 2025, the centre will introduce a one-day seminar targeted at members of the tax profession and tax policy makers. However, unlike the current symposium, this seminar will focus on summarizing extant academic research for this audience with a particular focus on translating it into practical insights, specifically tailored to the practice and design of tax in Canada. Presenters will be drawn primarily from centre membership but will also include academics from across North America. The seminar will be biennial, to allow for research to evolve between events.

Through this updated initiative, the Centre aims to continue fostering innovation in tax practice and policy, advancing knowledge that will have a lasting, positive impact on both the Canadian and global tax communities. By adapting its efforts, the Centre is committed to influencing the next generation of tax professionals as they navigate an increasingly complex landscape.

Alongside this new initiative, the Centre will also promote research that speaks more directly to tax practice. While the research focused on academic audiences is critical to establishing thought leadership, it is equally important to produce applied research that addresses challenges facing tax practice and policy makers. The centre will play a key role in fostering mechanisms to support and increase this type of research.

Other Activities

The biennial Texas-Waterloo Current Research in Taxation Symposium began in 2014 and has continued through to the most recent event in September 2024. Moving forward, the centre will continue this important and successful initiative, while exploring ongoing refinements to maximize the symposium's effectiveness.

The Centre has established itself as a leader in Canadian tax education, evident through initiatives such as the annual Tax Educators' conference and the more recent quarterly online updates. The Centre remains committed to further advancing tax curricula and enhancing teaching pedagogy to improve tax education for all students across Canada.

Other activities of the centre remain important and are expected to continue.

d. University of Waterloo Centre for Information Integrity and Information Systems Assurance

UWCISA plans to continue to expand the Data Analytics and Emerging Technologies (DA&T) curriculum in AFM, increasing course offerings in emerging technologies, given strong broad base in data analytics and solid narrow base in emerging technologies.

Further, it anticipates a need to expand its PD workshops for practitioners to the point of offering monthly 1.5-3hr sessions on a variety of topics in UWCISA's focus areas. Topics include generative AI, System and Organizational Controls (SOC) reporting, cybersecurity best practices, specific data analytics tools including Alteryx and MindBridge, business model reporting and assurance, and use of specialists in financial statement audits.

Other key initiatives include the following:

- Develop an assurance specialization for AFM and other SAF undergraduate students to increase the number of assurance courses available to students who want to develop expertise in this area. Courses within the specialization would include internal audit, advanced external audit, audit data analytics and other advanced tools, SOC assurance, IT controls and IT auditing.
- Collaborate with CPA Canada, CPA Ontario, Information Systems Audit and Control Association and other professional bodies on educational and informational papers (e.g., white papers) related to emerging topics in the information integrity and information system assurance space. Topics include quantum computing, advanced machine learning and AI.
- Continue to produce high impact research that are published in top accounting and IS journals. Current papers being worked on by UWCISA members relate to topics such as accounting firm development of new assurance services, business model descriptions, neuro-cognitive measures of professional skepticism, non-audit specialists, client incivility against auditors and other accountants, auditor disclosures (e.g., CAMs/KAMs), phishing countermeasures, organizations implementation of cybersecurity regulations, organization communication of ransomware attacks, CPA familiarity with emerging technologies and tools, use of algorithm managers in financial statement audits, the state of research on large language models and generative AI in accounting and finance, consumer responsiveness to conversational agents, communicating value creation in integrated reporting, and how IT capability impacts ESG performance.

e. CPA Ontario Centre for Sustainability Reporting and Performance Management:

Ongoing Objectives

- Continue to be internationally recognized as leaders in the creation of practice-relevant performance management research and the dissemination of that research to practitioners. Given the expertise within SAF, our focus will be on behavioural research emphasizing the importance of employees in strategy execution.
- To produce high quality, impactful sustainability-oriented research that is relevant to academic, practitioner, standard setter, and regulatory audiences.
- Provide financial support to help the Assistant Professors and PhD students at SAF in the areas of sustainability reporting and performance management to develop as scholars, build their reputation for scholarship, and disseminate their research.

- Provide financial support to assist SAF/UW to purchase the archival databases that are necessary to conduct world-class empirical research.
- Create opportunities for knowledge sharing and dialogue between academic researchers/ educators and practitioners, regulators, and standard setters, including hosting open-access webinars targeted to joint practitioner-academic audiences related to sustainability reporting topics on an approximately bimonthly basis.
- Support the dissemination of academic research to practitioner audiences (i.e., a brief practitioner summary of each academic study supported by the CSPM will be required of funding recipients and promoted via the CSPM website).

Planned Activities

Sustainability

- Host an annual conference targeted to a joint academic-practitioner audience related to current issues in sustainability reporting.
- Provide up to approximately $30K-$50K in funding per year to help support SAF/UW database subscriptions. The specific databases to be purchased will depend upon faculty requests, which in turn are determined by the research questions to be investigated (i.e., unknown at this time).
- Provide travel funding of approximately $10K per year to support three conference attendances by faculty and/or PhD students presenting their original related to sustainability topics.

Performance Management

- In 2025, we will hold the 5th Performance Management Field Research Symposium in Madison, Wisconsin. The symposium will be co-hosted with the University of Wisconsin. We have 100 performance management faculty and PhD students from Canada and the United States signed up to attend. This two-day event will again feature four research working paper presentations focused on different performance management topics, and each paper was followed by a discussion by a prominent research topic expert. We plan to host similar events in 2027 (Toronto, Canada) and 2029 (Madison, Wisconsin).
- We plan to fund up to $8,000 for up to ten experimental research projects each year for five years. Projects must explore a performance management topic and be approved by the CSPM advisory board.
- We plan to fund travel up to $3,000 for up to three presentations of performance management topics each year for five years.
- We plan to fund ten students each year ($250 per student) to participate in the performance management academic mentorship program. We will run this program for the next five years.
- We plan to fund the creation of four YouTube videos each year for five years that summarize CSPM-funded performance management research findings for the purpose of disseminating those findings to practitioners.

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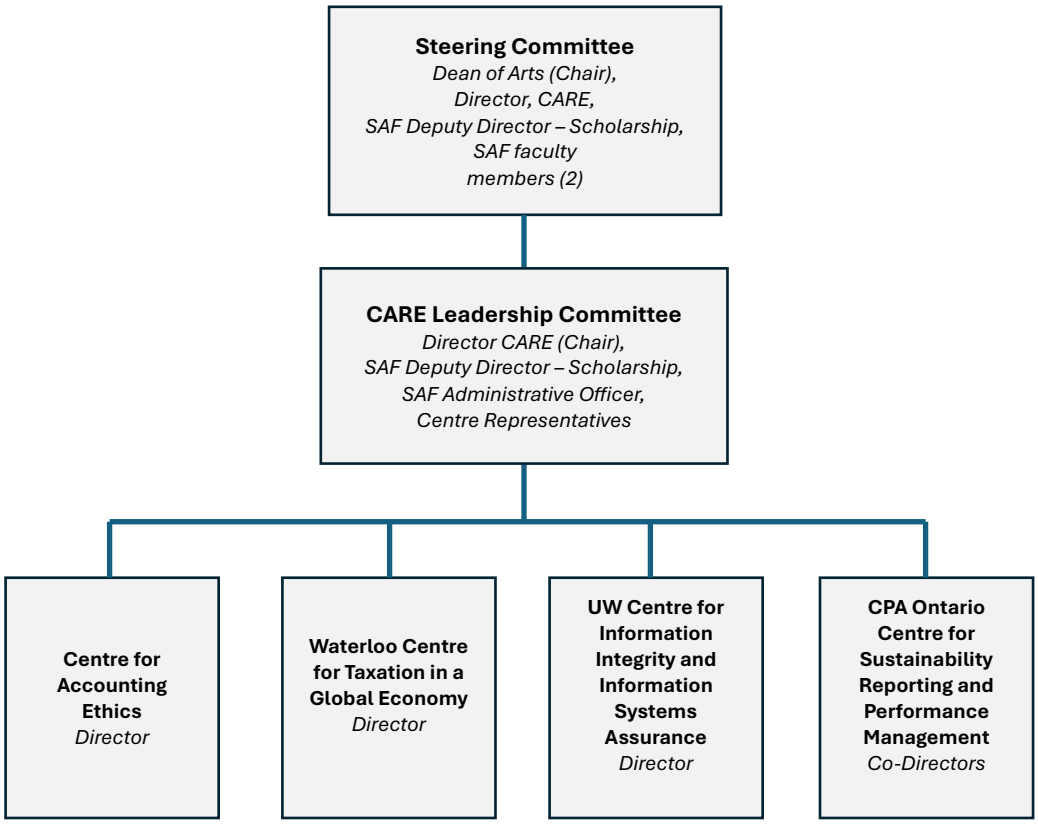
5. ORGANIZATIONAL STRUCTURE

a. Existing Structure

CARE has been operating in much the same way since it was founded in 1980. As an entity designed to raise funds for activities within the SAF, it has been directed and managed by the Director of the SAF, along with the SAF's Administrative Officer. Starting in 1994, the activities of CARE were concentrated into sub-centres with specific purposes and structures. Each of the four existing sub-centres within CARE have their own oversight structure, typically including external advisory councils. Descriptions of these are provided in Section 2.

b. New Structure

While developing this report, it became apparent that CARE could improve its governance structure by following more closely the requirements under Policy 44, "Research Centres and Institutes." The organizational structure of CARE, going forward, is shown in the following diagram.



c. Steering Committee

In accordance with the University of Waterloo Policy 44, "Research Centres and Institutes," the Steering Committee is CARE's governing body. It provides oversight of the general and financial management of CARE in a manner consistent with the University's policies, as well as guidance regarding creation or cessation of centres within CARE.

The Steering Committee is chaired by the Dean of Arts (or designate). The Steering Committee also consists of the Director of CARE plus three additional SAF faculty members, normally including the Deputy Director – Scholarship of the SAF.

The two additional faculty members will be appointed by the CARE Leadership Committee following a call for expressions of interest by the Deputy Director – Scholarship. It is desirable for one of the two faculty members of the Steering Committee to be a Tenured Faculty Member of the SAF, and for one of the two faculty members to be a Permanent Teaching Stream Faculty Member of the SAF. Terms of each of these faculty members are for three years, preferably with a staggered start date to support continuity and knowledge retention on the Steering Committee

The Steering Committee will meet at least once per year. Quorum shall consist of the Chair or their designate, the Director, plus one additional faculty member other than the Deputy Director – Scholarship. Meetings of the Steering Committee and the meeting minutes will be available to CARE members. The powers of the Steering Committee are those granted under Policy 44, paragraph 10.3.8.

d. CARE Leadership Committee

The CARE Director is responsible for the overall business leadership, development and day-to-day operations of CARE, including all duties specified in Policy 44, paragraph 10.4.6. The CARE Director is normally the Director of the SAF. For a specific reason and a specific period, the Director of the SAF can designate another regular faculty member from within the SAF to fulfill the role of CARE Director, with the approval of the Chair of the Steering Committee. The CARE Director is assisted and advised in the completion of these duties by the members of the CARE Leadership Committee which includes the SAF Deputy Director – Scholarship, the SAF Administrative Officer and one representative from each sub-Centre in CARE, which may be the sub-Centre Director/Co-Director or an alternative designate selected by the sub-Centre membership in a manner suitable to the membership. The primary role of the CARE Leadership Committee is to coordinate joint activities across the sub-Centres such as fund raising, reporting, shared administrative and technological support and to provide oversight of alignment with sub-Centre activities with the CARE Vision and Mandate. The CARE Leadership Committee will meet at least annually.

e. Centres' Leadership

Drawing on the shared resource of SAF and CARE, the sub-Centres operate largely autonomously from each other. The centres are central to advancing the University of Waterloo' s mission as a leading institution for accounting and finance research and education. In particular, the Centres are instrumental to gaining national and international reputation for research and education within the specific discipline of the centre. The Centres Leadership is responsible for coordinating the activities of the centres to achieve synergistic growth and efficiencies.

Collectively, the primary objectives of the centres are to manage, promote and increase the research and educational activities and funding of accounting and finance at the University of Waterloo. As described in section 2, each centre has a unique focus that represents a discipline to achieve the broader mandate of CARE. Ultimately, the goal of each centre is to foster research and education within its discipline across the country and internationally.

It has Is been the practice in the School of Accounting and Finance that the most appropriate structure is to have these units operate under the umbrella of CARE rather than as free-standing centres in and of themselves. The centres were established at the request of the founding donors

and each has its own Advisory Board or other oversight body that often includes experts from industry. The Director of CARE, or a representative, attends meetings of the Advisory Boards or other oversight body.

These Centres Directors will be of academic stature, appointed for their intellectual and administrative abilities and for their commitment to research, education and CARE's mission and vision. The Centre Directors will be tenured Associate or Full Professors within the School of Accounting and Finance with the following abilities/responsibilities:

- Enhance the School's commitment to excellence in the specific area of fundamental and applied accounting and finance research of the centre;
- Enhance the School's commitment to excellence in accounting and finance education within the scope of the centre;
- Associate productively with CARE members in a collegial and collaborative manner, both internal and external;
- Maintain the confidence and co-operation of Waterloo colleagues; and
- Represent and affect CARE's overall vision, mission and initiatives, as well as the specific centre's vision, mission and initiatives.

The Centre Directors will be appointed by the Director. In making the decision to appoint the Centre Directors, the Director will solicit input from the Chair of the Steering Committee, the members of the centre and Centre partners. The Centre Directors will typically serve for a period of four years, renewable for a second term of four years with the support of the Director and the centre members. The terms of the Centre Directors should be staggered, where possible.

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6. Finances

a. Overview and Financial Statement

CARE is funded completely from sources external to the University. Below is a summary of the sources and uses of funds during the reporting period, broken down for each centre, and reported according to major use.

When reviewing the financial information below, note that some centres show negative balances for this reporting period. This reflects the on-going, collaborative and integrated nature of CARE's centres. While the Centre for Accounting Ethics and the Waterloo Centre for Taxation in a Global Economy report negative net funds at the end of the 6-year reporting period, these centres all began this most current reporting period with carry-over surpluses. **The overall net increase in funds for CARE was almost $48 thousand over the reporting period.**

CARE remains financially self-sufficient, thriving on generous support primarily from alumni donations, and corporate sponsorships. Our centres have not needed university operating funding to sustain their research and educational programs and will not need such funding in the future.

Statement of Funds Sources and Uses
Centre for Accounting Research and Education
January 1, 2019 – December 31, 2024

	Ethics Center	*Tax Centre*	*UWCISA*	*CSPM*	*Total*
Revenue					
Sponsorships	50,653	400,000	611,982	484,000	1,546,635
Donations			7,000		7,000
Service revenue	3,178		36,083		39,261
Total	53,831	400,000	655,065	484,000	1,592,896
Expenses					
Research	46,283	292,295	240,682	301,480	880,740
Teaching			15,681		15,681
PhD students		69,314	70,838	8,021	148,173
Administration	8,269	8,995	256,937	110,791	384,992
Computing and research data		50,966	17,401	47,125	115,492
Total	54,552	421,570	601,539	467,417	1,545,078
Net addition to (draw on) carry forwards	(721)	(21,570)	53,526	16,583	47,818

b. Revenue

The vast majority of CARE's funding arises through sponsorships and donations, while approximately 2% of the total revenue is from conference registrations and similar for-fee activities. The delineation of sponsorships versus donations is based on each centre's approach to their supporters and highlights the fact that our supporters continue to receive direct benefit from their sponsorship dollars.

Each centre has evolved its own approach to raising funds due to varying opportunities and objectives.

Centre for Accounting Ethics. The Centre for Accounting Ethics was formed with a significant contribution following an accounting scandal. While the centre continues to receive new funding, it continues to draw down the original contribution.

Waterloo Centre for Taxation in a Global Economy. The tax centre has a series of sponsors who contribute to the centre annually. The members consistently include the two Canadian national tax organizations with a significant focus in taxation, CPA Canada and the Canadian Tax Foundation; the four international accounting firms, Deloitte, EY, KPMG, PwC; and more recently, a national accounting firm, Grant Thornton. In addition to the regular membership, Deloitte also exclusively sponsors the annual Tax Policy Research Symposium.

University of Waterloo Centre for Information Integrity and Information Systems Assurance. UWCISA raises funds through its primary sponsors, other donations, and fees paid by participants at its professional educational activities. Main sponsors are CPA Canada, the Information Systems Audit and Control Association, and starting in 2018, the Institute of Internal Auditors Canada. Specific events, including the biennial Information Integrity and Information Systems Assurance Symposium are sponsored by specific organizations, but also generated additional revenue via registration fees.

CPA Ontario Centre for Sustainability Reporting and Performance Management. CSPM is exclusively sponsored by CPA Ontario. The funding agreement is renewed periodically, with the most recent agreement lasting three years and ending during fiscal 2025. The centre was originally called CPA Ontario Centre for Research and Education, but the mission was expanded in 2021 to include sustainability reporting, which explains the shift to the present name.

c. Budget for 2025 – 2029

While funding for the centres of CARE has not been committed, the centres have successfully raised funds throughout their history. Thus, we project that the centres will continue to raise funds at similar levels going forward. We commit to only spend the revenue generated by each centre and will not rely on University of Waterloo operating funds.

Statement of Planned Revenue and Expenditures
Centre for Accounting Research and Education
January 1, 2025 – December 31, 2029

	2025	***2026***	***2027***	***2028***	***2029***	***Total***
Revenue	300,000	310,000	325,000	340,000	350,000	1,625,000
Expenses						
Research	175,000	170,000	170,000	177,000	179,000	871,000
Teaching	30,000	33,000	40,000	40,000	40,000	183,000
PhD students	30,000	32,000	35,000	38,000	41,000	176,000
Administration	50,000	55,000	60,000	65,000	70,000	300,000
Computing and research data	40,000	20,000	20,000	20,000	20,000	120,000
Total	325,000	310,000	325,000	340,000	350,000	1,650,000
Net addition to (draw on) carry forwards	(25,000)	0	0	0	0	(25,000)

The plan is to spend down the approximately $25,000 surplus funds generated over the period 2019 – 2024 during these five years.

7. Closing

CARE remains steadfast in its mission to advance academic excellence and foster innovation in accounting and finance. As a vital bridge between rigorous research and industry needs, CARE has demonstrated significant impact over the past five years by generating impactful, high-caliber research, interdisciplinary collaboration, and strategic initiatives addressing critical, emerging areas like sustainability reporting, global taxation and digital transformation. Our ability to secure consistent funding, foster global partnerships and host impactful educational events underscores our role as a leader in shaping the future of the profession.

Renewal of CARE is essential to sustaining SAF's trajectory of excellence. With a focus on preparing future leaders and addressing the evolving needs of the business world, CARE is uniquely positioned to drive meaningful advancements in both research and practice. By continuing to bridge the gap between academia and industry, CARE will further its contributions to fostering innovation, ethical standards and global impact in the fields of accounting and finance in Canada and around the world.

APPENDIX 1. CARE Members

Current Members of CARE from SAF:

Muhammad Azim	David Ha	Brad Pomeroy
Steve Balaban	Frank Hayes	Adam Presslee
Andrew Bauer	Tracy Hilpert	Donna Psutka
Tim Bauer	Alan Huang	Julie Robson
Garvin Blair	Wenqian Hu	Dan Rogozynski
Efrim Boritz	Daniel Jiang	Laila Rohani
Neil Brisley	Tisha King	Sasan Saiy
Lynn Carty	Kenneth Klassen	Theophanis Stratopoulos
Darren Charters	Deb Kraft	James Thompson
Changling Chen	David Lin	Joyce Tian
Alec Cram	Ross Lu	Nancy Vanden Bosch
Elizabeth Demers	Shari Mann	Adam Vitalis
Alan Douglas	Haaris Mian	Tony Wirjanto
Sepideh Ebrahimi	Tu Nguyen	Kaishu Wu
Krista Fiolleau	Seda Oz	Mingyue Zhang
Steve Fortin	Blake Phillips	

Other Members

Nicky Carty	Behram Faroogh	Linda Thorne
Malik Datardina	Melissa Robertson	

Administrative Support

Jenny Rothwell	Tracy Williams

Retired CARE members

Greg Berberich	Ranjini Jha	Kenneth Vetzal
D'Arcy Delamere	Duane Kennedy	Alan Webb
Sally Gunz	Linda Robinson	

Other Faculty Members supported by CARE from 2019 – 2024

The faculty members listed below were supported by CARE from 2019 to 2024 with research or teaching stipends, research expense funds, conference travel and training, but were not current members of retired members of CARE.

Xuyang Ma	Jeff McIlravey	Neal Stoughton

PhD Students supported by CARE from 2019 – 2024

Jillian Adams	Dorian Lane	Pei Wang
Yixing (Ivee) Che	Amar Mahmoud	Xiaoqi (Victor) Wang
Xi (Stella) Chen	Ala Mokhtar	Hamza Warraich
Yijia (Ben) Chen	Kate Patterson	Christopher Wong
Chan (Jessie) Ge	Karen Pinto	Betty Xing
Zhi (Helena) He	Andrea Stapleton	Jonathan Yuan
Yifei Kuang	Qi (Rachel) Tang	Chunmei Zhu

APPENDIX 2. CARE Donors and Sponsors

Complete list of External Partners & Stakeholders (is this redundant with section 2? Probably take out of section 2 and leave here)

Centre for Accounting Ethics

CPA Canada

Canadian Academic Accounting Association

Waterloo Centre for Taxation in a Global Economy

Sponsors

Canadian Tax Foundation	PWC	Deloitte
KPMG	EY	
CPA Canada	Grant Thornton	

Industry and Academic Partnerships:

Formal collaboration with the University of Texas at Austin and informal collaborations with many other universities, enhancing Waterloo's academic reputation.

University of Waterloo Centre for Information Integrity and Information System Assurance

CPA Canada	American Accounting Association (AAA)	Cybersecurity and Privacy Institute
Information Systems Audit and Control Association – (ISACA)	American Institute of Certified Public Accountants	Institute of Internal Auditors (IIA)
ISACA Toronto	Auditing and Assurance Standards Board	IIA Canada
The Institute of Internal Auditors Canada	Canadian Academic Accounting Association	IIA - Toronto Chapter
AAA - Accounting Information Systems (AIS)	CPA Canada - Audit and Assurance Technology Committee (AATC)	International Journal of Accounting Information Systems (IJAIS)
AAA - Strategic and Emerging Technologies (SET)		Thin
TWENTY20		

Formal collaboration with the Rutgers University and informal collaborations with many other universities, enhancing Waterloo's academic reputation.

CPA Ontario Centre for Sustainability Reporting and Performance Management

CPA Ontario

APPENDIX 3. Research Papers

List of CARE Research Published in Refereed Journals from 2019 – 2024

2024

Adam, V., Boritz, J. E., Simeoni, L. (2024). Internal Audit Competencies. *International Journal of Auditing, 28*(3), 458-484. Aggregate Tone and Gross Domestic Product (Gaertner, F., Kausar, A., Li, H., Steele, L.) (2024). Contemporary Accounting Research, 4 *(4), 2574-2599.

Bauer, Tim D., **J. Efrim Boritz**, **Krista Fiolleau**, **Bradley Pomeroy**, **Adam Vitalis**, and **Pei Wang**. "Cataloging the Marketplace of Assurance Services." *Auditing a Journal of Practice & Theory* 43, no. 3 (August 1, 2024): 49–75.

Berger, Leslie, Lan Guo, **Kelsey Matthews**, and Christopher Wong. "Strategic Bias in Team Members' Communication About Relative Contributions: The Effects of Voluntary Communication and Explanation." Behavioral Research in Accounting (March 12, 2024): 1–20.

Cram, W. A., D'Arcy, J., Benlian, A. (2024). Time Will Tell: The Case for an Idiographic Approach to Behavioral Cybersecurity Research. MIS Quarterly, 48 (1), 95-136.

Demers, Elizabeth, Victor Xiaoqi Wang, and Kean Wu. "Measuring Corporate Human Capital Disclosures: Lexicon, Data, Code, and Research Opportunities." *Journal of Information Systems* 38, no. 2 (July 1, 2024): 163–86.

Dong, M., **Stratopoulos, T. C.,** & Wang, V. (2024). A Scoping Review of ChatGPT Research in Accounting and Finance. International Journal of Accounting Information Systems. https://doi.org/10.1016/j.accinf.2024.100715

Fan, Qintao, David A. Guenther, and **Kaishu Wu**. "Fixed and Variable Tax Expense and the Cost of Equity Capital." *The Journal of the American Taxation Association* (May 17, 2024): 1–20.

Fang, Bingxu, **Sasan Saiy**, and Dushyantkumar Vyas. "Industry Peer Information and the Equity Valuation Accuracy of Firms Emerging from Chapter 11." *Management Science* (May 17, 2024).

Gong, G., **Jiang, X. D**., Xie, B. (2024). The Use of Cash Flow Metrics in CEO Compensation and the Design of Loan Contracts. Contemporary Accounting Research, 41 (4), 2384-2416.

Hope, Ole-Kristian, **Haihao Lu**, and Songlan Peng. "Economic Consequences of AS 18: Related-Party Transactions With Principals Versus Nonprincipals." *The Accounting Review* (October 1, 2024): 1–35.

King, Tisha. "First Things First: Using Anchoring Bias to Examine the Effect of Penalty Severity and Social Norms on Tax Compliance." *Journal of Business Ethics* (July 1, 2024).

Smith, Steven D., and **Tyler F. Thomas**. "The Effects of Strategic Alignment and Strategic Clarity on Multidimensional Task Performance." *Accounting Organizations and Society* 112 (June 2024): 101524.

Stratopoulos, T. C., Ye, H. (2024). Engagement and Crowding-out Effects of Leaderboard Gamification on Medical Crowdfunding. Journal of Management Information Systems.

Tang, Qi Rachel, and **Alan Guoming Huang**. "KPI Information Acquisition by Analysts: Evidence From Conference Calls." *Journal of Business Finance & Accounting* (July 25, 2024).

Wu, Kaishu. "The Interaction Between Incentive and Opportunity in Corporate Tax Planning: Evidence From Financially Constrained Firms." *Advances in Accounting* 67 (December, 2024): 100757.

2023

Ahmed, D., Hendrikse, J., Joos, P., Lev, B. (2023). Are ESG Ratings Informative About Companies' Socially Responsible Behaviors Abroad? Evidence from the Russian Invasion of Ukraine. Accountability in a Sustainable World Quarterly, 2 (1), 49-64.

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APPENDIX 4. Symposia and Conferences

Complete List of CARE-Funded Symposia and Conferences from 2019 – 2024

Centre for Accounting Ethics

2019 Ethics Workshop with Canadian Academic Accounting Association (CAAA). Data Privacy presented by Jonathan Joynt, Manager – Breach, Compliance, Intake and Resolution Directorate, Office of the Privacy Commissioner of Canada and Deborah Evans, Chief Privacy Officer, Rogers Communications

2019 Biennial Ethics Symposium. The Impact of Technology on Ethics, Professionalism and Judgment in Accounting. Partnering with UWCISA, CPA Canada and the *Journal of Business Ethics*, the program included research paper presentations, and presentations by Jeff Lui, Director in Deloitte's Artificial Intelligence (AI) Practice; Jerrard Gaertner, Managed Analytic Services, Ryerson University, University of Toronto; Eric Cohen, Audit Data Standards, Blockchain, Continuous Audits; Brian Friedrich, International

2021 Ethics Workshop with CAAA. Issues of Diversity Facing Accounting Academics presented by Dr. Maureen Sterling, Odette School of Business; Dr. Bertrand Malsch, Smith School of Business and Stephanie Fox, VP of Financial Reporting & Assurance Standards Canada and Executive Sponsor for Diversity, Equity and Inclusion Council for CPA Canada

2022 Ethics Workshop with CAAA. Incorporating Environmental and Social Reporting Into Curriculum presented by Blake Phillips, University of Waterloo and Vern Albush (he/him) Director Sustainability, Federated Cooperatives Limited

2022 Biennial Ethics Symposium. Impact of Global Pandemic, Specifically Covid-19, On Ethics, Professionalism and Judgement In Accounting And Financial Reporting. Guest speakers included José R Hernandez, Chief Executive Officer, Ortus Strategies; Zain Raheel, Partner, National Leader Forensics & Integrity Services EY Toronto; and Douglas Johnson, Chief Risk Officer (CRO) at Haventree.

Waterloo Centre for Taxation in a Global Economy

2019 Tax Educators' Conference. "Teaching Value-Added Taxes (HST) in Canada" Toronto. This half-day conference provides professional development to university tax instructors from across Ontario.

2019 Tax Policy Research Symposium. "Taxation of Global Digital Commerce" Toronto. This 1.5-day symposium brought together tax academics, government officials and practitioners from across Canada to discuss technology innovations' impact on tax practice, and also current tax academic research.

2020 Tax Educators' Conference. "Teaching Data Analytics in Tax" Online. This half-day conference, held online during COVID, provides professional development to university tax instructors from across Ontario.

2020 Texas-Waterloo Tax Policy Symposium. Austin, Online. The half-day symposium was shortened due to COVID. This symposium drew approximately 110 academic accounting

researchers in tax from North America, Europe and Asia. Three research papers were presented and discussed.

2021 Tax Educators' Conference. "Teaching Tax in a Changing World" Online. This half-day conference, held online during COVID, provides professional development to university tax instructors from across Ontario.

2021 Tax Policy Research Symposium. "Should We Fight Income Inequality Through the Tax System?" Online. While online during COVID, this 1.5-day symposium brought together tax academics, government officials and practitioners from across Canada to discuss changing social justice issues and the tax system, and also current tax academic research.

2022 Tax Educators' Conference. "Comp Map 2.0—Changing Tax Education" Online. This half-day conference, held online during COVID, provides professional development to university tax instructors from across Ontario.

2022 Tax Policy Research Symposium. "Second Pillar of Wisdom? Much Ado about a Global Minimum Tax" Online. While online during COVID, this 1.5-day symposium brought together tax academics, government officials and practitioners from across Canada to discuss a recent global tax policy initiative supported by the OECD and the G20 countries, and also current tax academic research.

2022 Texas-Waterloo Tax Policy Symposium. Toronto. The 1.5-day symposium drew approximately 90 academic accounting researchers in tax from North America, Europe and Asia. Six research papers were presented and discussed.

2023 Tax Policy Research Symposium. "Tax rules for a modern world - Canada's GAAR and mandatory disclosure rules" Toronto and online. Returning to pre-COVID activities, this one-day symposium brought together tax academics, government officials and practitioners from across Canada to discuss one of Canada's tax policy approaches to maintaining a strong tax system, and also current tax academic research.

2023 Tax Educators' Conference. "Perceived Skills Gap in Tax Education versus Early-Career Practice" Toronto and online. This half-day conference provides professional development to university tax instructors from across Ontario.

University of Waterloo Centre for Information Integrity and Information Systems Assurance

2019 11th Biennial Symposium on Information Integrity and Information Systems Assurance. The program included one panel discussion, nine research paper presentations and three research reports

2021 12th Biennial Symposium on Information Integrity and Information Systems Assurance. The program included two workshops on various technologies, four panel discussions, six research paper presentations and four research reports.

2023 13th Biennial Symposium on Information Integrity and Information Systems Assurance. The program included four workshops on various technologies, four panel discussions, ten research paper presentations and four research reports.

CPA Ontario Centre for Sustainability Reporting and Performance Management

2019 Field-based Performance Management Research. This one-day event featured four research working paper presentations focused on different performance management topics.

2021 Followership and Leadership in the Accounting Profession. This two-hour virtual symposium was designed to benefit accountants (CPAs) and human resources professionals who work with accountants.

2021 Field Research Symposium. This virtual symposium held over five days included a panel discussion of key researchers using this method, and four research paper presentations.

2022 Managing, Motivating and Engaging Remote Workers. This half-day conference drew expertise from a key note speaker and panelists.

2023 Field Research Symposium. This two-day event featured four research working paper presentations focused on different performance management topics. The common theme of the research being presented is the studies' reliance on field-based data.

2024 Contemporary Issues in Sustainability Reporting Symposium. This 1.5 day symposium included three key note speakers, Zacharias Sautner from the University of Zurich, Richard Sloan from the University of Southern California and Jeff Hales from the International Sustainability Standards Board, along with four research paper presentations and a panel discussion.

UNIVERSITY OF WATERLOO

FACULTY OF ARTS | Office of the Dean
519-888-4567, ext. 48246 | doa-admin@uwaterloo.ca |

February 5, 2025

Re: Centre for Accounting Research and Education (CARE)

Dear Members of Senate Research Council,

I am writing on behalf of the Faculty of Arts to register our full support for the School of Accounting and Finance's Centre for Accounting Research and Education (CARE). Our support also extends to the sub-units affiliated with this Centre, namely UW Centre for Information Integrity and Information Systems Assurance (est. 1981), The Centre for Accounting Ethics (est. 1991), The CPA Learning Centre (exp. 2010), the CA-SAF Centre for Capital Markets Education (est. 2012), The Waterloo Centre for Taxation in a Global Economy (est. 2013), and the CPA Ontario Centre for Sustainability Reporting and Performance Management (est. 2017, formerly the Centre for Performance Management Research and Education).

Collectively, these units and the faculty and students affiliated with them have done sterling service in advancing the reputation of the School as an internationally recognized centre of accounting research and in ensuring that such research is as widely disseminated as possible.

Sincerely,

Alexie Tcheuyap, FRSC
Dean, Faculty of Arts
Professor, French Studies
University of Waterloo

Appendix 6. Meeting Minutes – CARE Steering Committee

Meeting Date: Feb 4th 2025

Participants: Chair: Ana Ferrer, Blake Phillips, Julie Robson, Alan Douglas

Agenda Items:

1. **Submission Report from Last Year**
    - The report was sent back and is now being resubmitted following a change in policy.
2. **Current Submissions** - Bernie requested the following be added
    - Financials up to December 2024.
    - Reflections from individuals involved in the subcenters.
    - Letter of support from the Dean.
3. **Creation of Centre for Entrepreneurial Finance**
    - Efforts are underway to establish a new centre within CARE.
4. **Overview of CARE Centers**
    - There are currently four centres within CARE.
    - The Center for Sustainability Reporting and Performance Management is a recent addition within the last five years.
5. **Upcoming Leadership Changes**
    - Efrim Boritz will retire in 2025, with Tim Bauer slated to succeed him.
    - Emphasis on a rotating directorship model under the new governance structure.
6. **Organizational Structure**
    - Steering committee mandated under Policy 44.
    - CARE Leadership Committee to coordinate activities affecting all subcenters, with annual reflection on activities.
7. **Financial Matters**
    - Discussions on appropriate carry forward amounts are ongoing.
    - Past carry forward funds were consolidated into the general CARE WO, which will not recur per discussions with the Dean's office.
    - Future funding to be managed centrally, with distribution to centers based on CARE directors' decisions.

- Projected spending aligned with historical funding patterns, though CPA Ontario's new funding model may affect funding levels.

8. **Expenditure Questions**
    - Expenditure projections contingent upon expected funding levels from donors and carry forward amounts.
9. **Administrative Matters**
    - Some SAF salaries categorized under administration, including conference costs.
10. **Approval of Reports**
    - Motion to approve the CARE Report

Phillips and Douglas

Carried

11. **Next Meeting**
    - Scheduled for mid-March 2026.
12. **Adjournment**
    - Motion to adjourn

Phillips and Douglas

Carried

SGRC - Regular Agenda - Faculty of Arts - March 17, 2025

Meeting Information

Agenda Page Title
SGRC - Regular Agenda - Faculty of Arts - January 27, 2025

Career Level
Graduate

Faculty/Unit
Arts

Date
01/27/2025

Time

Location

Summary

Other Business

Attachment(s)

Course Proposals

Course Proposal Details

Courses: Retire
No proposals have been added.

Courses: New
No proposals have been added.

Courses: Changes
No proposals have been added.

Programs & Plans Proposals

Programs & Plans Proposal Details

Programs & Plans: Retire
No proposals have been added.

Programs & Plans: Major Modifications

Code	Title	Type	Workflow Step
PhD in Psychology	Doctor of Philosophy (PhD) in Psychology	Program	SGRC, Senate Graduate and Research Council (SGRC) | Under Review
MA in English-Critical Media Studies	Master of Arts (MA) in English - Critical Media Studies	Program	SGRC, Senate Graduate and Research Council (SGRC) | Under Review
MA in English-Critical Media Studies-Co-op	Master of Arts (MA) in English - Critical Media Studies - Co-operative Program (direct entry)	Program	SGRC, Senate Graduate and Research Council (SGRC) | Under Review

Programs & Plans: Minor Modifications

No proposals have been added.

Regulations Proposals

Regulations Proposal Details

Regulations: Retire

No proposals have been added.

Regulations: New

No proposals have been added.

Regulations: Changes

No proposals have been added.

PhD in Psychology
Doctor of Philosophy (PhD) in Psychology

Under Review | Spring 2025

Proposal Information

Status
Active

Workflow Status
In Progress

SGRC, Senate Graduate and Research Council (SGRC) expand ▲
Waiting for Approval | Approval Delegate(s)

Mike Grivicic
Tim Weber-Kraljevski
Diana Goncalves
Melanie Figueiredo
Ashley Day

Changes

- Calendar Activation Date
- Graduate Course Requirements
- Graduate Research Fields
- Effective Term and Year
- Admin Notes

Effective Date and Career

Career
Graduate

Important!

Proposed
Effective Term and Year
Fall 2025

Existing
Effective Term and Year
Winter 2024

Proposal Details

Proposal Type
Change

Academic Unit Approval
09/10/2024

Quality Assurance Designation
Major Modification

Major Modification Categories
Add/re-name a graduate research field, graduate specialization, honours, option, specialization, undergraduate diploma, minor

Is there an impact to existing students?
Yes

Impact on Existing Students
No impact for the most part. Students who currently have arrangements that mirror the formal “General Psychology” GRF will receive that designation when they graduate (assuming they meet the requirements).

Is the credential name changing?
No

Graduate Co-operative Requirements
Not Applicable

Internship Requirements
Not Applicable

Rationale and Background for Change(s)
Updating the degree requirements to include a new Graduate Research Field called “General Psychology” and clarify a pre-requisite for the Industrial/Organizational Psychology (IO) graduate research field: Psychology currently has 6 Graduate Research Fields. To accommodate flexibility in course selection for graduate students we are adding a “General Psychology” graduate research field. This will allow, for example, a student whose research focus crosses the boundaries of our current disciplinary structure to better customize their associated courses to complement that focus. The General Psychology graduate research field has the same course number requirements and distribution (i.e., core, breadth, statistics) as most of the other Graduate Research Fields. We have long allowed students this flexibility informally with some success. This change will formalize this process administratively.
With respect to clarifying the pre-requisite for the IO graduate research field. This requirement is already in place in practice just not currently reflected in the GSAC. The change will rectify this issue.

Consultations (Departmental)

Supporting Documentation

General Program/Plan Information

Faculty
Faculty of Arts

Academic Unit
Department of Psychology

Graduate Field of Study
Psychology

Faculty
Faculty of Arts

Program/Plan Name
Doctor of Philosophy (PhD) in Psychology

Graduate Credential Type

Accelerated Program

PhD

Not applicable

Program Types

Admit Term(s)

Fall

Delivery Mode

On-campus

Delivery Mode Information

Length of Program

- The Department requires a minimum period of registration of 9 terms beyond an Honours Bachelor's degree or 6 terms beyond a Master's degree. While a PhD may be obtained within 9 terms of an Honours BA, a period of 12 to 18 terms is typical.

Registration Option(s)

Full-time

Registration Options Information

Proposed

Graduate Research Fields

- Clinical Psychology
- Cognitive Neuroscience
- Cognitive Psychology
- Developmental Psychology
- General Psychology
- Industrial/Organizational Psychology
- Social Psychology

Existing

Graduate Research Fields

- Clinical Psychology
- Cognitive Neuroscience
- Cognitive Psychology
- Developmental Psychology
- Industrial/Organizational Psychology
- Social Psychology

Graduate Specializations

Additional Program Information

- Students admitted to the Clinical Psychology field (area of research) of the PhD program must supply a Criminal Record Check (Vulnerable Sector) to the Department of Psychology prior to being matriculated.

Admissions

Admission Requirements: Minimum Requirements

- A 80% overall standing, or equivalent, in the last two years of study in the previous degree is the minimum requirement for admission.
- Candidates applying to the Industrial/Organizational Psychology graduate research field within the program must submit results from the Graduate Record Examination (Verbal, Quantitative, and Analytic scores). These scores are optional for students applying to the Cognitive Neuroscience, Cognitive Psychology, and Developmental Psychology graduate research fields.
- Please note that in most areas a Master's degree is not required for admission into the PhD program (the exception is Social Psychology and Clinical Psychology).
- English language proficiency (ELP) (if applicable)

Admission Requirements: Application materials

- Graduate Record Examination (GRE)
    - Required for candidates applying to the Industrial/Organizational Psychology graduate research field within the program and optional for candidates applying to the Cognitive Neuroscience, Cognitive Psychology, and Developmental Psychology graduate research fields.
- Personal statement
- Supplementary information form
- Transcript(s)

Admission Requirements: References

- Number of references: 3
- Type of references: academic

Requirements Information

Graduate Degree Requirements

- Students must complete the course and milestone requirements listed below in addition to the Graduate Academic Integrity Module (Graduate AIM).
- Students must be admitted to one of the following Graduate Research Fields:
    - Clinical Psychology
    - Cognitive Neuroscience
    - Cognitive Psychology
    - Developmental Psychology
    - Industrial/Organizational Psychology
    - Social Psychology

Graduate Course Requirements

No Rules

Proposed

Graduate Course Requirements

- Course requirements are determined by the student's previous academic background and their Graduate Research Field.
- Where applicable course requirements for students entering with a Bachelors degree or equivalent or an MA degree from the University of Waterloo in the Graduate Research Field in which they are completing their PhD are described below. Students entering directly into a PhD without completing an MA may be permitted to complete an MA during their PhD. If students have relevant academic background beyond a Bachelor's degree or equivalent but have not completed the MA degree from the University of Waterloo in the Graduate Research Field in which they are completing their PhD, then the PhD course requirements can, when deemed appropriate, be determined in consultation with the student's advisor, the Area Head, and Associate Chair, Graduate Studies in Psychology prior to admission.
- Students enrolled in the doctoral program must complete the Department's core requirements, statistics requirements (or credit granted for evidence of a strong undergraduate statistics background) and comprehensive breadth requirements as described within each Graduate Research Field's course requirements below. Courses with a numeric grading basis must be taken to meet the core and statistics requirements unless departmental permission is provided to take a course with a Credit/No Credit grading basis. For the purposes of the breadth requirement the relevant areas are listed below. Whether a course meets a breadth requirement is determined by the Graduate Research Field. If a student is unclear about whether a course will meet their breadth requirements, then they should consult with their supervisor and area head before enrolling in the course.
    - Clinical Psychology
    - Cognitive Psychology
    - Cognitive Neuroscience
    - Developmental Psychology
    - Industrial/Organizational Psychology
    - Quantitative Methods
    - Social Psychology
- All courses taken to meet degree requirements must be accepted for graduate credit by the Department of Psychology and no degree candidate can fulfil more than half of the minimum department course requirements with Credit/No Credit courses.
- Course requirements are minimum requirements only. Students may be required to take additional courses depending on their previous academic background and Graduate Research Field.
- Courses from outside the Department of Psychology may also be considered. Departmental permission is required. Note: When selecting a course from outside of the Department of Psychology, students should check with their advisor about its suitability.
- Transfer credits may also be considered. The acceptance of transfer credits from prior registration at another university will be determined in individual cases by the Associate Dean (Graduate Studies) of the Faculty at the time of admission to the program. Transfer credits must be "unused" credits (i.e., they must not have been credited towards an earlier acquired degree or other academic credential). Transfer credits must be specified in writing at the time of departmental recommendation for admission. A minimum of 70% (University of Waterloo converted grade) is required for transfer credit.
- Courses from outside the Department of Psychology and transfer credits can usually count for no more than 2 one-term credits toward breadth requirements.
- Use of a course not listed in the course requirements below to meet a degree requirement and other course substitutions are permitted but require departmental permission. Students should confirm the appropriateness of the course substitution with their advisor and have it approved by the Area head, and Associate Chair, Graduate Studies in Psychology.
- Students pursuing the **Clinical Psychology** Graduate Research Field must complete the following courses contingent upon the student's previous academic background.

- If a student enters the PhD with only a Bachelor's degree or equivalent, then the student is required to meet the course requirements beginning Year One below.
- If a student enters the PhD program having completed the MA in Psychology degree with a Clinical Psychology Graduate Research Field from the University of Waterloo, then the student is required to meet the course requirements beginning Year Three below in addition to completing any courses listed in Year One and Year Two not already completed. By the end of the PhD, students need to have completed all requirements from Year One to Year Six below or approved substitutes when courses completed during both the MA and PhD are considered. The courses are listed below in a typical sequence. Individual student's course sequences may vary, for example, based on course availability.
    - 2 statistics courses one of which must be PSYCH 630 Multiple Regression from the following list or an approved substitute:
        - PSYCH 630 Advanced Analysis of Variance
        - PSYCH 632 Multiple Regression
        - PSYCH 640 Special Topics in Psychology (on departmentally approved topics)
        - PSYCH 800 Psychometric Theory & Structural Equation Modeling
        - PSYCH 801 Advanced Structural Equation Modeling
        - PSYCH 803 Meta-Analysis
        - PSYCH 804 Multi-Level Modeling Applications in Psychology
    - 4 breadth courses from other graduate research fields outside of Clinical Psychology (e.g., not from the list of core, clinical practica, or research
      Clinical Psychology courses below) or an approved substitute. Students need to ensure that they meet the CPA breadth requirements.
    - Year One
        - Coursework (core):
            - PSYCH 716 Adult Psychopathology
            - PSYCH 717 Psychological Assessment I
            - PSYCH 718 Psychological Assessment II
            - PSYCH 719 Ethics and Professional Issues in Clinical Psychology
        - Clinical Practica:
            - PSYCH 720A Practicum in Interviewing & Cognitive Assessment I
            - PSYCH 720B Practicum in Interviewing & Cognitive Assessment II
            - PSYCH 721A Diagnostic Assessment Practicum I
            - PSYCH 721B Diagnostic Assessment Practicum II
            - PSYCH 722C Clinical Full-Time Fieldwork Placement I (0.50 unit weight) or PSYCH 811C Clinical Part-Time Fieldwork Placement I (0.25 unit weight)
        - Research Activities:
            - PSYCH 621 Advanced Clinical Research Forum I
        - Year Two
            - Coursework (core):
                - PSYCH 723 Child Psychopathology and Psychotherapy
                - PSYCH 724 Personality & Measurement Theory
                - PSYCH 725 Cognitive Behaviour Therapy
            - Clinical Practica:
                - PSYCH 726A Practicum in Integrated Assessment I
                - PSYCH 726B Practicum in Integrated Assessment II
                - Elective: PSYCH 738A, PSYCH 738B, PSYCH 738C Clinical Fieldwork Placement II (optional, by approval). Note: Students must have completed PSYCH 722C Clinical Full-Time Fieldwork Placement I or a set of 2 of PSYCH 811A, PSYCH 811B, and PSYCH 811C Clinical Part-Time Fieldwork Placement I, before they are eligible to take PSYCH 738A, PSYCH 738B, PSYCH 738C Clinical Fieldwork Placement II.
            - Research Activities:
                - PSYCH 621 Advanced Clinical Research Forum II
        - Year Three

        - Coursework (core):
            - PSYCH 727 Efficacy and Program Evaluation
            - PSYCH 728 Psychotherapy: Classical Roots & Contemporary Developments
        - Clinical Practica:
            - PSYCH 729A, PSYCH 729B, PSYCH 729C Child and Adolescent Psychotherapy Practicum I, II, III
            - PSYCH 730A, PSYCH 730B, PSYCH 730C Adult Psychotherapy Practicum I, II, III
            - Elective: PSYCH 738A, PSYCH 738B, PSYCH 738C Clinical Fieldwork Placement II (optional, by approval). Note: Students must have completed PSYCH 722C Clinical Full-Time Fieldwork Placement I or a set of 2 of PSYCH 811A, PSYCH 811B, and PSYCH 811C Clinical Part-Time Fieldwork Placement I, before they are eligible to take PSYCH 738A, PSYCH 738B, PSYCH 738C Clinical Fieldwork Placement II.
        - Research Activities:
            - PSYCH 621 Advanced Clinical Research Forum III
    - Year Four
        - Coursework (core):
            - PSYCH 731 Emotion-Focused Therapy
        - Clinical Practica:
            - PSYCH 732A, PSYCH 732B, PSYCH 732C Child and Adolescent Psychotherapy Practicum I, II, III
            - PSYCH 733A, PSYCH 733B, PSYCH 733C Adult Psychotherapy Practicum I, II, III
            - Elective: PSYCH 737A, PSYCH 737B, PSYCH 737C Emotion-Focused Therapy Practicum
            - Elective: PSYCH 738A, PSYCH 738B, PSYCH 738C Clinical Fieldwork Placement II or PSYCH 739A, PSYCH 739B, PSYCH 739C Clinical Fieldwork Placement III (optional, by approval)
        - Research Activities:
            - PSYCH 621 Advanced Clinical Research Forum IV
    - Year Five (and beyond)
        - Clinical Practica:
            - PSYCH 734A, PSYCH 734B, PSYCH 734C Practicum in Supervision I, II, III (required of all students)
            - PSYCH 735A, PSYCH 735B, PSYCH 735C Child and Adolescent Psychotherapy Practicum I, II, III
            - PSYCH 736A, PSYCH 736B, PSYCH 736C Adult Psychotherapy Practicum I, II, III
            - Elective: PSYCH 737A, PSYCH 737B, PSYCH 737C Emotion-Focused Therapy Practicum
            - Elective: PSYCH 740A, PSYCH 740B, PSYCH 740C Senior Practicum I or PSYCH 741A, PSYCH 741B, PSYCH 741C Senior Practicum II or PSYCH 742A, PSYCH 742B, PSYCH 742C Senior Practicum III (optional, by approval)
    - Year Six
        - Students must compete a year of predoctoral residency, the successful completion of which results in the crediting of the Graduate Studies Clinical Internship milestone.
- Students pursuing the **Cognitive Neuroscience** Graduate Research Field must complete the following courses contingent upon the student's previous academic background.
- If a student enters the PhD with only a Bachelor's degree or equivalent, then the student is required to complete 12 one-term (0.50 unit weight) courses.
- If a student enters the PhD having completed the MA in Psychology degree with a Cognitive Neuroscience Graduate Research Field from the University of Waterloo, then the student is required to complete 8 one-term (0.50 unit weight) courses such that students meet all of the course requirements listed below when courses completed during both the MA and PhD are considered.
    - 2 statistics courses from the following list or an approved substitute
        - PSYCH 630 Advanced Analysis of Variance
        - PSYCH 632 Multiple Regression
        - PSYCH 640 Special Topics in Psychology (on departmentally approved topics)

        - PSYCH 800 Psychometric Theory & Structural Equation Modeling
        - PSYCH 801 Advanced Structural Equation Modeling
        - PSYCH 803 Meta-Analysis
        - PSYCH 804 Multi-Level Modeling Applications in Psychology
    - 6 core courses in Cognitive Neuroscience including PSYCH 677A Fundamentals of Behavioural Neuroscience and PSYCH 784 Human Neuroanatomy and Neuropathology with the remaining selected from the following list or an approved substitute:
        - PSYCH 640 Special Topics in Psychology (on departmentally approved topics)
        - PSYCH 670 Special Topics in Behavioural Neuroscience
        - PSYCH 779A Cognitive Neuropsychology I
        - PSYCH 781 Cognitive Neuroscience of Memory
        - PSYCH 782 Visual Neuroscience
        - PSYCH 783 Neuroimaging of Cognition
        - PSYCH 785 Attention and the Brain
        - PSYCH 788 (cross-listed as HLTH-672) Epidemiologic Methods in Aging Research
        - PSYCH 789 Mind-wandering and Inattention
        - PSYCH 790 Case Studies in Neuropsychology
        - PSYCH 792 An Introduction to Methods in Computational Neuroscience
        - PSYCH 794 Cognitive Neuroscience of Face Perception
    - 4 breadth courses from other graduate research fields outside of Cognitive Neuroscience (e.g., not from the list of Cognitive Neuroscience core courses
      above) or an approved substitute.
    - Students must also take PSYCH 707 Cognitive Neuroscience Seminar in the Fall and Winter terms for a minimum of 4 years unless departmental permission is provided otherwise, or the student completes the program early. Students are encouraged to take PSYCH 707 for a 5th year if they have not yet finished their PhD. Note: PSYCH 707 is a 0.0 unit weight credit/no credit course.
- Students pursuing the **Cognitive Psychology** Graduate Research Field must complete the following courses contingent upon the student's previous academic background.
- If a student enters the PhD with only a Bachelor's degree or equivalent, then the student is required to complete 12 one-term (0.50 unit weight) courses.
- If a student enters the PhD having completed the MA in Psychology degree with a Cognitive Psychology Graduate Research Field from the University of Waterloo, then the student is required to complete 8 one-term (0.50 unit weight) courses such that students meet all of the course requirements listed below when courses completed during both the MA and PhD are considered.
    - 2 statistics courses including PSYCH 630 Advanced Analysis of Variance with the remaining selected from the following list or an approved substitute:
        - PSYCH 632 Multiple Regression
        - PSYCH 640 Special Topics in Psychology (on departmentally approved topics)
        - PSYCH 800 Psychometric Theory & Structural Equation Modeling
        - PSYCH 801 Advanced Structural Equation Modeling
        - PSYCH 803 Meta-Analysis
        - PSYCH 804 Multi-Level Modeling Applications in Psychology
    - 6 core courses in Cognitive Psychology from the following list or an approved substitute:
        - COGSCI 600 Seminar in Cognitive Science
        - PSYCH 640 Special Topics in Psychology (on departmentally approved topics)
        - PSYCH 650 Special Topics in Cognition and Perception
        - PSYCH 758 Applied Practicum in Cognitive Psychology
        - PSYCH 759 Research Practicum in Cognitive Psychology
        - PSYCH 769 Causal Reasoning
        - PSYCH 770 Basic Issues in Cognition
        - PSYCH 771 Basic Visual Processes
        - PSYCH 774 Visual Cognition
        - PSYCH 775 Consciousness and Cognition

        - PSYCH 776 Problem Solving, Judgment and Decision Making
        - PSYCH 777 Human Memory
        - PSYCH 778 Attention
        - PSYCH 779 Language and Reading
        - PSYCH 810 Directed Studies (on departmentally approved topics)
    - 4 breadth courses from other graduate research fields outside of Cognitive Psychology (e.g., not from the list of Cognitive Psychology courses above) or an approved substitute.
    - Students must also take PSYCH 747 Cognitive Psychology Seminar in the Fall and Winter terms for a minimum of 4 years unless departmental permission is provided otherwise, or the student completes the program early. Note: PSYCH 747 is a 0.0 unit weight credit/no credit course.
- Students pursuing the **Developmental Psychology** must complete the following courses contingent upon the student's previous academic background.
- If a student enters the PhD with only a Bachelor's degree or equivalent, then the student is required to complete 12 one-term (0.50 unit weight) courses.
- If a student enters the PhD having completed the MA in Psychology degree with a Developmental Psychology Graduate Research Field from the University of Waterloo or the MASc in Developmental and Communication Science at the University of Waterloo, then the student is required to complete 8 one-term (0.50 unit weight) courses such that students meet all of the course requirements listed below when courses completed during both the MA or MASc and PhD are considered.
    - 2 statistics courses from the following list or an approved substitute:
        - PSYCH 630 Advanced Analysis of Variance
        - PSYCH 632 Multiple Regression
        - PSYCH 640 Special Topics in Psychology (on departmentally approved topics)
        - PSYCH 800 Psychometric Theory & Structural Equation Modeling
        - PSYCH 801 Advanced Structural Equation Modeling
        - PSYCH 804 Multi-Level Modeling Applications in Psychology
    - 6 core courses in Developmental Psychology from the following list or an approved substitute:
        - PSYCH 640 Special Topics in Psychology (on departmentally approved topics)
        - PSYCH 680 Special Topics in Child Behaviour and Development
        - PSYCH 701 Foundations in Cognitive/Social Development: Basic
        - PSYCH 702 Foundations in Cognitive/Social Development: Social Cognitive Development
        - PSYCH 705 Foundations in Language Development: Basic Language Development
        - PSYCH 706 Foundations in Language Development: Pragmatics of Language
        - PSYCH 708 Reasoning about Ownership of Property
        - PSYCH 709 Reasoning about Beliefs and Desires
        - PSYCH 713 Theories of Pretense
        - PSYCH 810 Directed Studies (on departmentally approved topics)
    - 4 breadth courses from other graduate research fields outside of Developmental Psychology (i.e., not from the list of Developmental Psychology courses above) or an approved substitute.
    - Students must also take PSYCH 710 Current Issues in Developmental Psych Seminar in the Fall and Winter terms for a minimum of 4 years unless departmental permission is provided otherwise, or the student completes the program early. Note: PSYCH 710 is a 0.00 unit weight credit/no credit course.
- Students pursuing the Industrial/Organizational Psychology Graduate Research Field are required to have completed the Master of Applied Science (MASc) in Industrial and Organizational (I-O) Psychology degree from the University of Waterloo before entering the PhD program. Master's degrees in I-O psychology or related fields from other universities will be considered on a case-by-case basis.
- Students pursuing the **Industrial/Organizational Psychology** Graduate Research Field must complete the following courses:
    - 2 statistics courses from the following list or an approved substitute:
        - PSYCH 630 Advanced Analysis of Variance
        - PSYCH 640 Special Topics in Psychology (on departmentally approved topics)
        - PSYCH 800 Psychometric Theory & Structural Equation Modeling
        - PSYCH 801 Advanced Structural Equation Modeling

        - PSYCH 804 Multi-Level Modeling Applications in Psychology
    - 2 core courses in Industrial/Organizational Psychology selected from the following list or an approved substitute:
        - PSYCH 640 Special Topics in Psychology (on departmentally approved topics)
        - PSYCH 876 The Psychology of Justice in the Workplace
        - PSYCH 877 Work Motivation
        - PSYCH 878 Job Performance
        - PSYCH 883 Organizational and Management Development
        - PSYCH 884 Special Topics in Industrial & Organizational Psychology
        - PSYCH 886 Psychology of Training
        - PSYCH 888 Negotiation, Conflict Management, and Teamwork: Theory and Practice
    - 2 breadth courses from other graduate research fields outside of Industrial/Organizational Psychology (e.g., not from the list of core Industrial/Organizational Psychology courses above) or an approved substitute.
    - Students must also take PSYCH 885 Industrial and Organizational Psychology Research Seminar in the Fall and Winter terms for a minimum of 4 years unless departmental permission is provided otherwise, or the student completes the program early. Note: PSYCH 885 is a 0.00 unit weight credit/no credit course.
- Students in Industrial/Organizational Psychology must take all courses for a numeric grade unless they are only offered Credit/No Credit.
- Students pursuing the **Social Psychology** Graduate Research Field must complete the following courses contingent upon the student's previous academic background.
- If a student enters the PhD with only a Bachelor's degree or equivalent, then the student is required to complete 12 one-term (0.50 unit weight) courses.
- If a student enters the PhD having completed the MA in Psychology degree with a Social Psychology Graduate Research Field from the University of Waterloo, then the student is required to complete 8 one-term (0.50 unit weight) courses such that students meet all of the course requirements listed below when courses completed during both the MA and PhD are considered.
    - Minimum 2 statistics courses from the following list or an approved substitute:
        - PSYCH 630 Advanced Analysis of Variance
        - PSYCH 632 Multiple Regression
        - PSYCH 640 Special Topics in Psychology (on departmentally approved topics)
        - PSYCH 800 Psychometric Theory & Structural Equation Modeling
        - PSYCH 801 Advanced Structural Equation Modeling
        - PSYCH 804 Multi-Level Modeling Applications in Psychology
    - 6 core courses in Social Psychology including PSYCH 704A Social Psychology and PSYCH 870 Research Design & Methods with the remaining selected from the following list or an approved substitute:
        - PSYCH 640 Special Topics in Psychology (on departmentally approved topics)
        - PSYCH 690 Special Topics in Social and Personality
        - PSYCH 743 Advanced Intergroup Relations
        - PSYCH 744 Personality in Social Context
        - PSYCH 745 Close Relationships
        - PSYCH 746 Culture and the Mind
        - PSYCH 748 Self-Regulation and Motivation
        - PSYCH 749 Wisdom
    - 4 breadth courses from other graduate research fields outside of Social Psychology (i.e., not from the list of Social Psychology courses above) or an approved substitute. Up to 2 of these breadth courses may be additional statistics courses.
    - Students must also take PSYCH 714 Social Seminar in the Fall and Winter terms for a minimum of 4 years unless departmental permission is provided otherwise, or the student completes the program early. Note: PSYCH 714 is a 0.00 unit weight credit/no credit course.
- The General Psychology Graduate Research Field is designed to capture student research trajectories that fall outside the six main Graduate Research Fields articulated above. Students cannot be admitted into the PhD program in the General Psychology Graduate Research Field. Entry into the General Psychology Graduate Research Field and course requirements require the approval of the Associate Chair Graduate Studies in Psychology.

- Students pursuing the **General Psychology** Graduate Research Field must complete the following courses contingent upon the student's previous academic background. If a student had entered the PhD with only a Bachelor's degree or equivalent, then the student is required to complete 12 one-term (0.50 unit weight) courses. If a student had entered the PhD having completed an MA or MASC in Psychology degree from the University of Waterloo, then the student is required to complete 8 one-term (0.50 unit weight) courses such that students meet all of the course requirements listed below when courses completed during both the MA/MASC and PhD are considered.
    - 2 statistics courses selected from the following list or an approved substitute:
        - PSYCH 630 Advanced Analysis of Variance
        - PSYCH 632 Multiple Regression
        - PSYCH 640 Special Topics in Psychology (on departmentally approved topics)
        - PSYCH 800 Psychometric Theory & Structural Equation Modeling
        - PSYCH 801 Advanced Structural Equation Modeling
        - PSYCH 803 Meta-Analysis
        - PSYCH 804 Multi-Level Modeling Applications in Psychology
    - 6 core courses from one or more of the Clinical Psychology, Cognitive Neuroscience, Cognitive Psychology, Developmental Psychology, Industrial/Organizational Psychology, or Social Psychology graduate research fields.
    - 4 breadth courses from other graduate research fields outside of the graduate research fields from which the core courses are selected or an approved substitute.
    - Students must also take one of PSYCH 621, PSYCH 707, PSYCH 710, PSYCH 714, PSYCH 747, PSYCH 885 (i.e., area seminars) in the Fall and Winter terms for a minimum of 4 years unless departmental permission is provided otherwise, or the student completes the program early. Note: PSYCH 621, PSYCH 707, PSYCH 710, PSYCH 714, PSYCH 747, PSYCH 885 are 0.00 unit weight credit/no credit courses.

Existing

Graduate Course Requirements

- Course requirements are determined by the student's previous academic background and their Graduate Research Field.
- Where applicable course requirements for students entering with a Bachelors degree or equivalent or an MA degree from the University of Waterloo in the Graduate Research Field in which they are completing their PhD are described below. Students entering directly into a PhD without completing an MA may be permitted to complete an MA during their PhD. If students have relevant academic background beyond a Bachelor's degree or equivalent but have not completed the MA degree from the University of Waterloo in the Graduate Research Field in which they are completing their PhD, then the PhD course requirements can, when deemed appropriate, be determined in consultation with the student's advisor, the Area Head, and Associate Chair, Graduate Studies in Psychology prior to admission.
- Students enrolled in the doctoral program must complete the Department's core requirements, statistics requirements (or credit granted for evidence of a strong undergraduate statistics background) and comprehensive breadth requirements as described within each Graduate Research Field's course requirements below. Courses with a numeric grading basis must be taken to meet the core and statistics requirements unless departmental permission is provided to take a course with a Credit/No Credit grading basis. For the purposes of the breadth requirement the relevant areas are listed below. Whether a course meets a breadth requirement is determined by the Graduate Research Field. If a student is unclear about whether a course will meet their breadth requirements, then they should consult with their supervisor and area head before enrolling in the course.
    - Clinical Psychology
    - Cognitive Psychology
    - Cognitive Neuroscience
    - Developmental Psychology
    - Industrial/Organizational Psychology
    - Quantitative Methods
    - Social Psychology
- All courses taken to meet degree requirements must be accepted for graduate credit by the Department of Psychology and no degree candidate can fulfil more than half of the minimum department course requirements with Credit/No Credit courses.

- Course requirements are minimum requirements only. Students may be required to take additional courses depending on their previous academic background and Graduate Research Field.
- Courses from outside the Department of Psychology may also be considered. Departmental permission is required. Note: When selecting a course from outside of the Department of Psychology, students should check with their advisor about its suitability.
- Transfer credits may also be considered. The acceptance of transfer credits from prior registration at another university will be determined in individual cases by the Associate Dean (Graduate Studies) of the Faculty at the time of admission to the program. Transfer credits must be "unused" credits (i.e., they must not have been credited towards an earlier acquired degree or other academic credential). Transfer credits must be specified in writing at the time of departmental recommendation for admission. A minimum of 70% (University of Waterloo converted grade) is required for transfer credit.
- Courses from outside the Department of Psychology and transfer credits can usually count for no more than 2 one-term credits toward breadth requirements.
- Use of a course not listed in the course requirements below to meet a degree requirement and other course substitutions are permitted but require departmental permission. Students should confirm the appropriateness of the course substitution with their advisor and have it approved by the Area head, and Associate Chair, Graduate Studies in Psychology.
- Students pursuing the **Clinical Psychology** Graduate Research Field must complete the following courses contingent upon the student's previous academic background.
- If a student enters the PhD with only a Bachelor's degree or equivalent, then the student is required to meet the course requirements beginning Year One below.
- If a student enters the PhD program having completed the MA in Psychology degree with a Clinical Psychology Graduate Research Field from the University of Waterloo, then the student is required to meet the course requirements beginning Year Three below in addition to completing any courses listed in Year One and Year Two not already completed. By the end of the PhD, students need to have completed all requirements from Year One to Year Six below or approved substitutes when courses completed during both the MA and PhD are considered. The courses are listed below in a typical sequence. Individual student's course sequences may vary, for example, based on course availability.
    - 2 statistics courses one of which must be PSYCH 630 Multiple Regression from the following list or an approved substitute:
        - PSYCH 630 Advanced Analysis of Variance
        - PSYCH 632 Multiple Regression
        - PSYCH 640 Special Topics in Psychology (on departmentally approved topics)
        - PSYCH 800 Psychometric Theory & Structural Equation Modeling
        - PSYCH 801 Advanced Structural Equation Modeling
        - PSYCH 803 Meta-Analysis
        - PSYCH 804 Multi-Level Modeling Applications in Psychology
    - 4 breadth courses from other graduate research fields outside of Clinical Psychology (e.g., not from the list of core, clinical practica, or research
      Clinical Psychology courses below) or an approved substitute. Students need to ensure that they meet the CPA breadth requirements.
    - Year One
        - Coursework (core):
            - PSYCH 716 Adult Psychopathology
            - PSYCH 717 Psychological Assessment I
            - PSYCH 718 Psychological Assessment II
            - PSYCH 719 Ethics and Professional Issues in Clinical Psychology
        - Clinical Practica:
            - PSYCH 720A Practicum in Interviewing & Cognitive Assessment I
            - PSYCH 720B Practicum in Interviewing & Cognitive Assessment II
            - PSYCH 721A Diagnostic Assessment Practicum I
            - PSYCH 721B Diagnostic Assessment Practicum II

        - PSYCH 722C Clinical Full-Time Fieldwork Placement I (0.50 unit weight) or PSYCH 811C Clinical Part-Time Fieldwork Placement I (0.25 unit weight)
    - Research Activities:
        - PSYCH 621 Advanced Clinical Research Forum I
    - Year Two
        - Coursework (core):
            - PSYCH 723 Child Psychopathology and Psychotherapy
            - PSYCH 724 Personality & Measurement Theory
            - PSYCH 725 Cognitive Behaviour Therapy
        - Clinical Practica:
            - PSYCH 726A Practicum in Integrated Assessment I
            - PSYCH 726B Practicum in Integrated Assessment II
            - Elective: PSYCH 738A, PSYCH 738B, PSYCH 738C Clinical Fieldwork Placement II (optional, by approval). Note: Students must have completed PSYCH 722C Clinical Full-Time Fieldwork Placement I or a set of 2 of PSYCH 811A, PSYCH 811B, and PSYCH 811C Clinical Part-Time Fieldwork Placement I, before they are eligible to take PSYCH 738A, PSYCH 738B, PSYCH 738C Clinical Fieldwork Placement II.
        - Research Activities:
            - PSYCH 621 Advanced Clinical Research Forum II
    - Year Three
        - Coursework (core):
            - PSYCH 727 Efficacy and Program Evaluation
            - PSYCH 728 Psychotherapy: Classical Roots & Contemporary Developments
        - Clinical Practica:
            - PSYCH 729A, PSYCH 729B, PSYCH 729C Child and Adolescent Psychotherapy Practicum I, II, III
            - PSYCH 730A, PSYCH 730B, PSYCH 730C Adult Psychotherapy Practicum I, II, III
            - Elective: PSYCH 738A, PSYCH 738B, PSYCH 738C Clinical Fieldwork Placement II (optional, by approval). Note: Students must have completed PSYCH 722C Clinical Full-Time Fieldwork Placement I or a set of 2 of PSYCH 811A, PSYCH 811B, and PSYCH 811C Clinical Part-Time Fieldwork Placement I, before they are eligible to take PSYCH 738A, PSYCH 738B, PSYCH 738C Clinical Fieldwork Placement II.
        - Research Activities:
            - PSYCH 621 Advanced Clinical Research Forum III
    - Year Four
        - Coursework (core):
            - PSYCH 731 Emotion-Focused Therapy
        - Clinical Practica:
            - PSYCH 732A, PSYCH 732B, PSYCH 732C Child and Adolescent Psychotherapy Practicum I, II, III
            - PSYCH 733A, PSYCH 733B, PSYCH 733C Adult Psychotherapy Practicum I, II, III
            - Elective: PSYCH 737A, PSYCH 737B, PSYCH 737C Emotion-Focused Therapy Practicum
            - Elective: PSYCH 738A, PSYCH 738B, PSYCH 738C Clinical Fieldwork Placement II or PSYCH 739A, PSYCH 739B, PSYCH 739C Clinical Fieldwork Placement III (optional, by approval)
        - Research Activities:
            - PSYCH 621 Advanced Clinical Research Forum IV
    - Year Five (and beyond)
        - Clinical Practica:
            - PSYCH 734A, PSYCH 734B, PSYCH 734C Practicum in Supervision I, II, III (required of all students)
            - PSYCH 735A, PSYCH 735B, PSYCH 735C Child and Adolescent Psychotherapy Practicum I, II, III

        - PSYCH 736A, PSYCH 736B, PSYCH 736C Adult Psychotherapy Practicum I, II, III
        - Elective: PSYCH 737A, PSYCH 737B, PSYCH 737C Emotion-Focused Therapy Practicum
        - Elective: PSYCH 740A, PSYCH 740B, PSYCH 740C Senior Practicum I or PSYCH 741A, PSYCH 741B, PSYCH 741C Senior Practicum II or PSYCH 742A, PSYCH 742B, PSYCH 742C Senior Practicum III (optional, by approval)
    - Year Six
        - Students must compete a year of predoctoral residency, the successful completion of which results in the crediting of the Graduate Studies Clinical Internship milestone.
- Students pursuing the **Cognitive Neuroscience** Graduate Research Field must complete the following courses contingent upon the student's previous academic background.
- If a student enters the PhD with only a Bachelor's degree or equivalent, then the student is required to complete 12 one-term (0.50 unit weight) courses.
- If a student enters the PhD having completed the MA in Psychology degree with a Cognitive Neuroscience Graduate Research Field from the University of Waterloo, then the student is required to complete 8 one-term (0.50 unit weight) courses such that students meet all of the course requirements listed below when courses completed during both the MA and PhD are considered.
    - 2 statistics courses from the following list or an approved substitute
        - PSYCH 630 Advanced Analysis of Variance
        - PSYCH 632 Multiple Regression
        - PSYCH 640 Special Topics in Psychology (on departmentally approved topics)
        - PSYCH 800 Psychometric Theory & Structural Equation Modeling
        - PSYCH 801 Advanced Structural Equation Modeling
        - PSYCH 803 Meta-Analysis
        - PSYCH 804 Multi-Level Modeling Applications in Psychology
    - 6 core courses in Cognitive Neuroscience including PSYCH 677A Fundamentals of Behavioural Neuroscience and PSYCH 784 Human Neuroanatomy and Neuropathology with the remaining selected from the following list or an approved substitute:
        - PSYCH 640 Special Topics in Psychology (on departmentally approved topics)
        - PSYCH 670 Special Topics in Behavioural Neuroscience
        - PSYCH 779A Cognitive Neuropsychology I
        - PSYCH 781 Cognitive Neuroscience of Memory
        - PSYCH 782 Visual Neuroscience
        - PSYCH 783 Neuroimaging of Cognition
        - PSYCH 785 Attention and the Brain
        - PSYCH 788 (cross-listed as HLTH-672) Epidemiologic Methods in Aging Research
        - PSYCH 789 Mind-wandering and Inattention
        - PSYCH 790 Case Studies in Neuropsychology
        - PSYCH 792 An Introduction to Methods in Computational Neuroscience
        - PSYCH 794 Cognitive Neuroscience of Face Perception
    - 4 breadth courses from other graduate research fields outside of Cognitive Neuroscience (e.g., not from the list of Cognitive Neuroscience core courses above) or an approved substitute.
    - Students must also take PSYCH 707 Cognitive Neuroscience Seminar in the Fall and Winter terms for a minimum of 4 years unless departmental permission is provided otherwise, or the student completes the program early. Students are encouraged to take PSYCH 707 for a 5th year if they have not yet finished their PhD. Note: PSYCH 707 is a 0.0 unit weight credit/no credit course.
- Students pursuing the **Cognitive Psychology** Graduate Research Field must complete the following courses contingent upon the student's previous academic background.
- If a student enters the PhD with only a Bachelor's degree or equivalent, then the student is required to complete 12 one-term (0.50 unit weight) courses.
- If a student enters the PhD having completed the MA in Psychology degree with a Cognitive Psychology Graduate Research Field from the University of Waterloo, then the student is required to complete 8 one-term (0.50 unit weight)

courses such that students meet all of the course requirements listed below when courses completed during both the MA and PhD are considered.

- 2 statistics courses including PSYCH 630 Advanced Analysis of Variance with the remaining selected from the following list or an approved substitute:
  - PSYCH 632 Multiple Regression
  - PSYCH 640 Special Topics in Psychology (on departmentally approved topics)
  - PSYCH 800 Psychometric Theory & Structural Equation Modeling
  - PSYCH 801 Advanced Structural Equation Modeling
  - PSYCH 803 Meta-Analysis
  - PSYCH 804 Multi-Level Modeling Applications in Psychology
- 6 core courses in Cognitive Psychology from the following list or an approved substitute:
  - COGSCI 600 Seminar in Cognitive Science
  - PSYCH 640 Special Topics in Psychology (on departmentally approved topics)
  - PSYCH 650 Special Topics in Cognition and Perception
  - PSYCH 758 Applied Practicum in Cognitive Psychology
  - PSYCH 759 Research Practicum in Cognitive Psychology
  - PSYCH 769 Causal Reasoning
  - PSYCH 770 Basic Issues in Cognition
  - PSYCH 771 Basic Visual Processes
  - PSYCH 774 Visual Cognition
  - PSYCH 775 Consciousness and Cognition
  - PSYCH 776 Problem Solving, Judgment and Decision Making
  - PSYCH 777 Human Memory
  - PSYCH 778 Attention
  - PSYCH 779 Language and Reading
  - PSYCH 810 Directed Studies (on departmentally approved topics)
- 4 breadth courses from other graduate research fields outside of Cognitive Psychology (e.g., not from the list of Cognitive Psychology courses above) or an approved substitute.
- Students must also take PSYCH 747 Cognitive Psychology Seminar in the Fall and Winter terms for a minimum of 4 years unless departmental permission is provided otherwise, or the student completes the program early. Note: PSYCH 747 is a 0.0 unit weight credit/no credit course.

- Students pursuing the **Developmental Psychology** must complete the following courses contingent upon the student's previous academic background.
- If a student enters the PhD with only a Bachelor's degree or equivalent, then the student is required to complete 12 one-term (0.50 unit weight) courses.
- If a student enters the PhD having completed the MA in Psychology degree with a Developmental Psychology Graduate Research Field from the University of Waterloo or the MASc in Developmental and Communication Science at the University of Waterloo, then the student is required to complete 8 one-term (0.50 unit weight) courses such that students meet all of the course requirements listed below when courses completed during both the MA or MASc and PhD are considered.
  - 2 statistics courses from the following list or an approved substitute:
    - PSYCH 630 Advanced Analysis of Variance
    - PSYCH 632 Multiple Regression
    - PSYCH 640 Special Topics in Psychology (on departmentally approved topics)
    - PSYCH 800 Psychometric Theory & Structural Equation Modeling
    - PSYCH 801 Advanced Structural Equation Modeling
    - PSYCH 804 Multi-Level Modeling Applications in Psychology
  - 6 core courses in Developmental Psychology from the following list or an approved substitute:
    - PSYCH 640 Special Topics in Psychology (on departmentally approved topics)
    - PSYCH 680 Special Topics in Child Behaviour and Development
    - PSYCH 701 Foundations in Cognitive/Social Development: Basic
    - PSYCH 702 Foundations in Cognitive/Social Development: Social Cognitive Development
    - PSYCH 705 Foundations in Language Development: Basic Language Development

        - PSYCH 706 Foundations in Language Development: Pragmatics of Language
        - PSYCH 708 Reasoning about Ownership of Property
        - PSYCH 709 Reasoning about Beliefs and Desires
        - PSYCH 713 Theories of Pretense
        - PSYCH 810 Directed Studies (on departmentally approved topics)
    - 4 breadth courses from other graduate research fields outside of Developmental Psychology (i.e., not from the list of Developmental Psychology courses above) or an approved substitute.
    - Students must also take PSYCH 710 Current Issues in Developmental Psych Seminar in the Fall and Winter terms for a minimum of 4 years unless departmental permission is provided otherwise, or the student completes the program early. Note: PSYCH 710 is a 0.00 unit weight credit/no credit course.
- Students pursuing the **Industrial/Organizational Psychology** Graduate Research Field must complete the following courses:
    - 2 statistics courses from the following list or an approved substitute:
        - PSYCH 630 Advanced Analysis of Variance
        - PSYCH 640 Special Topics in Psychology (on departmentally approved topics)
        - PSYCH 800 Psychometric Theory & Structural Equation Modeling
        - PSYCH 801 Advanced Structural Equation Modeling
        - PSYCH 804 Multi-Level Modeling Applications in Psychology
    - 2 core courses in Industrial/Organizational Psychology selected from the following list or an approved substitute:
        - PSYCH 640 Special Topics in Psychology (on departmentally approved topics)
        - PSYCH 876 The Psychology of Justice in the Workplace
        - PSYCH 877 Work Motivation
        - PSYCH 878 Job Performance
        - PSYCH 883 Organizational and Management Development
        - PSYCH 884 Special Topics in Industrial & Organizational Psychology
        - PSYCH 886 Psychology of Training
        - PSYCH 888 Negotiation, Conflict Management, and Teamwork: Theory and Practice
    - 2 breadth courses from other graduate research fields outside of Industrial/Organizational Psychology (e.g., not from the list of core Industrial/Organizational Psychology courses above) or an approved substitute.
    - Students must also take PSYCH 885 Industrial and Organizational Psychology Research Seminar in the Fall and Winter terms for a minimum of 4 years unless departmental permission is provided otherwise, or the student completes the program early. Note: PSYCH 885 is a 0.00 unit weight credit/no credit course.
- Students in Industrial/Organizational Psychology must take all courses for a numeric grade unless they are only offered Credit/No Credit.
- Students pursuing the **Social Psychology** Graduate Research Field must complete the following courses contingent upon the student's previous academic background.
- If a student enters the PhD with only a Bachelor's degree or equivalent, then the student is required to complete 12 one-term (0.50 unit weight) courses.
- If a student enters the PhD having completed the MA in Psychology degree with a Social Psychology Graduate Research Field from the University of Waterloo, then the student is required to complete 8 one-term (0.50 unit weight) courses such that students meet all of the course requirements listed below when courses completed during both the MA and PhD are considered.
    - Minimum 2 statistics courses from the following list or an approved substitute:
        - PSYCH 630 Advanced Analysis of Variance
        - PSYCH 632 Multiple Regression
        - PSYCH 640 Special Topics in Psychology (on departmentally approved topics)
        - PSYCH 800 Psychometric Theory & Structural Equation Modeling
        - PSYCH 801 Advanced Structural Equation Modeling
        - PSYCH 804 Multi-Level Modeling Applications in Psychology
    - 6 core courses in Social Psychology including PSYCH 704A Social Psychology and PSYCH 870 Research Design & Methods with the remaining selected from the following list or an approved substitute:
        - PSYCH 640 Special Topics in Psychology (on departmentally approved topics)

        - PSYCH 690 Special Topics in Social and Personality
        - PSYCH 743 Advanced Intergroup Relations
        - PSYCH 744 Personality in Social Context
        - PSYCH 745 Close Relationships
        - PSYCH 746 Culture and the Mind
        - PSYCH 748 Self-Regulation and Motivation
        - PSYCH 749 Wisdom
    - 4 breadth courses from other graduate research fields outside of Social Psychology (i.e., not from the list of Social Psychology courses above) or an approved substitute. Up to 2 of these breadth courses may be additional statistics courses.
    - Students must also take PSYCH 714 Social Seminar in the Fall and Winter terms for a minimum of 4 years unless departmental permission is provided otherwise, or the student completes the program early. Note: PSYCH 714 is a 0.00 unit weight credit/no credit course.

Milestone Requirements

PhD Thesis

- The Department requires a successful defense of the PhD Thesis.
- Students must be admitted to one of the following Graduate Research Fields:
    - Clinical Psychology
    - Cognitive Neuroscience
    - Cognitive Psychology
    - Developmental Psychology
    - Industrial/Organizational Psychology
    - Social Psychology
- A Graduate Research Field is a University credential that is recognized on the student's transcript and is intended to reflect that a student has successfully completed research concentrated in the area of the Graduate Research Field. The Department, represented by the student's supervisor and examining committee, must assess whether a student's completed research warrants the field designation at the time of degree completion. To obtain the Graduate Research Field designation, students must also complete the required courses associated with their chosen Graduate Research Field outlined in the above course requirements section.

Notes

- Department of Psychology website
- Doctor of Philosophy (PhD) in Psychology future students program page

Workflow Information

Workflow Path	Faculty/AFIW Path(s) for Workflow	Senate Workflow
Committee approvals	Faculty of Arts	--

Dependencies

Dependent Courses and Programs/Plans

PREREQUISITES

- PSYCH 621 - Advanced Clinical Research — View Courses
- PSYCH 747 - Cognition and Perception Seminar — View Courses
- PSYCH 714 - Current Topics in Social Psych Seminar — View Courses

- PSYCH 707 - Cognitive Neuroscience Seminar — View Courses
- PSYCH 710 - Current Issues in Developmental Psych Seminar — View Courses
- PSYCH 885 - Industrial & Organizational Psychology Research Seminar — View Courses

MA in English-Critical Media Studies
Master of Arts (MA) in English - Critical Media Studies

Under Review | Spring 2025

Proposal Information

Status
Active

Workflow Status
In Progress

SGRC, Senate Graduate and Research Council (SGRC) expand ▲
Waiting for Approval | Approval Delegate(s)

Mike Grivicic
Tim Weber-Kraljevski
Diana Goncalves
Melanie Figueiredo
Ashley Day

Changes

- Program/Plan Name
- Coursework Option: Course Requirements
- Master's Research Paper Option: Course Requirements
- Notes
- Effective Term and Year

Show All ▼

Effective Date and Career

Career
Graduate

Important!

Proposed
Effective Term and Year
Fall 2025

Existing
Effective Term and Year
Spring 2024

Proposal Details

Proposal Type
Change

Academic Unit Approval
09/27/2024

Quality Assurance Designation
Major Modification

Major Modification Categories

Change program name

Is there an impact to existing students?
Yes

Impact on Existing Students
See "Current Student Impact" section below.

Is the credential name changing?
Yes

Impact of Credential Name Change
The name change applies only to future students (current students may opt in)

Current Student Impact
All currently registered students in the MA in English - Experimental Digital Media programs will have the option of graduating with either the original or revised program name. Details of the program name change will be communicated to them by the Department, via email. By default, students will retain the original program name. Students who wish to change to the revised program name will need indicate this to the Graduate Officer/Graduate Coordinator.

Graduate Co-operative Requirements
Not Applicable

Internship Requirements
Not Applicable

Rationale and Background for Change(s)
Changing the names of the “Master of Arts (MA) in English - Experimental Digital Media” programs to “Master of Arts (MA) in English - Critical Media Studies”: The motion for changing the name of the MA in English - Experimental Digital Media (XDM) program comes out two exigencies: 1) declining enrollments in the XDM program; 2) the need for English’s digital program to be flexible and dynamic in its name as to adjust with changing technologies and changing fields that engage with these technologies. Faculty who currently teach in the program have determined, in consultation with similar programs in the province, that it has been facing declining enrollments in part because students post-COVID in this study area are opting to enroll in programs that seem less “experimental” and more traditional, in some ways. Changing the name of the XDM program to “Critical Media Studies” [CMS] not only is in alignment with this changing student preference, but it continues to reflect what English faculty in this MA stream do (highlighting faculty expertise in fields such as media theory, tech ethics, feminist media studies, social media studies, critical design, device and interface analysis, and game studies). The name change from XDM to CMS importantly retains a clear and designated connection between Critical Media Studies and the Critical Media Lab, which has long been a centre of activity for these English MA students (students are currently required to complete elements of the degree with the Critical Media Lab). Renaming the program thus provides greater correlation between the degree itself and locations for student activity within the degree.
We anticipate that this name change will not only help in recruiting students to this MA program from local undergraduate programs that have an emphasis on both English and Critical Media Studies (such as Western’s Media, Information, and Technoculture program or Trent University’s Media Studies program), but also be appealing to a number of University of Waterloo Communication Arts undergraduate students who may be studying in this area and seeking hands-on application at the graduate level of ideas in critical media studies.

Consultations (Departmental)

Supporting Documentation

General Program/Plan Information

Faculty
Faculty of Arts

Academic Unit
Department of English Language and Literature

Graduate Field of Study
English Language and Literature

Faculty
Faculty of Arts

Proposed
Program/Plan Name
Master of Arts (MA) in English - Critical Media Studies

Existing
Program/Plan Name
Master of Arts (MA) in English - Experimental Digital Media

Graduate Credential Type
Master's

Accelerated Program
Not applicable

Study Options (New)
Master's Research Paper / Coursework

Program Types

Admit Term(s)
Fall

Delivery Mode
On-campus

Delivery Mode Information

Length of Program
- 3 terms (12 months)

Registration Option(s)
Full-time
Part-time

Registration Options Information

Graduate Research Fields

Graduate Specializations

Additional Program Information

Admissions

Admission Requirements: Minimum Requirements

- An Honours Bachelor's degree in English, or its equivalent, with an average of at least 78% in English courses, and at least 75% overall.
    - Those with Honours degrees not in English may apply to the program but may be required to take as many as 10 undergraduate courses in English to prepare them for graduate-level study in the discipline. Additional courses will be chosen in consultation with the Graduate Officer and will generally correspond to the minor program in English.
- A Statement of Interest, no more than 500 words, explaining your reasons for applying to the program.
- English language proficiency (ELP) (if applicable)

Admission Requirements: Application materials

- Supplementary information form
- Transcript(s)

Admission Requirements: References

- Number of references: 3
- Type of references: at least 2 academic

Requirements Information

Graduate Degree Requirements

- Students must complete the course and milestone requirements associated with their chosen study option in addition to the Graduate Academic Integrity Module (Graduate AIM).

Coursework Option: Course Requirements

No Rules

Proposed

Coursework Option: Course Requirements

- Students must complete the following 8 courses:
  - ENGL 701 Critical Design Methods (with an added "digital bootcamp" element)
  - 3 courses designated as Critical Media Studies
  - 1 course designated as Literature
  - 3 elective courses
- Students may include 2 extra-departmental graduate courses in their degree requirements, but these courses must be approved by the Graduate Committee. For a course outside the University of Waterloo, the Ontario Visiting Graduate Student (OVGS) form must be completed. For a course inside the University, the Departmental Graduate Studies Committee must approve. In either case, the Department's Graduate Office must be supplied with a syllabus in electronic form and the course must be approved before the beginning of the term in which it is scheduled to run.
- If students can demonstrate that a reading course is necessary to their overall program, they may petition the Departmental Graduate Studies Committee to allow such an independent course. Directed reading courses must be designed and submitted to the Graduate Committee by the instructor in consultation with the student, and the course outline (with rationale, reading list, assignments and schedule) must be approved by the Graduate Committee in the term prior to the one in which the course is to be run. A reading course will not be approved if a course in a similar area, or with the same faculty member, will be taught that year; if the proposed course overlaps substantially with work that is also to be credited as an MRP or thesis; or if it would not be feasible within that term's scheduling and enrolment constraints. Students are permitted to take only 1 reading course as part of the degree.
- In order to graduate, candidates must receive an average of at least 75% in their courses. If a student receives one failing grade or two grades lower than 70%, the Departmental Graduate Studies Committee will review their standing in the program and the student may be asked to withdraw from the program.

Existing

Coursework Option: Course Requirements

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  - ENGL 701 Critical Design Methods (with an added "digital bootcamp" element)
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Coursework Option: Milestone Requirements

Master's Research Paper Option: Course Requirements

No Rules

Proposed

Master's Research Paper Option: Course Requirements

- Students must complete the following 6 courses:
    - ENGL 701 Critical Design Methods (with an added "digital bootcamp" element)
    - 2 courses designated as Critical Media Studies
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    - 2 elective courses from either within or outside the Department
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Existing

Master's Research Paper Option: Course Requirements

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- In order to graduate, candidates must receive an average of at least 75% in their courses. If a student receives one failing grade or two grades lower than 70%, the Departmental Graduate Studies Committee will review their standing in the program and the student may be asked to withdraw from the program.

Master's Research Paper Option: Milestone Requirements

Master's Research Paper

- Students must prepare a proposal for their project and a working bibliography with advice from their planned supervisor. These proposals must be submitted for approval to the Department Graduate Committee before the end of the second academic term.
- The project is the culminating point of the program, in which students demonstrate a mastery of critical theories and theoretical concepts by embodying them in digital artifacts, environments, or practice. Projects will entail the design, conception or production of objects-to-think-with, evocative objects that focus attention on key cultural and theoretical issues in the humanities.
- In many cases the project will remain at a design or prototype stage, although the manufacture of the object is by no means ruled out in principle. The design or prototype itself will be accompanied by a commentary of 40 pages in which the student will describe the theoretical and cultural context of the project and its aims, analyse its feasibility and its functioning, describe its cultural and rhetorical significance, and indicate its possible lines of development.

Proposed

Notes

- Department of English Language and Literature website
- Master of Arts (MA) in English - Critical Media Studies future students program page

Existing

Notes

- Department of English Language and Literature website
- Master of Arts (MA) in English - Experimental Digital Media future students program page

Workflow Information

Workflow Path	Faculty/AFIW Path(s) for Workflow	Senate Workflow
Committee approvals	Faculty of Arts	--

Dependencies

Dependent Courses and Programs/Plans

PREREQUISITES

ENGL 799 - Media Theory and Critique	View Courses
ENGL 700 - Rhetorical Studies	View Courses
ENGL 797 - Digital Media and Literature	View Courses
ENGL 796 - Propaganda and Ideology	View Courses
ENGL 780 - Studies in Genre	View Courses
ENGL 755 - Studies in 19th Century American Literature	View Courses
ENGL 770 - Studies in Canadian Literature	View Courses
ENGL 725 - Studies in Romanticism	View Courses
ENGL 710 - Studies in Renaissance Drama	View Courses
ENGL 750 - Studies in Early American Literature	View Courses
ENGL 715 - Studies in Renaissance Prose and Poetry	View Courses
ENGL 705 - Studies in Old and Middle English Literature	View Courses

ENGL 790 - Discourse Analysis	View Courses
ENGL 735 - Studies in Modern British Literature	View Courses
ENGL 793 - History of Rhetoric	View Courses
ENGL 792 - Semiotics	View Courses
ENGL 785 - Studies in Literary Criticism	View Courses
ENGL 791 - Professional Writing	View Courses
ENGL 794 - Digital Culture	View Courses
ENGL 775 - Studies in Commonwealth Literature	View Courses
ENGL 720 - Studies in the Restoration and Eighteenth Century Literature	View Courses
ENGL 730 - Studies in Victorian Literature	View Courses
ENGL 795 - Studies in Selected Topics	View Courses
ENGL 789 - Writing Studies	View Courses
ENGL 702 - Rhetorical Research Methods	View Courses

MA in English-Critical Media Studies-Co-op
Master of Arts (MA) in English - Critical Media Studies - Co-operative Program (direct entry)

Under Review | Spring 2025

Proposal Information

Status
Active

Workflow Status
In Progress

SGRC, Senate Graduate and Research Council (SGRC) expand ▲
Waiting for Approval | Approval Delegate(s)

Mike Grivicic
Tim Weber-Kraljevski
Diana Goncalves
Melanie Figueiredo
Ashley Day

Changes

- Program/Plan Name
- Coursework Option: Course Requirements
- Master's Research Paper Option: Course Requirements
- Notes
- Effective Term and Year

Show All ▼

Effective Date and Career

Career
Graduate

Important!

Proposed
Effective Term and Year
Fall 2025

Existing
Effective Term and Year
Spring 2024

Proposal Details

Proposal Type
Change

Academic Unit Approval
09/27/2024

Quality Assurance Designation
Major Modification

Major Modification Categories

Change program name

Is there an impact to existing students?
Yes

Impact on Existing Students
See "Current Student Impact" section below.

Is the credential name changing?
Yes

Impact of Credential Name Change
The name change applies only to future students (current students may opt in)

Current Student Impact
All currently registered students in the MA in English - Experimental Digital Media programs will have the option of graduating with either the original or revised program name. Details of the program name change will be communicated to them by the Department, via email. By default, students will retain the original program name. Students who wish to change to the revised program name will need indicate this to the Graduate Officer/Graduate Coordinator.

Graduate Co-operative Requirements
No

Internship Requirements
Not Applicable

Rationale and Background for Change(s)
Changing the names of the “Master of Arts (MA) in English - Experimental Digital Media” programs to “Master of Arts (MA) in English - Critical Media Studies”: The motion for changing the name of the MA in English - Experimental Digital Media (XDM) program comes out two exigencies: 1) declining enrollments in the XDM program; 2) the need for English’s digital program to be flexible and dynamic in its name as to adjust with changing technologies and changing fields that engage with these technologies. Faculty who currently teach in the program have determined, in consultation with similar programs in the province, that it has been facing declining enrollments in part because students post-COVID in this study area are opting to enroll in programs that seem less “experimental” and more traditional, in some ways. Changing the name of the XDM program to “Critical Media Studies” [CMS] not only is in alignment with this changing student preference, but it continues to reflect what English faculty in this MA stream do (highlighting faculty expertise in fields such as media theory, tech ethics, feminist media studies, social media studies, critical design, device and interface analysis, and game studies). The name change from XDM to CMS importantly retains a clear and designated connection between Critical Media Studies and the Critical Media Lab, which has long been a centre of activity for these English MA students (students are currently required to complete elements of the degree with the Critical Media Lab). Renaming the program thus provides greater correlation between the degree itself and locations for student activity within the degree.
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Consultations (Departmental)

Supporting Documentation

General Program/Plan Information

Faculty
Faculty of Arts

Academic Unit
Department of English Language and Literature

Graduate Field of Study
English Language and Literature

Faculty
Faculty of Arts

Proposed

Program/Plan Name

Master of Arts (MA) in English - Critical Media Studies - Co-operative Program (direct entry)

Existing

Program/Plan Name

Master of Arts (MA) in English - Experimental Digital Media - Co-operative Program (direct entry)

Graduate Credential Type

Master's

Accelerated Program

Not applicable

Study Options (New)

Master's Research Paper / Coursework

Program Types

Co-operative

Admit Term(s)

Fall

Delivery Mode

On-campus

Delivery Mode Information

Length of Program

- 5 terms (20 months)

Registration Option(s)

Full-time
Part-time

Registration Options Information

Graduate Research Fields

Graduate Specializations

Additional Program Information

Admissions

Admission Requirements: Minimum Requirements

- An Honours Bachelor's degree in English, or its equivalent, with an average of at least 78% in English courses, and at least 75% overall.
    - Those with Honours degrees not in English may apply to the program but may be required to take as many as 10 undergraduate courses in English to prepare them for graduate-level study in the discipline. Additional courses will be chosen in consultation with the Graduate Officer and will generally correspond to the minor program in English.
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Admission Requirements: Application materials

- Supplementary information form
- Transcript(s)

Admission Requirements: References

- Number of references: 3
- Type of references: at least 2 academic

Requirements Information

Graduate Degree Requirements

- Students must complete the course and milestone requirements associated with their chosen study option in addition to the Graduate Academic Integrity Module (Graduate AIM).

Coursework Option: Course Requirements

No Rules

Proposed

Coursework Option: Course Requirements

- Students must complete the following 8 courses:
  - ENGL 701 Critical Design Methods (with an added "digital bootcamp" element)
  - 3 courses designated as Critical Media Studies
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  - 3 elective courses
- Students may include 2 extra-departmental graduate courses in their degree requirements, but these courses must be approved by the Graduate Committee. For a course outside the University of Waterloo, the Ontario Visiting Graduate Student (OVGS) form must be completed. For a course inside the University, the Departmental Graduate Studies Committee must approve. In either case, the Department's Graduate Office must be supplied with a syllabus in electronic form and the course must be approved before the beginning of the term in which it is scheduled to run.
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- In order to graduate, candidates must receive an average of at least 75% in their courses. If a student receives one failing grade or two grades lower than 70%, the Departmental Graduate Studies Committee will review their standing in the program and the student may be asked to withdraw from the program.

Existing

Coursework Option: Course Requirements

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Coursework Option: Milestone Requirements

Graduate Studies Work Report I

Graduate Studies Work Report II

Master's Research Paper Option: Course Requirements

No Rules

Proposed

Master's Research Paper Option: Course Requirements

- Students must complete the following 6 courses:
    - ENGL 701 Critical Design Methods (with an added "digital bootcamp" element)
    - 2 courses designated as Critical Media Studies
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- Students may include 2 extra-departmental graduate courses in their degree requirements, but these courses must be approved by the Graduate Committee. For a course outside the University of Waterloo, the Ontario Visiting Graduate Student (OVGS) form must be completed. For a course inside the University, the Departmental Graduate Studies Committee must approve. In either case, the Department's Graduate Office must be supplied with a syllabus in electronic form and the course must be approved before the beginning of the term in which it is scheduled to run.
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Master's Research Paper Option: Milestone Requirements

Graduate Studies Work Report I

Graduate Studies Work Report II

Master's Research Paper

- Students must prepare a proposal for their project and a working bibliography with advice from their planned supervisor. These proposals must be submitted for approval to the Department Graduate Committee before the end of the second academic term.
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- In many cases the project will remain at a design or prototype stage, although the manufacture of the object is by no means ruled out in principle. The design or prototype itself will be accompanied by a commentary of 40 pages in which the student will describe the theoretical and cultural context of the project and its aims, analyse its feasibility and its functioning, describe its cultural and rhetorical significance, and indicate its possible lines of development.

Proposed

Notes

- Department of English Language and Literature website
- Master of Arts (MA) in English - Critical Media Studies - Co-operative Program future students program page

Existing

Notes

- Department of English Language and Literature website
- Master of Arts (MA) in English - Experimental Digital Media - Co-operative Program future students program page

Workflow Information

Workflow Path	Faculty/AFIW Path(s) for Workflow	Senate Workflow
Committee approvals	Faculty of Arts	--

Dependencies

Dependent Courses and Programs/Plans

PREREQUISITES

- ENGL 799 - Media Theory and Critique — View Courses
- ENGL 700 - Rhetorical Studies — View Courses
- ENGL 797 - Digital Media and Literature — View Courses
- ENGL 796 - Propaganda and Ideology — View Courses

ENGL 780 - Studies in Genre	View Courses
ENGL 755 - Studies in 19th Century American Literature	View Courses
ENGL 770 - Studies in Canadian Literature	View Courses
ENGL 725 - Studies in Romanticism	View Courses
ENGL 710 - Studies in Renaissance Drama	View Courses
ENGL 750 - Studies in Early American Literature	View Courses
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ENGL 793 - History of Rhetoric	View Courses
ENGL 792 - Semiotics	View Courses
ENGL 785 - Studies in Literary Criticism	View Courses
ENGL 791 - Professional Writing	View Courses
ENGL 794 - Digital Culture	View Courses
ENGL 775 - Studies in Commonwealth Literature	View Courses
ENGL 720 - Studies in the Restoration and Eighteenth Century Literature	View Courses
ENGL 730 - Studies in Victorian Literature	View Courses
ENGL 795 - Studies in Selected Topics	View Courses
ENGL 789 - Writing Studies	View Courses
ENGL 702 - Rhetorical Research Methods	View Courses

SGRC - Regular Agenda - Faculty of Engineering - March 17, 2025

Meeting Information

Agenda Page Title

SGRC - Regular Agenda - Faculty of Engineering - March 17, 2025

Career Level

Graduate

Faculty/Unit

Date

03/17/2025

Time

Location

Summary

Programs & Plan Changes:

MEng in Civil Engineering & MEng in Civil Engineering – Co-operative Program: new Graduate Specialization in Future Cities

New Collaborative Programs:

Master of Engineering (MEng) in Civil Engineering - Health Technologies - Co-operative Program

Master of Engineering (MEng) in Electrical and Computer Engineering - Health Technologies - Co-operative Program

Master of Engineering (MEng) in Systems Design Engineering - Health Technologies - Co-operative Program

Other Business

Attachment(s)

- Civil MEng & MEng Coop - Future Cities Specialization -Reviewed by GSPA.docx
- CEE - MEng in HealthTech - Program Brief and Template.pdf
- ECE - MEng in HealthTech - Program Brief and Template.pdf
- SYDE - MEng in HealthTech - Program Brief and Template.pdf
- MEng in HealthTech - Industry and Job Analysis by CEE-2.pdf

Course Proposals

Course Proposal Details

Courses: Retire

No proposals have been added.

Courses: New

No proposals have been added.

Courses: Changes

No proposals have been added.

Programs & Plans Proposals

Programs & Plans Proposal Details

Programs & Plans: Retire

No proposals have been added.

Programs & Plans: Major Modifications

No proposals have been added.

Programs & Plans: Minor Modifications

No proposals have been added.

Regulations Proposals

Regulations Proposal Details

Regulations: Retire

No proposals have been added.

Regulations: New

No proposals have been added.

Regulations: Changes

No proposals have been added.

Graduate Studies
Program Revision Template

Prior to form submission, review the content revision instructions and information regarding major/minor modifications. For questions about the form submission, contact Trevor Clews, Graduate Studies and Postdoctoral Affairs (GSPA).

Faculty: Engineering

Programs: 1) Master of Engineering (MEng) in Civil Engineering

2) Master of Engineering (MEng) in Civil Engineering – Co-operative Program

Program contact name(s): Adil Al-Mayah

Form completed by: Adil Al-Mayah

Description of proposed changes:
Note: changes to courses and milestones also require the completion/submission of the SGRC Graduate Studies Course/Milestone Form.

Updating the MEng degree requirements to include a new Graduate Specialization in Future Cities.

Note: the content in the "Current Graduate Studies Academic Calendar content" column includes material that was approved by SGRC on November 18, 2024 which takes effect Spring 2025.

Is this a major modification to the program? Yes

Rationale for change(s):

Offering the MEng with an option focused on Future Cities was envisioned by the Future Cities Institute and proposed earlier in the mandate of the Turkstra Chair in Urban Engineering. The new specialization aims to revitalize engineering leadership within municipalities by positioning the civil engineering profession as the critical role in designing sustainable and resilient infrastructure for urban prosperity by applying technology and technical competencies. The motives for the new specialization include:

- *Increasing demand for engineering decision-makers in Canadian municipalities.*
- *Addressing urban challenges that are interrelated and complex.*
- *Opportunity for interdisciplinary knowledge and practice.*
- *Need for resilient and sustainable infrastructure to address climate change mitigation and adaptation.*
- *Urban engineering promotes economic and social prosperity.*
- *Engineering is a leadership profession and cities need engineering leadership.*

Proposed effective date: Term: Fall Year: 2025

Current Graduate Studies Academic Calendar (GSAC) page (include the link to the web page where the changes are to be made):

https://uwaterloo.ca/academic-calendar/graduate-studies/catalog#/programs/Syig1A0s3

https://uwaterloo.ca/academic-calendar/graduate-studies/catalog#/programs/Syly8tXsR

Current Graduate Studies Academic Calendar content:	**Proposed Graduate Studies Academic Calendar content**:
Graduate specializations • Architectural Engineering • Environmental and Water Resources Engineering • Sustainable Structural Systems • Transportation Engineering **Degree requirements** • Students must complete the course requirements listed below in addition to the Graduate Academic Integrity Module (Graduate AIM). **Coursework option: Course requirements** • Students must complete 8 one-term graduate level courses (0.50 unit weight) taken from the 500, 600 and 700 series courses (or courses acceptable for graduate credit). • At least 4 of the 8 required courses must be taken within the Department of Civil and Environmental Engineering. • An English for Multilingual Speakers (EMLS) technical/professional writing course for Engineers is required for all students who were not English Language Proficiency (ELP) exempt at the time of admission. • A maximum of 2 500 level courses may be counted for credit. • The candidate must obtain a pass in all courses credited to their program, with a minimum overall average of 70% (a grade of less than 65% in any course counts as a failure). • At least half of the courses used for credit must normally be Faculty of Engineering courses. • Students in the MEng in Civil Engineering program may choose to pursue a maximum of two of the following Graduate Specializations: 1. Architectural Engineering 2. Environmental and Water Resources Engineering 3. Sustainable Structural Systems 4. Transportation Engineering • A Graduate Specialization is a University credential that is recognized on the student's transcript but not on the diploma and is intended to reflect that a student has successfully completed a set of courses that together provide an in-depth study in the area of the Graduate Specialization. A student will only obtain the Graduate Specialization on	**Graduate specializations** • Architectural Engineering • Environmental and Water Resources Engineering • <u>Future Cities</u> • Sustainable Structural Systems • Transportation Engineering **Degree requirements** • Students must complete the course requirements listed below in addition to the Graduate Academic Integrity Module (Graduate AIM). **Coursework option: Course requirements** • Students must complete 8 one-term graduate level courses (0.50 unit weight) taken from the 500, 600 and 700 series courses (or courses acceptable for graduate credit). • At least 4 of the 8 required courses must be taken within the Department of Civil and Environmental Engineering. • An English for Multilingual Speakers (EMLS) technical/professional writing course for Engineers is required for all students who were not English Language Proficiency (ELP) exempt at the time of admission. • A maximum of 2 500 level courses may be counted for credit. • The candidate must obtain a pass in all courses credited to their program, with a minimum overall average of 70% (a grade of less than 65% in any course counts as a failure). • At least half of the courses used for credit must normally be Faculty of Engineering courses. • Students in the MEng in Civil Engineering program may choose to pursue a maximum of two of the following Graduate Specializations: 1. Architectural Engineering 2. Environmental and Water Resources Engineering 3. Sustainable Structural Systems 4. Transportation Engineering <u>5. Future Cities</u> • A Graduate Specialization is a University credential that is recognized on the student's transcript but not on the diploma and is intended to reflect that a student has successfully completed a set of courses that together provide an in-depth study in the area of the Graduate Specialization. A student will

Current Graduate Studies Academic Calendar content:	Proposed Graduate Studies Academic Calendar content:
their transcript if they have completed the requirements associated with the MEng degree and the requirements associated with the Graduate Specialization. • All MEng Graduate Specializations in Civil Engineering consist of a set of at least 4 graduate (0.50 weight) level courses and this set is comprised of a mix of compulsory and elective courses. Compulsory courses are those that are prescribed as part of the Graduate Specialization. Elective courses are those that are on a list of courses designated as electives for a given Graduate Specialization. The requirements for the Graduate Specializations are described below. 1. Graduate Specialization in Architectural Engineering • To receive the Graduate Specialization in Architectural Engineering, students must successfully complete AE 601 Comprehensive Building Design Studio, at least 2 compulsory courses and 1 elective course. Alternatively, students have the option to complete 4 courses from the compulsory courses list. Note: If students have already successfully completed the compulsory courses, students must complete alternate courses that are approved by the Department Associate Chair, Graduate Studies. o Compulsory courses: ▪ AE 601 Comprehensive Building Design Studio ▪ Choose at least 2 from the following list: ▪ CIVE 507 Building Science and Technology ▪ ARCH 642 Modernism to the 21st Century ▪ CIVE 630/AE 572/ME 572 Building Energy Analysis o Elective courses (choose at least 1 from the following list): ▪ ARCH 684 Special Topics in Architecture ▪ CIVE 505 Structural Dynamics ▪ CIVE 512 Rehabilitation of Structures ▪ CIVE 596 Construction Engineering ▪ CIVE 601 Risk and Reliability ▪ CIVE 602 Prestressed Concrete	only obtain the Graduate Specialization on their transcript if they have completed the requirements associated with the MEng degree and the requirements associated with the Graduate Specialization. • All MEng Graduate Specializations in Civil Engineering consist of a set of at least 4 graduate (0.50 weight) level courses and this set is comprised of a mix of compulsory and elective courses. Compulsory courses are those that are prescribed as part of the Graduate Specialization. Elective courses are those that are on a list of courses designated as electives for a given Graduate Specialization. The requirements for the Graduate Specializations are described below. 1. Graduate Specialization in Architectural Engineering • To receive the Graduate Specialization in Architectural Engineering, students must successfully complete AE 601 Comprehensive Building Design Studio, at least 2 compulsory courses and 1 elective course. Alternatively, students have the option to complete 4 courses from the compulsory courses list. Note: If students have already successfully completed the compulsory courses, students must complete alternate courses that are approved by the Department Associate Chair, Graduate Studies. o Compulsory courses: ▪ AE 601 Comprehensive Building Design Studio ▪ Choose at least 2 from the following list: ▪ CIVE 507 Building Science and Technology ▪ ARCH 642 Modernism to the 21st Century ▪ CIVE 630/AE 572/ME 572 Building Energy Analysis o Elective courses (choose at least 1 from the following list): ▪ ARCH 684 Special Topics in Architecture ▪ CIVE 505 Structural Dynamics ▪ CIVE 512 Rehabilitation of Structures ▪ CIVE 596 Construction Engineering ▪ CIVE 601 Risk and Reliability ▪ CIVE 602 Prestressed Concrete

Current Graduate Studies Academic Calendar content:	**Proposed Graduate Studies Academic Calendar content**:
▪ CIVE 603 Reinforced Concrete Mechanics and Design ▪ CIVE 604 Advanced Structural Steel Design ▪ CIVE 622 Finite Element Analysis ▪ CIVE 700 Topics in Structural Engineering: Topic 15 Earthquake Engineering ▪ CIVE 700 Topics in Structural Engineering: Topic 25 Timber Design ▪ CIVE 700 Topics in Structural Engineering: Topic 27 Design of Structural Concrete Systems ▪ CIVE 700 Topics in Structural Engineering: Topic 33 Smart Structure Technology ▪ CIVE 700 Topics in Structural Engineering: Topic 34 Scientific Machine Learning for Engineers ▪ CIVE 700 Topics in Structural Engineering: Topic 35 Fire and Structures ▪ CIVE 700 Topics in Structural Engineering: Topic 36 Sustainable Buildings and Environment ▪ CIVE 700 Topics in Structural Engineering: Topic 39 Circular Engineering and the Built Environment ▪ CIVE 704 Bridge Design ▪ CIVE 710 Advanced Project Management ▪ CIVE 790R Master of Engineering Project ▪ ME 671 Fundamental Fire Dynamics ▪ ME 672 Advanced Fire Dynamics ▪ ME 673 Fire Modeling ▪ ME656 (AE573/ME573) HVAC Systems, Equipment & Energy Efficiency ▪ SYDE 532 Introduction to Complex Systems	▪ CIVE 603 Reinforced Concrete Mechanics and Design ▪ CIVE 604 Advanced Structural Steel Design ▪ CIVE 622 Finite Element Analysis ▪ CIVE 700 Topics in Structural Engineering: Topic 15 Earthquake Engineering ▪ CIVE 700 Topics in Structural Engineering: Topic 25 Timber Design ▪ CIVE 700 Topics in Structural Engineering: Topic 27 Design of Structural Concrete Systems ▪ CIVE 700 Topics in Structural Engineering: Topic 33 Smart Structure Technology ▪ CIVE 700 Topics in Structural Engineering: Topic 34 Scientific Machine Learning for Engineers ▪ CIVE 700 Topics in Structural Engineering: Topic 35 Fire and Structures ▪ CIVE 700 Topics in Structural Engineering: Topic 36 Sustainable Buildings and Environment ▪ CIVE 700 Topics in Structural Engineering: Topic 39 Circular Engineering and the Built Environment ▪ CIVE 704 Bridge Design ▪ CIVE 710 Advanced Project Management ▪ CIVE 790R Master of Engineering Project ▪ ME 671 Fundamental Fire Dynamics ▪ ME 672 Advanced Fire Dynamics ▪ ME 673 Fire Modeling ▪ ME656 (AE573/ME573) HVAC Systems, Equipment & Energy Efficiency ▪ SYDE 532 Introduction to Complex Systems
2. Graduate Specialization in Environmental and Water Resources Engineering • To receive the Graduate Specialization in Environmental and Water Resources Engineering, students must successfully complete at least 2 compulsory courses and 2	2. Graduate Specialization in Environmental and Water Resources Engineering • To receive the Graduate Specialization in Environmental and Water Resources Engineering, students must successfully complete at least 2 compulsory courses and 2

Current Graduate Studies Academic Calendar content:	**Proposed Graduate Studies Academic Calendar content**:
elective courses. Alternatively, students have the option to complete 4 courses from the compulsory courses list. ○ Compulsory courses (choose at least 2 from the following list): ▪ ENVE 573 Contaminant Transport ▪ ENVE 577 Engineering for Solid Waste Management ▪ ENVE 585 Air Quality Engineering & Impacts ▪ CIVE 671 Aquatic Chemistry ▪ CIVE 680 Water Management ○ Elective courses (choose 2 from the following list): ▪ CIVE 583/ENVE 583 Design of Urban Water Systems ▪ CIVE 670 Physico-Chemical Processes of Water and Wastewater Treatment ▪ CIVE 682 Free Surface Hydraulics ▪ CIVE 770 Topics in Environmental Engineering: Topic 24 River Restoration ▪ CIVE 770 Topics in Environmental Engineering: Topic 41 Atmospheric Emissions to Impacts ▪ CIVE 770 Topics in Environmental Engineering: Topic 45 Environmental Fate of Organic Pollutants ▪ CIVE 770 Topics in Environmental Engineering: Topic 53 Environmental and Water Resources Simulation Model Calibration ▪ CIVE 771 Biological Wastewater Treatment: Theory and Practice ▪ CIVE 781 Principles of Hydrologic Modelling ▪ CIVE 790R Master of Engineering Project ▪ EARTH 691 Special Studies for MSc Students: Topic 159 Geothermal Energy ▪ EARTH 691 Special Studies for MSc Students: Topic 161 Energy Geomechanics	elective courses. Alternatively, students have the option to complete 4 courses from the compulsory courses list. ○ Compulsory courses (choose at least 2 from the following list): ▪ ENVE 573 Contaminant Transport ▪ ENVE 577 Engineering for Solid Waste Management ▪ ENVE 585 Air Quality Engineering & Impacts ▪ CIVE 671 Aquatic Chemistry ▪ CIVE 680 Water Management ○ Elective courses (choose 2 from the following list): ▪ CIVE 583/ENVE 583 Design of Urban Water Systems ▪ CIVE 670 Physico-Chemical Processes of Water and Wastewater Treatment ▪ CIVE 682 Free Surface Hydraulics ▪ CIVE 770 Topics in Environmental Engineering: Topic 24 River Restoration ▪ CIVE 770 Topics in Environmental Engineering: Topic 41 Atmospheric Emissions to Impacts ▪ CIVE 770 Topics in Environmental Engineering: Topic 45 Environmental Fate of Organic Pollutants ▪ CIVE 770 Topics in Environmental Engineering: Topic 53 Environmental and Water Resources Simulation Model Calibration ▪ CIVE 771 Biological Wastewater Treatment: Theory and Practice ▪ CIVE 781 Principles of Hydrologic Modelling ▪ CIVE 790R Master of Engineering Project ▪ EARTH 691 Special Studies for MSc Students: Topic 159 Geothermal Energy ▪ EARTH 691 Special Studies for MSc Students: Topic 161 Energy Geomechanics
3. Graduate Specialization in Sustainable Structural Systems	3. Graduate Specialization in Sustainable Structural Systems

Current Graduate Studies Academic Calendar content:	**Proposed Graduate Studies Academic Calendar content**:

• To receive the Graduate Specialization in Sustainable Structural Systems, students must successfully complete at least 2 compulsory course and 2 elective courses. Alternatively, students have the option to complete 4 courses from the compulsory courses list.
  ○ Compulsory courses (choose at least 2 from the following list):
  ▪ CIVE 505 Structural Dynamics
  ▪ CIVE 507 Building Science and Technology
  ▪ CIVE 596 Construction Engineering
  ▪ CIVE 601 Engineering Risk and Reliability
  ▪ CIVE 622 Finite Element Analysis
  ○ Elective courses (choose 2 from the following list):
  ▪ CIVE 512 Rehabilitation of Structures
  ▪ CIVE 602 Prestressed Concrete
  ▪ CIVE 603 Reinforced Concrete Mechanics and Design
  ▪ CIVE 604 Advanced Structural Steel Design
  ▪ CIVE 700 Topics in Structural Engineering: Topic 15 Earthquake Engineering
  ▪ CIVE 700 Topics in Structural Engineering: Topic 21 Building Energy Analysis
  ▪ CIVE 700 Topics in Structural Engineering: Topic 25 Timber Design
  ▪ CIVE 700 Topics in Structural Engineering: Topic 27 Design of Structural Concrete Systems
  ▪ CIVE 700 Topics in Structural Engineering: Topic 33 Smart Structure Technology
  ▪ CIVE 700 Topics in Structural Engineering: Topic 34 Scientific Machine Learning for Engineers
  ▪ CIVE 700 Topics in Structural Engineering: Topic 35 Fire and Structures
  ▪ CIVE 700 Topics in Structural Engineering: Topic 36 Sustainable Buildings and Environment
  ▪ CIVE 700 Topics in Structural Engineering: Topic 39 Circular Engineering and the Built Environment
	• To receive the Graduate Specialization in Sustainable Structural Systems, students must successfully complete at least 2 compulsory course and 2 elective courses. Alternatively, students have the option to complete 4 courses from the compulsory courses list.
	  ○ Compulsory courses (choose at least 2 from the following list):
	  ▪ CIVE 505 Structural Dynamics
	  ▪ CIVE 507 Building Science and Technology
	  ▪ CIVE 596 Construction Engineering
	  ▪ CIVE 601 Engineering Risk and Reliability
	  ▪ CIVE 622 Finite Element Analysis
	  ○ Elective courses (choose 2 from the following list):
	  ▪ CIVE 512 Rehabilitation of Structures
	  ▪ CIVE 602 Prestressed Concrete
	  ▪ CIVE 603 Reinforced Concrete Mechanics and Design
	  ▪ CIVE 604 Advanced Structural Steel Design
	  ▪ CIVE 700 Topics in Structural Engineering: Topic 15 Earthquake Engineering
	  ▪ CIVE 700 Topics in Structural Engineering: Topic 21 Building Energy Analysis
	  ▪ CIVE 700 Topics in Structural Engineering: Topic 25 Timber Design
	  ▪ CIVE 700 Topics in Structural Engineering: Topic 27 Design of Structural Concrete Systems
	  ▪ CIVE 700 Topics in Structural Engineering: Topic 33 Smart Structure Technology
	  ▪ CIVE 700 Topics in Structural Engineering: Topic 34 Scientific Machine Learning for Engineers
	  ▪ CIVE 700 Topics in Structural Engineering: Topic 35 Fire and Structures
	  ▪ CIVE 700 Topics in Structural Engineering: Topic 36 Sustainable Buildings and Environment
	  ▪ CIVE 700 Topics in Structural Engineering: Topic 39 Circular Engineering and the Built Environment

Current Graduate Studies Academic Calendar content:	**Proposed Graduate Studies Academic Calendar content**:
▪ CIVE 710 Advanced Project Management ▪ CIVE 790R Master of Engineering Project 4. Graduate Specialization in Transportation Engineering • To receive the Graduate Specialization in Transportation Engineering, students must successfully complete at least 2 compulsory courses and 2 elective courses. Alternatively, students have the option to complete 4 courses from the compulsory courses list. o Compulsory courses (choose at least 2 from the following list): ▪ CIVE 542 Pavement Structural Design ▪ CIVE 640 Urban Transportation Planning Models: Principles & Applications ▪ CIVE 641 Advances in Public Transportation Planning, Operations & Control ▪ CIVE 642 Pavement Design and Management I ▪ CIVE 643 Fundamentals of Traffic Flow Theory o Elective courses (choose 2 from the following list): ▪ CIVE 644 Innovative and Sustainable Infrastructure Materials ▪ CIVE 645 Modeling Transportation, Land Use and Spatial Economics ▪ CIVE 646 Computer Applications in Transportation Engineering ▪ CIVE 742 Pavement Design and Management II	▪ CIVE 710 Advanced Project Management ▪ CIVE 790R Master of Engineering Project 4. Graduate Specialization in Transportation Engineering • To receive the Graduate Specialization in Transportation Engineering, students must successfully complete at least 2 compulsory courses and 2 elective courses. Alternatively, students have the option to complete 4 courses from the compulsory courses list. o Compulsory courses (choose at least 2 from the following list): ▪ CIVE 542 Pavement Structural Design ▪ CIVE 640 Urban Transportation Planning Models: Principles & Applications ▪ CIVE 641 Advances in Public Transportation Planning, Operations & Control ▪ CIVE 642 Pavement Design and Management I ▪ CIVE 643 Fundamentals of Traffic Flow Theory o Elective courses (choose 2 from the following list): ▪ CIVE 644 Innovative and Sustainable Infrastructure Materials ▪ CIVE 645 Modeling Transportation, Land Use and Spatial Economics ▪ CIVE 646 Computer Applications in Transportation Engineering ▪ CIVE 742 Pavement Design and Management II <u>5. Graduate Specialization in Future Cities</u> • <u>To receive the Graduate Specialization in Future Cities, students must successfully complete at least 4 compulsory courses and 4 elective courses.</u> o <u>Compulsory courses (choose 4 from the following list):</u> ▪ <u>CIVE 507 Building Science and Technology</u> ▪ <u>CIVE 583 Design of Urban Water Systems</u>

Current Graduate Studies Academic Calendar content:	Proposed Graduate Studies Academic Calendar content:
	▪ CIVE 596 Construction Engineering ▪ CIVE 601 Engineering Risk and Reliability ▪ CIVE 605 Advanced Building Energy Analysis ▪ CIVE 640 Urban Transportation Models: Principles & Applications ▪ CIVE 641 Advances in Public Transportation Planning, Operations & Control ▪ CIVE 642 Pavement Design and Management 1 ▪ CIVE 643 Fundamentals of Traffic Flow Theory ▪ CIVE 644 Innovative and Sustainable Infrastructure Materials ▪ CIVE 645 Modeling Transportation, Land Use and Spatial Economics ▪ CIVE 670 Physico-Chemical Processes of Water and Wastewater Treatment ▪ CIVE 680 Water Management ▪ CIVE 700 Topics in Structural Engineering: Topic 21 Building Energy Analysis ▪ CIVE 700 Topics in Structural Engineering: Topic 36 Sustainable Buildings and Environment ▪ CIVE 700 Topics in Structural Engineering: Topic 39 Circular Engineering and the Built Environment ▪ CIVE 770 Topics in Environmental Engineering: Topic 41 Atmospheric Emissions to Impacts ▪ CIVE 770 Topics in Environmental Engineering: Topic 53 Environmental and Water Resources Simulation Model Calibration ▪ CIVE 771 Biological Wastewater Treatment: Theory and Practice ▪ CIVE 781 Principles of Hydrologic Modelling ▪ ENVE 577 Engineering for Solid Waste Management ▪ ENVE 585 Air Quality Engineering & Impacts

Current Graduate Studies Academic Calendar content:	Proposed Graduate Studies Academic Calendar content:
	○ Choose 2 electives from the following list: ▪ ARCH 710 Special Topics in Visual and Digital Media (note: topics must be approved by the Department Associate Chair, Graduate Studies) ▪ ARCH 720 Special Topics in Urbanism and Landscape (note: topics must be approved by the Department Associate Chair, Graduate Studies) ▪ ARCH 740 Special Topics in Architectural History and Theory (note: topics must be approved by the Department Associate Chair, Graduate Studies) ▪ ARCH 770 Special Topics in Building Technology and Environment (note: topics must be approved by the Department Associate Chair, Graduate Studies) ▪ ARCH 780 Special Topics in Race, Equity and Environmental Justice (note: topics must be approved by the Department Associate Chair, Graduate Studies) ▪ ECE 660 Operation and Control of Future Integrated Energy Systems ▪ ECE 663 Energy Processing ▪ ECE 763 Sustainable Distributed Power Generation ▪ MSE 602 Strategic Management of Technological Innovation ▪ MSE 603 Principles of Operations Research ▪ MSE 744 Science and Technology Policy ▪ MSE 751 Knowledge Management ▪ SYDE 600 Systems Theory, Models, Research & Design ▪ SYDE 625 Tools of Intelligent Systems Design ▪ SYDE 632 Optimization Methods ▪ SYDE 643 Collaborative Systems Design ○ Choose 2 electives from the following list:

Current Graduate Studies Academic Calendar content:	Proposed Graduate Studies Academic Calendar content:
	▪ ECON 637 Economic Analysis and Global Governance ▪ ECON 655 Resource Economics ▪ ECON 657 Environmental Economics ▪ ECON 658 Water Resource Economics ▪ ERS 615/GEOG 615/ PLAN 615 Community Economic Development ▪ ERS 680 Sustainability Foundations ▪ ERS 701 Sustainability in Complex Socio-Ecological Systems ▪ FCIT 600 Cities, Systems, Synergy and Collaboration ▪ FCIT 601 Tools for Futures Thinking ▪ FCIT 602 Future Thinking and Cities ▪ FCIT 603 Sustainable Future Cities ▪ FCIT 604 The Socially Just City ▪ FCIT 606/GEMCC 653 Sustainability Transitions in Cities ▪ GEOG 609/PLAN 657 GIS and Spatial Decision Support for Planning and Resource Management ▪ GEOG 621/ PLAN 621 Metropolitan Form and Structure in Canada ▪ GEOG 665 Environmental Planning Theory and Practice ▪ GEOG 669/ERS 619 Energy Sustainability ▪ GEMCC 640 Climate Change Governance: From Global Treaties to Local Innovation ▪ GGOV 664 Law, Tech & Society ▪ PLAN 606 Modelling the City ▪ PLAN 627 Climate Change ▪ PLAN 669 Landscape restoration ▪ PSCI 604/ERS 604/GGOV 620 Advanced Topics in Global Environmental Governance ▪ PSCI 633 Canadian Public Policy ▪ PSCI 688/GGOV 610/PAC 630 Governance of Global Economy

Current Graduate Studies Academic Calendar content:	**Proposed Graduate Studies Academic Calendar content**:
	Milestone requirements **Leadership Modules** • Students pursuing the Graduate Specialization in Future Cities must complete the Leadership Modules milestone to develop their skills in self-leadership, team leadership, organization leadership, and societal leadership. To satisfy the milestone, students must complete 4 of the following modules: 1. Introduction to sustainable engineering leadership 2. Connecting your personal values to leadership and sustainability 3. Social intelligence and leadership 4. Developing team identity 5. Applied leadership in sustainable cities 6. Technological stewardship 7. Sustainable Engineering Leadership reflection

How will students currently registered in the program be impacted by these changes?

Current MEng students who satisfy the degree requirements of the new Graduate Specialization may obtain the Graduate Specialization by completing/submitting a program change form prior to degree completion.

Department/School approval date (mm/dd/yy): 01/16/25
Reviewed by GSPA (for GSPA use only) ☒ date (mm/dd/yy): 01/13/25
Faculty approval date (mm/dd/yy):
Senate Graduate & Research Council (SGRC) approval date (mm/dd/yy):
Senate approval date (mm/dd/yy) (if applicable):

UNIVERSITY OF WATERLOO

GRADUATE PROPOSAL

COLLABORATIVE HEALTH TECHNOLOGIES PROGRAM

MASTER OF ENGINEERING IN CIVIL ENGINEERING – HEALTH TECHNOLOGIES (CO-OP)

For submission to the
Ontario Universities Council on Quality Assurance

VOLUME I - PROPOSED BRIEF

DECEMBER 2024

*The Quality Council will normally require only an Expedited Approval process where:

a) there is a proposal for a **new Collaborative Program** at the graduate level; or
b) there is a proposal for **a new for-credit graduate diploma**.

NOTE: This template **must** be used for submission of a new program proposal.
Please consult the University of Waterloo Institutional Quality Assurance Process and the Quality Assurance Framework (QAF) for details or the Quality Assurance Office.
****Volumes I, II must be reviewed and approved by the Quality Assurance Office, GSPA and IAP prior to submission to your Faculty Council****

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1. Introduction

Brief Listing of the Program

The Collaborative Health Technologies Program offers students professional Master of Engineering (MEng) degree with mandatory co-op, as preparation to enter the broad and rapidly evolving field of *Health Technology*. Not only is co-op highly beneficial to students while completing this program, it also offers an important opportunity to those students who *never* had co-op experience during their undergraduate degree. The program is centered around a collaborative and interdisciplinary suite of courses offered by six departments in Engineering and supported by the Faculties of Arts and Health. In addition to coursework, the mandatory co--op program serves to enrich the learning of students with practical experience in industrial settings. This is a full-time, on-campus program, with an expected duration of 4-6 terms, based on the co-op and study sequence selected by particular students. Program tuition follows the existing UW graduate home program tuition structure.

To enroll in the Collaborative Health Technologies Program, students must meet the admission requirements of, and register in, the department of Civil and Environmental Engineering (CEE). Students must complete the Collaborative Health Technologies Program requirements that are structured as a combination of CEE department's MEng degree requirement, and the additional Collaborative Health Technologies Program requirements (i.e., the completion of sufficient courses from specified pools, and successful co-op work terms/reports).

The degree conferred will be that of the participating program (i.e. Civil Engineering), with the completion of the Collaborative Health Technologies Program indicated by a transcript notation to the degree and adjunct qualification to the degree (i.e. Master of Engineering in Civil Engineering – Health Technologies). The proposed collaborative program also offers a platform to allow future participation of other Faculties.

Method Used for Preparation of the Brief

The Collaborative Health Technologies Program was conceptualized by the Dean of Engineering and the Associate Dean Graduate Studies – Engineering. In April 2023, the initiative to develop the program received support from the New Interdisciplinary Networks, Programs, and Initiatives Fund from the University. The proposal was developed following consultations by the Associate Dean with Graduate Associate Chairs of the departments of Chemical Engineering, Civil and Environmental Engineering, Electrical and Computer Engineering, Management Science and Engineering, Mechanical and Mechatronics Engineering, and Systems Design Engineering. The Associate Dean also had discussions with counterparts in other Faculties (e.g., Arts, Health, and Science). The general proposal was presented to the departments in Engineering for consideration within the unit. Following approval, this departmental proposal brief to participate in the collaborative program evolved, incorporating the specific requirements of the home unit.

2. Objectives of the Program (QAF 2.1.2.1)

The Collaborative Health Technologies Program is timely and justified not only based on the critical need for skilled professionals at the intersection of healthcare and technology, but also by the University of Waterloo's own goals, e.g. Waterloo at 100, Global Futures. The following are some of the compelling reasons that justify the establishment of a Collaborative Health Technologies Program:

1. **Rapid Technological Advancements in Healthcare**: The healthcare industry is experiencing an unprecedented transformation due to rapid advancements in technology. Innovations such as artificial intelligence, telemedicine, wearable devices, and data analytics are reshaping healthcare delivery, diagnosis, treatment, and patient care. A dedicated program will equip future professionals with leading-edge skills needed to leverage and drive innovations in this field.
2. **Increasing Demand for Health Technology Experts**: There is a growing demand for professionals who possess a deep understanding of both healthcare and technology. This demand arises from the need to bridge the gap between traditionally siloed fields and create holistic solutions that address complex healthcare challenges. Graduates of a Collaborative Health Technology Program will fill this talent gap and drive innovation in healthcare settings.
3. **Addressing Healthcare Challenges**: The global healthcare landscape faces numerous challenges, including rising costs, an aging population, chronic diseases, disparities in healthcare access, and pandemics. A Collaborative Health Technologies Program will empower students to develop innovative solutions to address these challenges, improve healthcare access, and enhance patient outcomes.
4. **Opportunity for Interdisciplinary Collaboration**: A program that combines healthcare and technology will foster interdisciplinary collaboration. Students will learn to collaborate with healthcare professionals, engineers, data scientists, ethicists, and policymakers, fostering a diverse and comprehensive approach to problem-solving.
5. **Industry-Relevant Skill Development**: Employers in the healthcare and technology sectors seek professionals with specialized skills in areas such as health data analytics, digital health, telemedicine, medical device development, regulatory compliance, and AI applications in healthcare. Both the course-based components and the mandatory co-op of this Collaborative Health Technologies Program combine to ensure that graduates are well-prepared with these in-demand skills.
6. **Economic and Innovation Impact**: Investing in a Collaborative Health Technologies Program aligns with the current market demand and presents an opportunity to contribute to economic growth and innovation. Graduates equipped with the skills to develop and implement Health Technology solutions can drive entrepreneurship, create job opportunities, and contribute to the expansion of healthcare technology sectors.
7. **Addressing Future Healthcare Needs**: With the evolving landscape of healthcare and technology, preparing future professionals to navigate and lead in this dynamic environment is essential. Establishing a Collaborative Health Technologies Program now ensures that the workforce is ready to address the future needs and challenges of the healthcare industry.

Program Learning Outcomes and Graduate Degree Level Expectations (GDLE):

1. **Depth and Breadth of Knowledge**
    a. Understand the principles, concepts, terminology and tools of health technology
    b. Demonstrate awareness of key elements of both the ethical considerations and impacts of health technologies
    c. Interpret, understand, and critically assess state-of-the-art methods, theories, and advances in health technology
2. **Research & Scholarship**
    a. Integrate complex engineering concepts related to the breadth of health technology, and the underlying and associated sciences.
3. **Level of Application of Knowledge**
    a. Interpret, critically assess and apply state-of-the-art methods, theories, and advances in health technology
    b. Understand current issues faced by the health technology industry
4. **Professional Capacity / Autonomy**
    a. Independently recognize, define, and solve complex real-world health technology needs and associated challenges
    b. Engage in self-directed professional development and life-long learning
    c. Develop an ability to recognize, appreciate, consider and apply appropriate ethics, law, regulations, and accountability to the field of health technologies
    d. Understand the value of engaging in inter-disciplinary collaboration in health technology as well as the complexity of knowledge & limitations of different fields
    e. Adopt a mindset for collaboration (work effectively in interdisciplinary teams including healthcare professionals, engineers, designers, business developers, etc.)
5. **Level of Communication Skills**
    a. Effectively communicate complex concepts in health technology to a wide audience ranging from general public to experts in the field. Concepts may include health technology needs and associated challenges (includes GDLE 6 Awareness of Limits of Knowledge)
    b. The ability to communicate ideas, issues and conclusions clearly.
6. **Awareness of Limits of Knowledge**
    a. Cognizance of the complexity of knowledge and of the potential contributions of other interpretations, methods, and disciplines.
    b. Understand the value of inter-disciplinarity in the field of health technologies.

How does this Program align with the University of Waterloo Strategic Plan and Strategic Mandate Agreement?

The Collaborative Health Technologies Program aligns well with the University of Waterloo's strategic plan in several ways:

1. **Interdisciplinary Collaboration:** The program's collaboration between the departments in Engineering as well as the support by Arts and Health, demonstrate a commitment to interdisciplinary collaboration, a key focus area of the strategic plan. This collaboration brings together diverse perspectives and expertise, fostering innovation in health technology by integrating engineering skills with insights from health, social sciences, and humanities.
2. **Work-integrated Learning through Co-op:** The mandatory co-op component of the program aligns with the strategic plan's emphasis on experiential learning. This practical work experience allows students to apply their knowledge in real-world settings, contributing to their professional development while addressing real challenges in health technology.
3. **Benefits of Innovation and Research:** The program's focus on Health Technologies aligns with the strategic plan's emphasis on fostering innovation. Even though this is a course-based program, it does enable students to connect with faculty from various departments to engage with cutting-edge technologies and understand solutions to real-world problems.
4. **Community Partnerships:** Collaboration between different departments within Engineering, along with the support, through course offering, by Faculties of Arts and Health, opens opportunities for partnership with external organizations, hospitals, and industry players. This engagement aligns with the strategic plan's focus on strengthening community partnerships. Co-op placements also will play a key role in this aspect.
5. **Technology and Global Challenges:** By addressing healthcare challenges through technology and innovation, the program contributes to addressing global challenges, which is in line with the University's strategic goal of leveraging technology for positive societal impact.
6. **Commitment to Excellence and Diversity:** The collaborative nature of the program reflects the University's commitment to excellence in education and research. Furthermore, by integrating diverse perspectives from multiple departments and faculties, the program contributes to promoting diversity and inclusion, a priority area in the strategic plan.

   Overall, the Collaborative Health Technologies Program embodies many key pillars of the University of Waterloo's Strategic Plan by promoting interdisciplinary collaboration, experiential learning, innovation, community engagement, and a commitment to excellence and diversity.

3. Admission Requirements (QAF 2.1.2.5)

Admission into the Collaborative Health Technologies Program is through direct application to the program offered through the home administrative unit, i.e. CEE. Admission requirements for the program will be the same as those existing for the Master of Engineering (Co-op) degree in CEE.

The minimum academic requirements – including admissions requirements, minimum overall averages, and timelines for any milestones – in the program will be consistent with the requirements of the primary existing master's program for each participating department.

In detail, the admission requirements for MEng in the department of Civil and Environmental Engineering are:

- An Honours Bachelor's degree (or equivalent) with a 75% standing.
- Graduate Record Examination (GRE) score (only for those applicants who completed their degree outside of Canada or United States).
- A Supplementary Information Form (SIF), which contains questions specific to the program about why applicants want to enroll and their experience in the field, must be completed.
- Required application materials include, Resume, SIF, Academic transcript(s), Two reference letters from academic or professional sources, and Proof of English language Proficiency (ELP), if applicable.
  Minimum English Language Proficiency requirement: TOEFL 80 (writing 22, speaking 20, reading 20, listening 18), or IELTS 6.5 (writing 6.0, speaking 6.0)

These admission requirements are appropriate given the precedent of existing co-op Master's programs in the Faculty of Engineering. The level of required academic performance is indicative of what will be required of students during their studies within this proposed program and serves to select only students who will be capable of meeting course expectations and overall program learning outcomes. Furthermore, the Supplementary Information Form, resume, and reference letters will allow for recognition of the prior work, experience, aspirations, and career trajectory of applicants.

4. Structure (QAF 2.1.2.2)

The Collaborative Health Technologies Program is a co-op only, course-based program. Completion of 9 courses will be required to meet the coursework requirement of the program. Selection of courses will be as follows:

2 courses from the following University-level courses (ARTS, ENG):

- PHIL 626: Bioethics and Technology
- ECON 643: Health Economics
- MSE 619: Healthcare Analytics

2 courses, inclusive of ENVE 585, from the following Faculty-level courses (6 ENG depts):

- BME 600: Design of Biomedical Technologies
- BME 602: Foundations in Biomechanical Engineering
- CHE 621:Model Building and Response Surface Methodology
- ENVE 585: Air Quality Engineering and Impacts
- ECE 608: Quantitative Methods in Biomedical Engineering
- MSE 630: Human-Computer Interaction

1 course from the following Faculty of Health courses:

- HLTH 612: Introduction to Health Information and Data Standards
- HLTH 633: Digital Health
- HLTH 605B: Quantitative Methods and Analysis
- HLTH 650A/650B: Application of Artificial Intelligence in Health (0.25) / Machine Learning Techniques in Health (0.25)
- HLTH 606B: Principles of Epidemiology for Public Health
- HLTH 615: Requirements Specifications and Analysis in Health Systems

At least 3 courses of the total 9 courses, in addition to ENVE 585, from Civil and Environmental Engineering, with no more than 2 courses at the 500- level.

An English for Multilingual Speakers (EMLS) technical/professional writing course for Engineers is required for all students who were not English Language Proficiency (ELP) exempt at the time of admission.

The program study / co-op sequence is illustrated below. Having co-op during the program both allows students to apply what they have learned in school to their co-op employment, but also the reverse: apply what has been learned during co-op terms to their in-school experiences. This model allows for bidirectional inspiration and gives students an important *context* for what they are learning.

Term-1	Term-2	Term-3	Term-4	Term-5	Term-6
study	study	Co-op	Co-op	study	(study)
study	study	Co-op	study	(study)	

Rationale and Justification

The structure and regulations of the Collaborative Health Technologies Program align with the program learning outcomes and Degree-Level Expectations. More detail is given below.

Alignment with Program Learning Outcomes:

1. **Diversity of Course Offerings:** The coursework structure ensures a breadth of courses from various levels (University, Faculty, Department) covering different aspects of health technologies, such as ethics, analytics, biomedical engineering, rehabilitation engineering, human-computer interaction, health-care systems, epidemiology, systems theory etc. The proposed program is designed in such a way that potential future participation of additional Faculties with their own master's program model is both possible and would further enrich the program content.

2. **Integration of Practical Experience:** The mandatory incorporation of co-op allows students to apply theoretical knowledge gained in the classroom to real-world scenarios, and vice versa. This aligns with the objective of the program to foster practical application and real-world learning.

Meeting Degree Level Expectations:

1. **Depth and Breadth of Knowledge:** The variety of courses spanning different Departments and Faculties suggests a comprehensive coverage of topics relevant to health technologies, meeting the depth and breadth of knowledge expected at the master's level.
2. **Professional Skills Development:** The incorporation of co-op experiences facilitates the development of professional skills, preparing students for practical challenges in the field.

Rationale for Program Length:

The proposed program length is reasonable for several reasons:

1. **Course Load and Requirements:** 9 courses within the program, structured across different units and levels, can be reasonably completed within three to four study terms.
2. **Integration of Co-op Experience:** The inclusion of co-op necessitates a program duration that allows students to engage in these practical experiences without significantly extending the program length.
3. **Balancing Academic and Practical Learning:** The program aims to balance academic learning with real-world application. A structured timeframe enables students to attain both theoretical knowledge and practical skills within a manageable period.

5. Program Content (QAF 2.1.2.3)

Health Technologies represent the dynamic intersection of healthcare and cutting-edge technology, encompassing a diverse array of innovations designed to revolutionize patient care, improve healthcare accessibility, and enhance overall well-being. Embracing a multidisciplinary approach, Health Technologies integrate advancements in artificial intelligence, data analytics, telemedicine, medical imaging, ethics, and more, to drive transformative changes in the diagnosis, treatment, and management of health conditions. The Collaborative Health Technologies Program is a muti-disciplinary course-based program in the Faculty of Engineering with mandatory co-op, integrated within the timeline of the program. Its multi-disciplinarity is derived on the basis of the participation, through course offerings, of the Faculties of Arts and Health. Additionally, the enrolled students will also take appropriate courses across several departments within Engineering. All courses taken are at the graduate level. An overview of the program's course structure was given in Section 4. Here, additional information on the courses is given.

A brief description of the University-level courses, from which a student would be required to take two, is given below:

- **PHIL 626: Bioethics and Technology** (Arts)
  Students will grapple with a sample of ethical issues related to advanced and emerging medical technologies and/or biotechnologies. The primary goals of doing so are: (1) To gain familiarity with key ethical concepts and values, which may include patient autonomy, beneficence, justice, care, anti-ableism, inclusion, and others; and (2) to enhance core critical

thinking skills needed for ethics, which will help improve each student's self-understanding (of not only what they think is right and wrong, but, more importantly, why) and their capacity to engage with different perspectives on the "whats" and "whys" of ethics in a spirit of open-mindedness, mutual respect, and constructive cooperation. Frequent in-class discussion is typically an important element of student learning in this course.

- **ECON 643: Health Economics** (Arts)
  This course introduces students to the role of economics in health care and health policy. It is meant to be a survey of major topics in health economics and an introduction to the ongoing debate over health care policy. Topics include the economic determinants of health and health policy, the market for medical care, the market for health insurance, and the role of the government in health care, and health care reform.
- **MSE 619: Healthcare Analytics** (Engineering)
  This course provides an introductory course on health analytics including such topics as data acquisition, modelling, and predictive analytics. The course focuses on the practical application of the concepts to improve the quality of the analyses often found in the health sector. Application areas will be concentrated on topics found in health systems and may include topics such as planning and scheduling, disease diagnosis, and treatment planning. The learning outcomes include the ability to identify and apply appropriate analytical methods and models for healthcare.

A brief description of the Faculty-level courses, from which a student would be required to take two, is given below:

- **BME 600: Design of Biomedical technologies** (SYDE)
  Systems theory and formulation of system dynamics problems. Design and research methods for biomedical technologies. Problem formulation and definition, stakeholder engagement, needs analysis, generation of alternative solutions, feasibility analysis, optimization, selection, and solution implementation.
- **BME602: Foundations in Biomechanical Engineering** (MME)
  This course focuses on equipping students with foundational knowledge in the biomechanics of human physiology, pathology and treatment. The overarching aim of this course is to develop students' literacy in applying biomechanics principles and modern tools towards understanding the human body. The course will build on existing knowledge in mathematics and physics to develop new expertise and hands-on experience in the biomechanical modeling and analysis of physiological systems.
- **CHE 621: Model Building and Response Surface Methodology** (CHE)
  This course teaches process / product optimization based on design of experiments, empirical modelling, and non-linear mechanistic models. These methodologies aid in refining healthcare processes and products, ensuring they meet stringent standards of efficiency, safety, and effectiveness.
- **ENVE 585: Air Quality Engineering and Impacts** (CEE)
  This course introduces air quality design of engineering solutions and associated health and economic impacts. It includes topics focused on the indoor environment, the outdoor

environment, or both, such as: air pollution sources, emission estimation, control strategies, measurement, modeling methods, health impact assessment, cost-benefit analysis, technical policy analysis, and co-impacts with climate change.

- **ECE 608: Quantitative Methods in Biomedical Engineering** (ECE)
  This course focuses on topics related to the use of quantitative tools in biomedical engineering research studies. Educational emphasis will be placed on developing students' core competence in biostatistics and biomedical computing, so as to prepare them to pursue biomedical engineering investigations that are backed by quantitative reasoning and numerical insights.
- **MSE 630: Human Computer Interaction** (MSE)
  This course concentrates on the theoretical and practical issues related to the design of the human-computer interfaces. Aspects of human perception, cognition and various models of task analysis are discussed.

A brief description of the Faculty of Health courses that are part of the department-specific and health-specific list of electives is given below:

- **HLTH 612: Introduction to Health Information and Data Standards**
  This course focuses on health data as a key component of all health informatics systems. Topics include ontologies and other classification taxonomies found in health systems, data standards (with a focus on Canadian implementations of international standards), privacy and security of health data, client/patient assessment tools, and ethical considerations.
- **HLTH 633: Digital Health**
  The wide adoption of mobile technology presents a new opportunity. Leveraging this existing technology, healthcare systems can deliver remote care and collect real-time data on patients outside of health centres, minimizing unnecessary visits to hospitals and providing healthcare access to remote populations. In this course, we will explore how digital health technology has been designed, evaluated, and deployed in different countries. Case studies will be used to demonstrate how institutional and governmental constraints have a strong impact on the success of the deployment. The course will address the different digital health technologies in the market, such as Telehealth, remote patient monitoring, tele radiology, consumer health informatics, and mHealth. Important aspects of technology development like patient confidentiality, privacy, standards, communication and security protocols, regulatory requirements, among others, will be discussed when presenting the development of each digital health solution. By the end of this course, students will be prepared to design, evaluate, and deploy a digital health intervention and will have a solid understanding of the barriers and requirements for deploying digital health technology.
- **HLTH 605B: Quantitative Methods and Analysis**
  This course is a rigorous introduction to biostatistics for those planning a career in public health. Students will learn various biostatistical techniques, how to apply those techniques in the analysis of data from health studies, and how to interpret the results from those analyses. After a brief review of material from a basic statistics course, topics covered will include simple and multiple linear regression, analysis of categorical data, simple and

multiple logistic regression, and survival analysis. Emphasis will be on (i) conceptual understanding of topics, including literacy necessary for understanding scientific papers in public health, as well as (ii) carrying out various data analysis applications.

- **HLTH 650A / 650B: Application of Artificial Intelligence in Health (0.25) / Machine Learning Techniques in Health (0.25)**
  HLTH 650A focuses on the application of machine learning (ML) and artificial intelligence (AI) techniques in the field of healthcare and public health settings. Big data sources available for population health studies will be introduced to students and challenges related to AI in health data will also be discussed. The learning activities consist of lectures, student-led journal club discussions and a term paper to propose the application of ML techniques to solve population health or public health problems.
  HLTH 650B focusses on the techniques of machine learning (ML) commonly used to solve healthcare and public health problems. Various analytics techniques, including data wrangling, visualization, unsurprised and supervised learning, will be introduced to students. Challenges and strategies related to missing data, imbalanced data and model selections will also be discussed. The learning activities consist of lectures, labs, and a final project to demonstrate the proficiency of ML techniques to solve population health or public health problems.
- **HLTH 606B: Principles of Epidemiology for Public Health**
  This course introduces the principles, methods, and uses of epidemiology in the practice of public health. After completion of this course, students will be able to critically read and interpret epidemiologic research and clearly communicate epidemiologic findings. They will be familiar with health status measurement, data sources, screening, surveillance, outbreak investigation, and methods to support program planning and evaluation. Students will have a sound understanding of basic epidemiologic concepts, including prevalence, incidence, study designs, measures of association, bias, confounding and causal inference.
- **HLTH 615: Requirements Specifications and Analysis in Health Systems**
  This course introduces students to the requirements of definition phase of software development. Models, notations, and processes for software requirements identification, representation, validation, and analysis are discussed, as are mechanisms to evaluate the efficacy and efficiency of health information systems.

6. Mode of Delivery (QAF 2.1.2.2)

Courses made available for students of the Collaborative Health Technologies Program use a wide variety of teaching and learning methodologies (e.g., lectures, case-studies, student presentations, in-class group discussion, etc.) designed to provide students with an engaging learning experience. Though not specific to this program, at the University of Waterloo, instructors from all faculties are encouraged to make use of the Center for Teaching Excellence, which offers many resources to aid instructors in improving their teaching, course design, and delivery, emphasising *Active Learning* techniques. Instructors of courses offered to Collaborative Health Technologies Program students will be reminded of these resources.

Following program approval and implementation, the faculty-level administrative staff will ensure the program is continually meeting both intended learning outcomes and degree-level expectations.

7. Assessment of Teaching and Learning (QAF 2.1.2.4)

The performance of students will be assessed both on conventional and existing methods stipulated by the courses they will take, but also based on input from the co-operative education component of this program.

Assessment of teaching and learning will be conducted at the *student* and *program* levels. The program will be assessed at the program level by the Graduate Program Committee and program director. As part of this assessment, the Program Committee will review statistics, such as program performance versus learning objectives, student success rates and teaching evaluations – as provided through both student perception surveys and peer-assessment of teaching. The committee will identify opportunities to improve performance, such as enriching course content or teaching.

Performance indicators that will be considered by the Program Committee will include:

- Applications to and enrollment within the program;
- Student evaluations of courses;
- Student graduation rates;
- Surveys of alumni; and
- Surveys of employers/industry partners.

At the student level, there will be the following types of activities with assessments:

a) Coursework: Students will be assigned a grade based on typical assessment methods used in other graduate courses, such as papers, reports, tests, projects, and presentations.
b) Co-operative Education Work-Term Reports.

Refer to the table in Appendix A for more specific information on how assessments will be made, both for course-based and co-operative education components of this program.

8. Resources for All Programs (QAF 2.1.2.6)

For the anticipated enrolment numbers of the Collaborative Health Technologies Program, the additional students enrolling into pre-existing courses will not present a significant burden on the University's resources (i.e., students take courses from large pools and therefore, there will likely not be so many additional students per course that additional sections and having more instructors would be necessary – in fact, in some cases, the additional grad students enrolling may help improve the instructor utilization efficiency for courses that typically have too low of enrollment numbers). The program would not necessitate hiring any new faculty members and instead would rely on existing known-to-be qualified faculty members already teaching courses. In addition, students will have access to the University's

facilities and spaces, including library resources, working spaces, access to existing resources for student well-being and counselling, as well as technology support from their home department. This program is not expected to impose additional student costs for use of resources. Program coordination can be handled by existing staff resources in the home departments with the Faculty of Engineering providing additional support as needed, as is the case for other existing collaborative programs.

9. Resources for Graduate Programs (QAF 2.1.2.7)

Given the course-based nature of the Collaborative Health Technologies Program, an assessment of the research-related and supervisory expertise of faculty is not required for this program to function. The breadth of courses available for students to take is immense and course instructors may change from term-to-term. Therefore, nearly *all* faculty from the participating units may serve this program through the teaching of courses in which Health Technology students may enroll. On a course-by-course /offering-to-offering basis, ensuring instructor competence is left to the discretion of the corresponding department. Following the precedent of existing professional master's programs in Engineering, no financial assistance will be provided to students. Ensuring the quality of incoming students, will be left to the discretion of the home departments and will be put into action through the standard program admission requirements, as are described in Section 3.

10. Quality and Other Indicators (QAF 2.1.2.8)

To ensure the quality of the program a Program Committee will be created to oversee and regularly evaluate the program, to ensure all program requirements and course related graduate-level degree requirements are met. This committee will consist of a Program Director, the Course Coordinator, a faculty member from each participating department, and a graduate student representative. Furthermore, the co-op office will principally oversee all co-op related activities and components of this program. Within each department of Engineering, Graduate Associate Chairs will monitor the progress of their constituent students from this program, as is already their responsibility for existing professional programs. Specifically, student progression through the program, grades, and successful completion of co-op terms will be tracked. Where needed, remedial action will be taken to ensure students remain on-track and able to maximally benefit from participation in this program.

Appendix A - Summary of Learning Outcomes Mapped to Courses and Assessment Methods

Specific GDLEs and Associated Learning Outcomes	Courses										Co-operative Education			Assessment method							
	University-level ARTS | ENG			Faculty-level SYDE | MME | CHE | CIVE | ECE | MSE						Dept-level CEE | HEALTH										
	PHIL 626: Bioethics & Technology	ECON 643: Health Economics	MSE 619: Healthcare Analytics	BME 600: Design of Biomedical Technologies	BME 602: Foundations in Biomechanical Engineering	CHE 621: Model Building and Response Surface Methodology	ENVE 585: Air Quality Engineering & Impact	ECE 608: Quantitative Methods in Biomedical Engineering	MSE 630: Human-Computer Interaction	Dept-specific and Health-specific Elective Courses	Employer Input	Co-op Office Evaluation	Work Term Report	Forum communication	Multi-part assignments	Quizzes / Tests	Written assignments / arguments / policy briefs	Data interpretation, synthesis, visualization	Technical reports / plans	Slide decks / presentations	Video production
1. Depth and Breadth of Knowledge																					
Understand the principles, concepts, terminology, tools of health technology	A	A	A	C	A	A	A	A	A	AC	NA	NA	A	NA	A	A	A	A	A	A	NA
Demonstrate awareness of key elements of both the ethical considerations and impacts of health technologies	A	A	A	NA	C	NA	NA	NA	C	AC	A	NA	A	NA	A	A	A	A	A	A	NA
Interpret, understand, and critically assess state-of-the-art methods, theories, and advances in health technology	C	C	A	NA	A	C	C	A	A	AC	NA	NA	C	NA	A	A	A	A	A	A	NA
2. Research & Scholarship																					
Integrate complex engineering concepts related to the breadth of health technology, and the underlying and associated sciences.	NA	NA	A	C	A	A	A	A	A	AC	C	NA	C	NA	A	A	A	A	A	A	NA

Specific GDLEs and Associated Learning Outcomes	Courses										Co-operative Education			Assessment method							
	University-level ARTS | ENG			Faculty-level SYDE | MME | CHE | CIVE | ECE | MSE						Dept-level CEE | HEALTH										
	PHIL 626: Bioethics & Technology	ECON 643: Health Economics	MSE 619: Healthcare Analytics	BME 600: Design of Biomedical Technologies	BME 602: Foundations in Biomechanical Engineering	CHE 621: Model Building and Response Surface Methodology	ENVE 585: Air Quality Engineering & Impact	ECE 608: Quantitative Methods in Biomedical Engineering	MSE 630: Human-Computer Interaction	Dept-specific and Health-specific Elective Courses	Employer Input	Co-op Office Evaluation	Work Term Report	Forum communication	Multi-part assignments	Quizzes / Tests	Written assignments / arguments / policy briefs	Data interpretation, synthesis, visualization	Technical reports / plans	Slide decks / presentations	Video production
3. Level of Application of Knowledge																					
Interpret, critically assess and apply state-of-the-art methods, theories, and advances in health technology	A	A	A	C	A	A	A	A	A	AC	NA	NA	A	NA	A	A	A	A	A	A	NA
Understand current issues faced by the health technology industry	A	A	C	C	A	NA	NA	C	A	AC	A	C	A	NA	A	A	A	A	A	A	NA
4. Professional Capacity / Autonomy																					
Independently recognize, define, and solve complex real-world health technology needs and associated challenges	A	A	NA	C	C	C	C	C	C	AC	A	A	A	NA	AC	AC	AC	AC	C	AC	NA
Engage in self-directed professional development and life-long learning	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	C	C	A	NA	NA	NA	NA	NA	A	NA	NA
Develop an ability to recognize, appreciate, consider and apply appropriate ethics, law, regulations, and accountability to the field of health technologies	A	A	C	C	C	NA	NA	C	C	AC	A	C	A	NA	A	A	A	A	A	A	NA

Specific GDLEs and Associated Learning Outcomes	Courses										Co-operative Education			Assessment method							
	University-level ARTS | ENG			Faculty-level SYDE | MME | CHE | CIVE | ECE | MSE						Dept-level CEE | HEALTH										
	PHIL 626: Bioethics & Technology	ECON 643: Health Economics	MSE 619: Healthcare Analytics	BME 600: Design of Biomedical Technologies	BME 602: Foundations in Biomechanical Engineering	CHE 621: Model Building and Response Surface Methodology	ENVE 585: Air Quality Engineering & Impact	ECE 608: Quantitative Methods in Biomedical Engineering	MSE 630: Human-Computer Interaction	Dept-specific and Health-specific Elective Courses	Employer Input	Co-op Office Evaluation	Work Term Report	Forum communication	Multi-part assignments	Quizzes / Tests	Written assignments / arguments / policy briefs	Data interpretation, synthesis, visualization	Technical reports / plans	Slide decks / presentations	Video production
Understand the value of engaging in inter-disciplinary collaboration in health technology as well as the complexity of knowledge & limitations of different fields	C	C	C	C	NA	NA	NA	NA	NA	AC	NA	NA	A	NA	NA	NA	C	NA	A	C	NA
Adopt a mindset for collaboration (work effectively in interdisciplinary teams including healthcare professionals, engineers, designers, business developers, etc.)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	A	A	C	NA	NA	NA	NA	NA	C	NA	NA
5. Level of Communications Skills																					
Effectively communicate complex concepts in health technology to a wide audience ranging from general public to experts in the field. Concepts may include health technology needs and associated challenges (includes GDLE 6 Awareness of Limits of Knowledge)	C	C	C	NA	NA	NA	NA	NA	NA	NA	C	C	C	NA	NA	NA	NA	NA	C	C	NA
The ability to communicate ideas, issues and conclusions clearly.	C	C	NA	NA	NA	NA	NA	NA	NA	NA	C	C	A	NA	NA	NA	NA	NA	A	C	NA

Specific GDLEs and Associated Learning Outcomes	Courses										Co-operative Education			Assessment method							
	University-level ARTS | ENG			Faculty-level SYDE | MME | CHE | CIVE | ECE | MSE						Dept-level CEE | HEALTH										
	PHIL 626: Bioethics & Technology	ECON 643: Health Economics	MSE 619: Healthcare Analytics	BME 600: Design of Biomedical Technologies	BME 602: Foundations in Biomechanical Engineering	CHE 621: Model Building and Response Surface Methodology	ENVE 585: Air Quality Engineering & Impact	ECE 608: Quantitative Methods in Biomedical Engineering	MSE 630: Human-Computer Interaction	Dept-specific and Health-specific Elective Courses	Employer Input	Co-op Office Evaluation	Work Term Report	Forum communication	Multi-part assignments	Quizzes / Tests	Written assignments / arguments / policy briefs	Data interpretation, synthesis, visualization	Technical reports / plans	Slide decks / presentations	Video production
6. Awareness of Limits of Knowledge																					
Cognizance of the complexity of knowledge and of the potential contributions of other interpretations, methods, and disciplines.	A	A	C	C	C	C	C	C	C	AC	A	A	A	NA	C	NA	NA	NA	A	A	NA
Understand the value of inter-disciplinarity in the field of health technology.	C	C	C	C	C	C	C	C	C	AC	C	C	C	NA	C	NA	C	NA	C	C	NA

Table Legend:

Assessed (A) ..... The outcome is addressed and is formally assessed.
Covered (C) ..... The outcome is addressed but not assessed.
Assessed or Covered (AC)..... The outcome may be addressed and assessed but is at least covered (depending on selected courses).
Not addressed (NA) ..... The outcome is not addressed.

Graduate Studies
Program Revision Template

Prior to form submission, review the content revision instructions and information regarding major/minor modifications. For questions about the form submission, contact Trevor Clews, Graduate Studies and Postdoctoral Affairs (GSPA).

Faculty: Engineering

Program: Master of Engineering (MEng) in Civil Engineering – Health Technologies – Co-operative Program

Program contact name(s): Adil Al-Mayah, Siva Sivoththaman

Form completed by:

Description of proposed changes:

Note: changes to courses and milestones also require the completion/submission of the SGRC Graduate Studies Course/Milestone Form.

The Department of Civil and Environmental Engineering is joining the inaugural Collaborative Health Technologies Program and is thus adding a Master of Engineering (MEng) in Civil Engineering - Health Technologies - Co-operative Program (direct entry).

Is this a major modification to the program? Yes

Rationale for change(s):

Please refer to the attached brief for full details.

Proposed effective date: Term: Fall Year: 2025

Current Graduate Studies Academic Calendar (GSAC) page (include the link to the web page where the changes are to be made):

https://uwaterloo.ca/academic-calendar/graduate-studies/catalog#/programs?group=Civil%20and%20Environmental%20Engineering&bc=true&bcCurrent=Civil%20and%20Environmental%20Engineering&bcItemType=programs

Current primary program in the home unit: MEng in Civil Engineering - Co-operative Program Graduate Studies Academic Calendar content:	**Proposed MEng in Civil Engineering - Health Technologies - Co-operative Program Graduate Studies Academic Calendar content**:
Master of Engineering (MEng) in Civil Engineering - Co-operative Program (direct entry)	**Master of Engineering (MEng) in Civil Engineering - Health Technologies - Co-operative Program (direct entry)**

Current primary program in the home unit: MEng in Civil Engineering - Co-operative Program Graduate Studies Academic Calendar content:	Proposed MEng in Civil Engineering - Health Technologies - Co-operative Program Graduate Studies Academic Calendar content:
Admit term(s) • Fall • Winter • Spring **Delivery mode** • On-campus **Registration option(s)** • Full-time **Program type(s)** • Co-operative **Study option(s)** • Coursework **Length of program** • Full-time: 4-5 terms (16-20 months) **Additional program information** • The University of Waterloo does not provide funding for MEng in Civil Engineering students, and the candidates are expected to be self-supporting. **Admission requirements: Minimum requirements** • An Honours Bachelor's degree (or equivalent) with a 75% standing. • Graduate Record Examination (GRE) score (only for those applicants who completed their degree outside of Canada and the United States). • English language proficiency (ELP) (if applicable) **Admission requirements: Application materials** • Résumé • Supplementary information form • Transcript(s) **Admission requirements: References** • Number of references: 2 • Type of references: academic or professional **Degree requirements** • Students must complete the course and milestone requirements listed below in addition to the Graduate Academic Integrity Module (Graduate AIM).	**Admit term(s)** • Fall • Winter • Spring **Delivery mode** • On-campus **Registration option(s)** • Full-time **Program type(s)** • Co-operative • Collaborative **Study option(s)** • Coursework **Length of program** • Full-time: 4-5 terms (16-20 months) **Additional program information** • The University of Waterloo does not provide funding for MEng in Civil Engineering students, and the candidates are expected to be self-supporting. **Admission requirements: Minimum requirements** • An Honours Bachelor's degree (or equivalent) with a 75% standing. • Graduate Record Examination (GRE) score (only for those applicants who completed their degree outside of Canada and the United States). • English language proficiency (ELP) (if applicable) **Admission requirements: Application materials** • Résumé • Supplementary information form • Transcript(s) **Admission requirements: References** • Number of references: 2 • Type of references: academic or professional **Degree requirements** • Students must complete the course and milestone requirements listed below in addition to the Graduate Academic Integrity Module (Graduate AIM).

Current primary program in the home unit: MEng in Civil Engineering - Co-operative Program Graduate Studies Academic Calendar content:	**Proposed MEng in Civil Engineering - Health Technologies - Co-operative Program Graduate Studies Academic Calendar content**:

• The MEng in Civil Engineering - Co-operative Program will enable students to combine graduate studies with work experience.
• The program includes completion of 1-2 required work terms. The work term(s) typically takes place in term 3 (or terms 3 and 4). The work term(s) must meet Co-operative and Experiential Education (CEE) standard work term requirements and Departmental requirements. Students should apply to jobs related to their program of study. Note: the program must start and end on an academic term. Students in the program are encouraged to complete WIL 601 Career Foundations for Work-Integrated Learning in the academic term prior to the first work term.
 	
Coursework option: Course requirements
• Students must complete 8 one-term graduate level courses (0.50 unit weight) taken from the 500, 600 and 700 series courses (or courses acceptable for graduate credit).
• At least 4 of the 8 required courses must be taken within the Department of Civil and Environmental Engineering.
• An English for Multilingual Speakers (EMLS) technical/professional writing course for Engineers is required for all students who were not English Language Proficiency (ELP) exempt at the time of admission.
• A maximum of 2 500 level courses may be counted for credit.
• The candidate must obtain a pass in all courses credited to their program, with a minimum overall average of 70% (a grade of less than 65% in any course counts as a failure).
• At least half of the courses used for credit must normally be Faculty of Engineering courses.
 	
Coursework option: Milestone requirements
 	
Graduate Studies Work Report
• Students must complete one or two work-term experiences. For each work experience, a work report must be submitted to the Department for review to earn credit for the work report.
• Students are responsible for following the roles and responsibilities of Co-operative and Experiential Education (CEE).
	• The MEng in Civil Engineering - Health Technologies - Co-operative Program will enable students to combine graduate studies with work experience.
	• The program includes completion of 1-2 required work terms. The work term(s) typically takes place in term 3 (or terms 3 and 4). The work term(s) must meet Co-operative and Experiential Education (CEE) standard work term requirements and Departmental requirements. Students should apply to jobs related to their program of study. Note: the program must start and end on an academic term. Students in the program are encouraged to complete WIL 601 Career Foundations for Work-Integrated Learning in the academic term prior to the first work term.
	
	Coursework option: Course requirements
	• Students must complete ~~8~~ the following 9 one-term graduate level courses (0.50 unit weight) ~~taken from the 500, 600 and 700 series courses~~ (or courses acceptable for graduate credit):
	  ○ ENVE 585 Air Quality Engineering and Impacts
	  ○ 2 of the following Health Technologies core courses:
	  ▪ ECON 643 Health Economics
	  ▪ MSE 619 Healthcare Analytics
	  ▪ PHIL 626 Bioethics and Technology
	  ○ 1 of the following Faculty of Engineering Health Technologies elective courses:
	  ▪ BME 600 Design of Biomedical Technologies
	  ▪ BME 602 Foundations in Biomechanical Engineering
	  ▪ CHE 621 Model Building and Response Surface Methodology
	  ▪ ECE 608 Quantitative Methods in Biomedical Engineering
	  ▪ MSE 630 Human-Computer Interaction
	  ○ 1 of the following Health Technologies elective courses:
	  ▪ HLTH 605B Quantitative Methods and Analysis
	  ▪ HLTH 606B Principles of Epidemiology for Public Health

Current primary program in the home unit: MEng in Civil Engineering - Co-operative Program Graduate Studies Academic Calendar content:	Proposed MEng in Civil Engineering - Health Technologies - Co-operative Program Graduate Studies Academic Calendar content:
	▪ HLTH 612 Introduction to Health Information and Data Standards ▪ HLTH 615 Requirements Specifications and Analysis in Health Systems ▪ HLTH 633 Digital Health ▪ HLTH 650A Application of Artificial Intelligence in Health (0.25) and 650B Machine Learning Techniques in Health (0.25) ○ 4 CIVE graduate level courses • ~~At least 4 of the 8 required courses must be taken within the Department of Civil and Environmental Engineering.~~ • An English for Multilingual Speakers (EMLS) technical/professional writing course for Engineers is required for all students who were not English Language Proficiency (ELP) exempt at the time of admission. • A maximum of 2 500 level courses may be counted for credit. • The candidate must obtain a pass in all courses credited to their program, with a minimum overall average of 70% (a grade of less than 65% in any course counts as a failure). • At least half of the courses used for credit must normally be Faculty of Engineering courses. **Coursework option: Milestone requirements** **Graduate Studies Work Report** • Students must complete one or two work-term experiences. For each work experience, a work report must be submitted to the Department for review to earn credit for the work report. • Students are responsible for following the roles and responsibilities of Co-operative and Experiential Education (CEE).

How will students currently registered in the program be impacted by these changes?

Current students will not be impacted. The program will be open to new students once it goes into effect.

Department/School approval date (mm/dd/yy): 01/16/25
Reviewed by GSPA (for GSPA use only) ☒ date (mm/dd/yy): 01/14/25
Faculty approval date (mm/dd/yy):

Senate Graduate & Research Council (SGRC) approval date (mm/dd/yy):
Senate approval date (mm/dd/yy) (if applicable):

UNIVERSITY OF WATERLOO

GRADUATE PROPOSAL

COLLABORATIVE HEALTH TECHNOLOGIES PROGRAM

MASTER OF ENGINEERING IN ELECTRICAL AND COMPUTER ENGINEERING – HEALTH TECHNOLOGIES (CO-OP)

For submission to the
Ontario Universities Council on Quality Assurance

VOLUME I - PROPOSED BRIEF

DECEMBER 2024

*The Quality Council will normally require only an Expedited Approval process where:

a) there is a proposal for a **new Collaborative Program** at the graduate level; or
b) there is a proposal for **a new for-credit graduate diploma**.

NOTE: This template **must** be used for submission of a new program proposal.
Please consult the University of Waterloo Institutional Quality Assurance Process and the Quality Assurance Framework (QAF) for details or the Quality Assurance Office.
****Volumes I, II must be reviewed and approved by the Quality Assurance Office, GSPA and IAP prior to submission to your Faculty Council****

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1. Introduction

Brief Listing of the Program

The Collaborative Health Technologies Program offers students professional Master of Engineering (MEng) degree with mandatory co-op, as preparation to enter the broad and rapidly evolving field of *Health Technology*. Not only is co-op highly beneficial to students while completing this program, it also offers an important opportunity to those students who *never* had co-op experience during their undergraduate degree. The program is centered around a collaborative and interdisciplinary suite of courses offered by six departments in Engineering and supported by the Faculties of Arts and Health. In addition to coursework, the mandatory co--op program serves to enrich the learning of students with practical experience in industrial settings. This is a full-time, on-campus program, with an expected duration of 4-6 terms, based on the co-op and study sequence selected by particular students. Program tuition follows the existing UW graduate home program tuition structure.

To enroll in the Collaborative Health Technologies Program, students must meet the admission requirements of, and register in, the department of Electrical and Computer Engineering (ECE). Students must complete the Collaborative Health Technologies Program requirements that are structured as a combination ECE department's MEng degree requirement, and the additional Collaborative Health Technologies Program requirements (i.e., the completion of sufficient courses from specified pools, and successful co-op work terms/reports).

The degree conferred will be that of the participating program (i.e. Electrical and Computer Engineering), with the completion of the Collaborative Health Technologies Program indicated by a transcript notation to the degree and adjunct qualification to the degree (i.e. Master of Engineering in Electrical and Computer Engineering – Health Technologies). The proposed collaborative program also offers a platform to allow future participation of other Faculties.

Method Used for Preparation of the Brief

The Collaborative Health Technologies Program was conceptualized by the Dean of Engineering and the Associate Dean Graduate Studies – Engineering. In April 2023, the initiative to develop the program received support from the New Interdisciplinary Networks, Programs, and Initiatives Fund from the University. The proposal was developed following consultations by the Associate Dean with Graduate Associate Chairs of the departments of Chemical Engineering, Civil and Environmental Engineering, Electrical and Computer Engineering, Management Science and Engineering, Mechanical and Mechatronics Engineering, and Systems Design Engineering. The Associate Dean also had discussions with counterparts in other Faculties (e.g., Arts, Health, and Science). The general proposal was presented to the departments in Engineering for consideration within the unit. Following approval, this departmental proposal brief to participate in the collaborative program evolved, incorporating the specific requirements of the home unit.

2. Objectives of the Program (QAF 2.1.2.1))

The Collaborative Health Technologies Program is timely and justified not only based on the critical need for skilled professionals at the intersection of healthcare and technology, but also by the University of Waterloo's own goals, e.g. Waterloo at 100, Global Futures. The following are some of the compelling reasons that justify the establishment of a Collaborative Health Technologies Program:

1. **Rapid Technological Advancements in Healthcare**: The healthcare industry is experiencing an unprecedented transformation due to rapid advancements in technology. Innovations such as artificial intelligence, telemedicine, wearable devices, and data analytics are reshaping healthcare delivery, diagnosis, treatment, and patient care. A dedicated program will equip future professionals with leading-edge skills needed to leverage and drive innovations in this field.
2. **Increasing Demand for Health Technology Experts**: There is a growing demand for professionals who possess a deep understanding of both healthcare and technology. This demand arises from the need to bridge the gap between traditionally siloed fields and create holistic solutions that address complex healthcare challenges. Graduates of a Collaborative Health Technology Program will fill this talent gap and drive innovation in healthcare settings.
3. **Addressing Healthcare Challenges**: The global healthcare landscape faces numerous challenges, including rising costs, an aging population, chronic diseases, disparities in healthcare access, and pandemics. A Collaborative Health Technologies Program will empower students to develop innovative solutions to address these challenges, improve healthcare access, and enhance patient outcomes.
4. **Opportunity for Interdisciplinary Collaboration**: A program that combines healthcare and technology will foster interdisciplinary collaboration. Students will learn to collaborate with healthcare professionals, engineers, data scientists, ethicists, and policymakers, fostering a diverse and comprehensive approach to problem-solving.
5. **Industry-Relevant Skill Development**: Employers in the healthcare and technology sectors seek professionals with specialized skills in areas such as health data analytics, digital health, telemedicine, medical device development, regulatory compliance, and AI applications in healthcare. Both the course-based components and the mandatory co-op of this Collaborative Health Technologies Program combine to ensure that graduates are well-prepared with these in-demand skills.
6. **Economic and Innovation Impact**: Investing in a Collaborative Health Technologies Program aligns with the current market demand and presents an opportunity to contribute to economic growth and innovation. Graduates equipped with the skills to develop and implement Health Technology solutions can drive entrepreneurship, create job opportunities, and contribute to the expansion of healthcare technology sectors.
7. **Addressing Future Healthcare Needs**: With the evolving landscape of healthcare and technology, preparing future professionals to navigate and lead in this dynamic environment is essential. Establishing a Collaborative Health Technologies Program now ensures that the workforce is ready to address the future needs and challenges of the healthcare industry.

Program Learning Outcomes and Graduate Degree Level Expectations (GDLE):

1. **Depth and Breadth of Knowledge**
    a. Understand the principles, concepts, terminology and tools of health technology
    b. Demonstrate awareness of key elements of both the ethical considerations and impacts of health technologies
    c. Interpret, understand, and critically assess state-of-the-art methods, theories, and advances in health technology
2. **Research & Scholarship**
    a. Integrate complex engineering concepts related to the breadth of health technology, and the underlying and associated sciences.
3. **Level of Application of Knowledge**
    a. Interpret, critically assess and apply state-of-the-art methods, theories, and advances in health technology
    b. Understand current issues faced by the health technology industry
4. **Professional Capacity / Autonomy**
    a. Independently recognize, define, and solve complex real-world health technology needs and associated challenges
    b. Engage in self-directed professional development and life-long learning
    c. Develop an ability to recognize, appreciate, consider and apply appropriate ethics, law, regulations, and accountability to the field of health technologies
    d. Understand the value of engaging in inter-disciplinary collaboration in health technology as well as the complexity of knowledge & limitations of different fields
    e. Adopt a mindset for collaboration (work effectively in interdisciplinary teams including healthcare professionals, engineers, designers, business developers, etc.)
5. **Level of Communication Skills**
    a. Effectively communicate complex concepts in health technology to a wide audience ranging from general public to experts in the field. Concepts may include health technology needs and associated challenges (includes GDLE 6 Awareness of Limits of Knowledge)
    b. The ability to communicate ideas, issues and conclusions clearly.
6. **Awareness of Limits of Knowledge**
    a. Cognizance of the complexity of knowledge and of the potential contributions of other interpretations, methods, and disciplines.
    b. Understand the value of inter-disciplinarity in the field of health technologies.

How does this Program align with the University of Waterloo Strategic Plan and Strategic Mandate Agreement?

The Collaborative Health Technologies Program aligns well with the University of Waterloo's strategic plan in several ways:

1. **Interdisciplinary Collaboration:** The program's collaboration between the departments in Engineering as well as the support by Arts and Health, demonstrate a commitment to

interdisciplinary collaboration, a key focus area of the strategic plan. This collaboration brings together diverse perspectives and expertise, fostering innovation in health technology by integrating engineering skills with insights from health, social sciences, and humanities.

2. **Work-integrated Learning through Co-op:** The mandatory co-op component of the program aligns with the strategic plan's emphasis on experiential learning. This practical work experience allows students to apply their knowledge in real-world settings, contributing to their professional development while addressing real challenges in health technology.
3. **Benefits of Innovation and Research:** The program's focus on Health Technologies aligns with the strategic plan's emphasis on fostering innovation. Even though this is a course-based program, it does enable students to connect with faculty from various departments to engage with cutting-edge technologies and understand solutions to real-world problems.
4. **Community Partnerships:** Collaboration between different departments within Engineering, along with the support, through course offering, by Faculties of Arts and Health, opens opportunities for partnership with external organizations, hospitals, and industry players. This engagement aligns with the strategic plan's focus on strengthening community partnerships. Co-op placements also will play a key role in this aspect.
5. **Technology and Global Challenges:** By addressing healthcare challenges through technology and innovation, the program contributes to addressing global challenges, which is in line with the University's strategic goal of leveraging technology for positive societal impact.
6. **Commitment to Excellence and Diversity:** The collaborative nature of the program reflects the University's commitment to excellence in education and research. Furthermore, by integrating diverse perspectives from multiple departments and faculties, the program contributes to promoting diversity and inclusion, a priority area in the strategic plan.

Overall, the Collaborative Health Technologies Program embodies many key pillars of the University of Waterloo's Strategic Plan by promoting interdisciplinary collaboration, experiential learning, innovation, community engagement, and a commitment to excellence and diversity.

3. Admission Requirements (QAF 2.1.2.5)

Admission into the Collaborative Health Technologies Program is through direct application to the program offered through the home administrative unit, i.e. ECE. Admission requirements for the program will be the same as those existing for the Master of Engineering degree in ECE.

The minimum academic requirements – including admissions requirements, minimum overall averages, and timelines for any milestones – in the program will be consistent with the requirements of the primary existing master's program for each participating department.

In detail, the admission requirements for MEng in the department of Electrical and Computer Engineering are:

- Either (i) a 75% overall standing in the last two years, or equivalent, in a relevant four-year Honours Bachelor's degree or equivalent or (ii) a 75% overall standing or equivalent, in a relevant four-year Honours Bachelor's degree or equivalent, as the minimum requirement for admission to a Master's program for applicants educated at a Canadian institution. A 75% overall standing or equivalent, in a relevant four-year Honours Bachelor's degree or equivalent is the minimum requirement for admission to a Master's program for applicants educated outside of Canada.
- A Supplementary Information Form (SIF), which contains questions specific to the program about why applicants want to enroll and their experience in the field, must be completed.
- Required application materials include, Resume, SIF, Academic Transcript(s); Proof of English language Proficiency (if applicable); and two references with at least one from academic sources

  Minimum English Language Proficiency requirement: TOEFL 80 (writing 22, speaking 20, reading 20, listening 18), or IELTS 6.5 (writing 6.0, speaking 6.0).

These admission requirements are appropriate given the precedent of existing co-op Master's programs in the Faculty of Engineering. The level of required academic performance is indicative of what will be required of students during their studies within this proposed program and serves to select only students who will be capable of meeting course expectations and overall program learning outcomes. Furthermore, the Supplementary Information Form, resume, and reference letters will allow for recognition of the prior work, experience, aspirations, and career trajectory of applicants.

4. Structure (QAF 2.1.2.2)

The Collaborative Health Technologies Program is a co-op only, course-based program. Completion of 9 courses and a compulsory PD course will be required to meet the coursework requirement of the program. Selection of courses will be as follows:

2 courses from the following University-level courses (ARTS, ENG):

- PHIL 626: Bioethics and Technology
- ECON 643: Health Economics
- MSE 619: Healthcare Analytics

1 course from the following Faculty-level courses (5 ENG depts):

- BME 600: Design of Biomedical Technologies
- BME 602: Foundations in Biomechanical Engineering
- CHE 621: Model Building and Response Surface Methodology
- ECE 608: Quantitative Methods in Biomedical Engineering
- MSE 630: Human-Computer Interaction

2 courses from the following Faculty of Health courses:

- HLTH 612: Introduction to Health Information and Data Standards
- HLTH 633: Digital Health
- HLTH 650A / 650B: Application of Artificial Intelligence in Health (0.25) / Machine Learning Techniques in Health (0.25)
- HLTH 606B: Principles of Epidemiology for Public Health
- HLTH 615: Requirements Specifications and Analysis in Health Systems

4 graduate courses from ECE or from the above HLTH courses

Must have a minimum of 4 ECE courses

The program study / co-op sequence is illustrated below. Having co-op during the program both allows students to apply what they have learned in school to their co-op employment, but also the reverse: apply what has been learned during co-op terms to their in-school experiences. This model allows for bidirectional inspiration and gives students an important *context* for what they are learning.

Term-1	Term-2	Term-3	Term-4	Term-5	Term-6
study	study	Co-op	Co-op	study	(study)
study	study	Co-op	study	(study)	

Rationale and Justification

The structure and regulations of the Collaborative Health Technologies Program align with the program learning outcomes and Degree-Level Expectations. More detail is given below.

Alignment with Program Learning Outcomes:

1. **Diversity of Course Offerings:** The coursework structure ensures a breadth of courses from various levels (University, Faculty, Department) covering different aspects of health technologies, such as ethics, analytics, biomedical engineering, rehabilitation engineering, human-computer interaction, health-care systems, epidemiology, systems theory etc. The proposed program is designed in such a way that potential future participation of additional Faculties with their own master's program model is both possible and would further enrich the program content.
2. **Integration of Practical Experience:** The mandatory incorporation of co-op allows students to apply theoretical knowledge gained in the classroom to real-world scenarios, and vice versa. This aligns with the objective of the program to foster practical application and real-world learning.

Meeting Degree Level Expectations:

1. **Depth and Breadth of Knowledge:** The variety of courses spanning different Departments and Faculties suggests a comprehensive coverage of topics relevant to health technologies, meeting the depth and breadth of knowledge expected at the master's level.
2. **Professional Skills Development:** The incorporation of co-op experiences facilitates the development of professional skills, preparing students for practical challenges in the field.

Rationale for Program Length:

The proposed program length is reasonable for several reasons:

1. **Course Load and Requirements:** 9 courses within the program, structured across different units and levels, can be reasonably completed within three to four study terms.
2. **Integration of Co-op Experience:** The inclusion of co-op necessitates a program duration that allows students to engage in these practical experiences without significantly extending the program length.
3. **Balancing Academic and Practical Learning:** The program aims to balance academic learning with real-world application. A structured timeframe enables students to attain both theoretical knowledge and practical skills within a manageable period.

5. Program Content (QAF 2.1.2.3)

Health Technologies represent the dynamic intersection of healthcare and cutting-edge technology, encompassing a diverse array of innovations designed to revolutionize patient care, improve healthcare accessibility, and enhance overall well-being. Embracing a multidisciplinary approach, Health Technologies integrate advancements in artificial intelligence, data analytics, telemedicine, medical imaging, ethics, and more, to drive transformative changes in the diagnosis, treatment, and management of health conditions. The Collaborative Health Technologies Program is a muti-disciplinary course-based program in the Faculty of Engineering with mandatory co-op, integrated within the timeline of the program. Its multi-disciplinarity is derived on the basis of the participation, through course offerings, of the Faculties of Arts and Health. Additionally, the enrolled students will also take appropriate courses across several departments within Engineering. All courses taken are at the graduate level. An overview of the program's course structure was given in Section 4. Here, additional information on the courses is given.

A brief description of the University-level courses, from which a student would be required to take two courses, is given below:

- **PHIL 626: Bioethics and Technology** (Arts)
  Students will grapple with a sample of ethical issues related to advanced and emerging medical technologies and/or biotechnologies. The primary goals of doing so are: (1) To gain familiarity with key ethical concepts and values, which may include patient autonomy, beneficence, justice, care, anti-ableism, inclusion, and others; and (2) to enhance core critical thinking skills needed for ethics, which will help improve each student's self-understanding (of not only what they think is right and wrong, but, more importantly, why) and their capacity to engage with different perspectives on the "whats" and "whys" of ethics in a spirit

of open-mindedness, mutual respect, and constructive cooperation. Frequent in-class discussion is typically an important element of student learning in this course.

- **ECON 643: Health Economics** (Arts)
  This course introduces students to the role of economics in health care and health policy. It is meant to be a survey of major topics in health economics and an introduction to the ongoing debate over health care policy. Topics include the economic determinants of health and health policy, the market for medical care, the market for health insurance, and the role of the government in health care, and health care reform.
- **MSE 619: Healthcare Analytics** (Engineering)
  This course provides an introductory course on health analytics including such topics as data acquisition, modelling, and predictive analytics. The course focuses on the practical application of the concepts to improve the quality of the analyses often found in the health sector. Application areas will be concentrated on topics found in health systems and may include topics such as planning and scheduling, disease diagnosis, and treatment planning. The learning outcomes include the ability to identify and apply appropriate analytical methods and models for healthcare.

A brief description of the Faculty-level courses, from which a student would be required to take one course, is given below:

- **BME 600: Design of Biomedical technologies** (SYDE)
  Systems theory and formulation of system dynamics problems. Design and research methods for biomedical technologies. Problem formulation and definition, stakeholder engagement, needs analysis, generation of alternative solutions, feasibility analysis, optimization, selection, and solution implementation.
- **BME602: Foundations in Biomechanical Engineering** (MME)
  This course focuses on equipping students with foundational knowledge in the biomechanics of human physiology, pathology and treatment. The overarching aim of this course is to develop students' literacy in applying biomechanics principles and modern tools towards understanding the human body. The course will build on existing knowledge in mathematics and physics to develop new expertise and hands-on experience in the biomechanical modeling and analysis of physiological systems.
- **CHE 621: Model Building and Response Surface Methodology** (CHE)
  This course teaches process / product optimization based on design of experiments, empirical modelling, and non-linear mechanistic models. These methodologies aid in refining healthcare processes and products, ensuring they meet stringent standards of efficiency, safety, and effectiveness.
- **ECE 608: Quantitative Methods in Biomedical Engineering** (ECE)
  This course focuses on topics related to the use of quantitative tools in biomedical engineering research studies. Educational emphasis will be placed on developing students' core competence in biostatistics and biomedical computing, so as to prepare them to pursue biomedical engineering investigations that are backed by quantitative reasoning and numerical insights.

- **MSE 630: Human Computer Interaction** (MSE)
  This course concentrates on the theoretical and practical issues related to the design of the human-computer interfaces. Aspects of human perception, cognition and various models of task analysis are discussed.

A brief description of the Faculty of Health courses, from which a student would be required to take two courses, and that are part of the department-specific and health-specific list of electives is given below:

- **HLTH 612: Introduction to Health Information and Data Standards**
  This course focuses on health data as a key component of all health informatics systems. Topics include ontologies and other classification taxonomies found in health systems, data standards (with a focus on Canadian implementations of international standards), privacy and security of health data, client/patient assessment tools, and ethical considerations.
- **HLTH 633: Digital Health**
  The wide adoption of mobile technology presents a new opportunity. Leveraging this existing technology, healthcare systems can deliver remote care and collect real-time data on patients outside of health centres, minimizing unnecessary visits to hospitals and providing healthcare access to remote populations. In this course, we will explore how digital health technology has been designed, evaluated, and deployed in different countries. Case studies will be used to demonstrate how institutional and governmental constraints have a strong impact on the success of the deployment. The course will address the different digital health technologies in the market, such as Telehealth, remote patient monitoring, tele radiology, consumer health informatics, and mHealth. Important aspects of technology development like patient confidentiality, privacy, standards, communication and security protocols, regulatory requirements, among others, will be discussed when presenting the development of each digital health solution. By the end of this course, students will be prepared to design, evaluate, and deploy a digital health intervention and will have a solid understanding of the barriers and requirements for deploying digital health technology.
- **HLTH 650A / 650B: Application of Artificial Intelligence in Health (0.25) / Machine Learning Techniques in Health (0.25)**
  HLTH 650A focuses on the application of machine learning (ML) and artificial intelligence (AI) techniques in the field of healthcare and public health settings. Big data sources available for population health studies will be introduced to students and challenges related to AI in health data will also be discussed. The learning activities consist of lectures, student-led journal club discussions and a term paper to propose the application of ML techniques to solve population health or public health problems.
  HLTH 650B focusses on the techniques of machine learning (ML) commonly used to solve healthcare and public health problems. Various analytics techniques, including data wrangling, visualization, unsurprised and supervised learning, will be introduced to students. Challenges and strategies related to missing data, imbalanced data and model selections will also be discussed. The learning activities consist of lectures, labs, and a final project to demonstrate the proficiency of ML techniques to solve population health or public health problems.

- **HLTH 606B: Principles of Epidemiology for Public Health**
  This course introduces the principles, methods, and uses of epidemiology in the practice of public health. After completion of this course, students will be able to critically read and interpret epidemiologic research and clearly communicate epidemiologic findings. They will be familiar with health status measurement, data sources, screening, surveillance, outbreak investigation, and methods to support program planning and evaluation. Students will have a sound understanding of basic epidemiologic concepts, including prevalence, incidence, study designs, measures of association, bias, confounding and causal inference.
- **HLTH 615: Requirements Specifications and Analysis in Health Systems**
  This course introduces students to the requirements of definition phase of software development. Models, notations, and processes for software requirements identification, representation, validation, and analysis are discussed, as are mechanisms to evaluate the efficacy and efficiency of health information systems.

6. Mode of Delivery (QAF 2.1.2.2)

Courses made available for students of the Collaborative Health Technologies Program use a wide variety of teaching and learning methodologies (e.g., lectures, case-studies, student presentations, in-class group discussion, etc.) designed to provide students with an engaging learning experience. Though not specific to this program, at the University of Waterloo, instructors from all faculties are encouraged to make use of the Center for Teaching Excellence, which offers many resources to aid instructors in improving their teaching, course design, and delivery, emphasising *Active Learning* techniques. Instructors of courses offered to Collaborative Health Technologies Program students will be reminded of these resources.

Following program approval and implementation, the faculty-level administrative staff will ensure the program is continually meeting both intended learning outcomes and degree-level expectations.

7. Assessment of Teaching and Learning (QAF 2.1.2.4)

The performance of students will be assessed both on conventional and existing methods stipulated by the courses they will take, but also based on input from the co-operative education component of this program. Assessment of teaching and learning will be conducted at the *student* and *program* levels. The program will be assessed at the program level by the Graduate Program Committee and program director. As part of this assessment, the Program Committee will review statistics, such as program performance versus learning objectives, student success rates and teaching evaluations – as provided through both student perception surveys and peer-assessment of teaching. The committee will identify opportunities to improve performance, such as enriching course content or teaching.

Performance indicators that will be considered by the Program Committee will include:

- Applications to and enrollment within the program;
- Student evaluations of courses;
- Student graduation rates;

- Surveys of alumni; and
- Surveys of employers/industry partners.

At the student level, there will be the following types of activities with assessments:

a) Coursework: Students will be assigned a grade based on typical assessment methods used in other graduate courses, such as papers, reports, tests, projects, and presentations.
b) Co-operative Education Work-Term Reports.

Refer to the table in Appendix A for more specific information on how assessments will be made, both for course-based and co-operative education components of this program.

8. Resources for All Programs (QAF 2.1.2.6)

For the anticipated enrolment numbers of the Collaborative Health Technologies Program, the additional students enrolling into pre-existing courses will not present a significant burden on the University's resources (i.e., students take courses from large pools and therefore, there will likely not be so many additional students per course that additional sections and having more instructors would be necessary – in fact, in some cases, the additional grad students enrolling may help improve the instructor utilization efficiency for courses that typically have too low of enrollment numbers). The program would not necessitate hiring any new faculty members and instead would rely on existing known-to-be qualified faculty members already teaching courses. In addition, students will have access to the University's facilities and spaces, including library resources, working spaces, access to existing resources for student well-being and counselling, as well as technology support from their home department. This program is not expected to impose additional student costs for use of resources. Program coordination can be handled by existing staff resources in the home departments with the Faculty of Engineering providing additional support as needed, as is the case for other existing collaborative programs.

9. Resources for Graduate Programs (QAF 2.1.2.7)

Given the course-based nature of the Collaborative Health Technologies Program, an assessment of the research-related and supervisory expertise of faculty is not required for this program to function. The breadth of courses available for students to take is immense and course instructors may change from term-to-term. Therefore, nearly *all* faculty from the participating units may serve this program through the teaching of courses in which Health Technology students may enroll. On a course-by-course /offering-to-offering basis, ensuring instructor competence is left to the discretion of the corresponding department. Following the precedent of existing professional master's programs in Engineering, no financial assistance will be provided to students. Ensuring the quality of incoming students, will be left to the discretion of the home departments and will be put into action through the standard program admission requirements, as are described in Section 3.

10. Quality and Other Indicators (QAF 2.1.2.8)

To ensure the quality of the program a Program Committee will be created to oversee and regularly evaluate the program, to ensure all program requirements and course related graduate-level degree requirements are met. This committee will consist of a Program Director, the Course Coordinator, a faculty member from each participating department, and a graduate student representative. Furthermore, the co-op office will principally oversee all co-op related activities and components of this program. Within each department of Engineering, Graduate Associate Chairs will monitor the progress of their constituent students from this program, as is already their responsibility for existing professional programs. Specifically, student progression through the program, grades, and successful completion of co-op terms will be tracked. Where needed, remedial action will be taken to ensure students remain on-track and able to maximally benefit from participation in this program.

Appendix A - Summary of Learning Outcomes Mapped to Courses and Assessment Methods

Specific GDLEs and Associated Learning Outcomes	Courses									Co-operative Education			Assessment method							
	University-level ARTS | ENG			Faculty-level SYDE | MME | CHE | ECE | MSE					Dept-level ECE | HEALTH										
	PHIL 626: Bioethics & Technology	ECON 643: Health Economics	MSE 619: Healthcare Analytics	BME 600: Design of Biomedical Technologies	BME 602: Foundations in Biomechanical Engineering	CHE 621: Model Building and Response Surface Methodology	ECE 608: Quantitative Methods in Biomedical Engineering	MSE 630: Human-Computer Interaction	Health-specific electives and Dept-specific courses	Employer Input	Co-op Office Evaluation	Work Term Report	Forum communication	Multi-part assignments	Quizzes / Tests	Written assignments / arguments / policy briefs	Data interpretation, synthesis, visualization	Technical reports / plans	Slide decks / presentations	Video production
1. Depth and Breadth of Knowledge																				
Understand the principles, concepts, terminology, tools of health technology	A	A	A	C	A	A	A	A	AC	NA	NA	A	NA	A	A	A	A	A	A	NA
Demonstrate awareness of key elements of both the ethical considerations and impacts of health technologies	A	A	A	NA	C	NA	NA	C	AC	A	NA	A	NA	A	A	A	A	A	A	NA
Interpret, understand, and critically assess state-of-the-art methods, theories, and advances in health technology	C	C	A	NA	A	C	A	A	AC	NA	NA	C	NA	A	A	A	A	A	A	NA
2. Research & Scholarship																				
Integrate complex engineering concepts related to the breadth of health technology, and the underlying and associated sciences.	NA	NA	A	C	A	A	A	A	AC	C	NA	C	NA	A	A	A	A	A	A	NA

Specific GDLEs and Associated Learning Outcomes	Courses									Co-operative Education			Assessment method							
	University-level ARTS | ENG			Faculty-level SYDE | MME | CHE | ECE | MSE					Dept-level ECE | HEALTH										
	PHIL 626: Bioethics & Technology	ECON 643: Health Economics	MSE 619: Healthcare Analytics	BME 600: Design of Biomedical Technologies	BME 602: Foundations in Biomechanical Engineering	CHE 621: Model Building and Response Surface Methodology	ECE 608: Quantitative Methods in Biomedical Engineering	MSE 630: Human-Computer Interaction	Health-specific electives and Dept-specific courses	Employer Input	Co-op Office Evaluation	Work Term Report	Forum communication	Multi-part assignments	Quizzes / Tests	Written assignments / arguments / policy briefs	Data interpretation, synthesis, visualization	Technical reports / plans	Slide decks / presentations	Video production
3. Level of Application of Knowledge																				
Interpret, critically assess and apply state-of-the-art methods, theories, and advances in health technology	A	A	A	C	A	A	A	A	AC	NA	NA	A	NA	A	A	A	A	A	A	NA
Understand current issues faced by the health technology industry	A	A	C	C	A	NA	C	A	AC	A	C	A	NA	A	A	A	A	A	A	NA
4. Professional Capacity / Autonomy																				
Independently recognize, define, and solve complex real-world health technology needs and associated challenges	A	A	NA	C	C	C	C	C	AC	A	A	A	NA	AC	AC	AC	AC	C	AC	NA
Engage in self-directed professional development and life-long learning	NA	NA	NA	NA	NA	NA	NA	NA	NA	C	C	A	NA	NA	NA	NA	NA	A	NA	NA
Develop an ability to recognize, appreciate, consider and apply appropriate ethics, law, regulations, and accountability to the field of health technologies	A	A	C	C	C	NA	C	C	AC	A	C	A	NA	A	A	A	A	A	A	NA

Specific GDLEs and Associated Learning Outcomes	Courses									Co-operative Education			Assessment method							
	University-level ARTS | ENG			Faculty-level SYDE | MME | CHE | ECE | MSE					Dept-level ECE | HEALTH										
	PHIL 626: Bioethics & Technology	ECON 643: Health Economics	MSE 619: Healthcare Analytics	BME 600: Design of Biomedical Technologies	BME 602: Foundations in Biomechanical Engineering	CHE 621: Model Building and Response Surface Methodology	ECE 608: Quantitative Methods in Biomedical Engineering	MSE 630: Human-Computer Interaction	Health-specific electives and Dept-specific courses	Employer Input	Co-op Office Evaluation	Work Term Report	Forum communication	Multi-part assignments	Quizzes / Tests	Written assignments / arguments / policy briefs	Data interpretation, synthesis, visualization	Technical reports / plans	Slide decks / presentations	Video production
Understand the value of engaging in inter-disciplinary collaboration in health technology as well as the complexity of knowledge & limitations of different fields	C	C	C	C	NA	NA	NA	NA	AC	NA	NA	A	NA	NA	NA	C	NA	A	C	NA
Adopt a mindset for collaboration (work effectively in interdisciplinary teams including healthcare professionals, engineers, designers, business developers, etc.)	NA	NA	NA	NA	NA	NA	NA	NA	NA	A	A	C	NA	NA	NA	NA	NA	C	NA	NA
5. Level of Communications Skills																				
Effectively communicate complex concepts in health technology to a wide audience ranging from general public to experts in the field. Concepts may include health technology needs and associated challenges (includes GDLE 6 Awareness of Limits of Knowledge)	C	C	C	NA	NA	NA	NA	NA	NA	C	C	C	NA	NA	NA	NA	NA	C	C	NA
The ability to communicate ideas, issues and conclusions clearly.	C	C	NA	NA	NA	NA	NA	NA	NA	C	C	A	NA	NA	NA	NA	NA	A	C	NA

Specific GDLEs and Associated Learning Outcomes	Courses									Co-operative Education			Assessment method							
	University-level ARTS | ENG			Faculty-level SYDE | MME | CHE | ECE | MSE					Dept-level ECE | HEALTH										
	PHIL 626: Bioethics & Technology	ECON 643: Health Economics	MSE 619: Healthcare Analytics	BME 600: Design of Biomedical Technologies	BME 602: Foundations in Biomechanical Engineering	CHE 621: Model Building and Response Surface Methodology	ECE 608: Quantitative Methods in Biomedical Engineering	MSE 630: Human-Computer Interaction	Health-specific electives and Dept-specific courses	Employer Input	Co-op Office Evaluation	Work Term Report	Forum communication	Multi-part assignments	Quizzes / Tests	Written assignments / arguments / policy briefs	Data interpretation, synthesis, visualization	Technical reports / plans	Slide decks / presentations	Video production
6. Awareness of Limits of Knowledge																				
Cognizance of the complexity of knowledge and of the potential contributions of other interpretations, methods, and disciplines.	A	A	C	C	C	C	C	C	AC	A	A	A	NA	C	NA	NA	NA	A	A	NA
Understand the value of inter-disciplinarity in the field of health technology.	C	C	C	C	C	C	C	C	AC	C	C	C	NA	C	NA	C	NA	C	C	NA

Table Legend:

Assessed (A) ..... The outcome is addressed and is formally assessed.
Covered (C) ..... The outcome is addressed but not assessed.
Assessed or Covered (AC)..... The outcome may be addressed and assessed but is at least covered (depending on selected courses).
Not addressed (NA) ..... The outcome is not addressed.

Graduate Studies
Program Revision Template

Prior to form submission, review the content revision instructions and information regarding major/minor modifications. For questions about the form submission, contact Trevor Clews, Graduate Studies and Postdoctoral Affairs (GSPA).

Faculty: Engineering

Program: Master of Engineering (MEng) in Electrical and Computer Engineering – Health Technologies – Co-operative Program

Program contact name(s): Christopher Nielsen, Siva Sivoththaman, Jessica Rossi

Form completed by:

Description of proposed changes:
Note: changes to courses and milestones also require the completion/submission of the SGRC Graduate Studies Course/Milestone Form.

The Department of Electrical and Computer Engineering is joining the Collaborative Health Technologies Program and is thus adding a Master of Engineering (MEng) in Electrical and Computer Engineering - Health Technologies - Co-operative Program (direct entry).

Is this a major modification to the program? Yes

Rationale for change(s):

Please refer to the attached brief for full details.

Proposed effective date: Term: Fall Year: 2025

Current Graduate Studies Academic Calendar (GSAC) page (include the link to the web page where the changes are to be made):

https://uwaterloo.ca/academic-calendar/graduate-studies/catalog#/programs?group=Electrical%20and%20Computer%20Engineering

Current primary program in the home unit: MEng in Electrical and Computer Engineering - Co-operative Program Graduate Studies Academic Calendar content:	**Proposed MEng in Electrical and Computer Engineering - Health Technologies - Co-operative Program Graduate Studies Academic Calendar content**:
Master of Engineering (MEng) in Electrical and Computer Engineering - Co-operative Program (direct entry) **Admit term(s)** • Fall • Winter • Spring **Delivery mode**	**Master of Engineering (MEng) in Electrical and Computer Engineering - Health Technologies - Co-operative Program (direct entry)** **Admit term(s)** • Fall • Winter • Spring **Delivery mode**

Current primary program in the home unit: MEng in Electrical and Computer Engineering - Co-operative Program Graduate Studies Academic Calendar content:	Proposed MEng in Electrical and Computer Engineering - Health Technologies - Co-operative Program Graduate Studies Academic Calendar content:
• On-campus **Registration option(s)** • Full-time **Program type(s)** • Co-operative **Study option(s)** • Coursework **Length of program** • Full-time: 5-6 terms (20-24 months) **Graduate specializations** • Artificial Intelligence and Machine Learning • Biomedical Engineering • Business Leadership • Computer Networking and Security • Nanoelectronic Circuits and Systems • Nanoelectronic Devices and Materials • Software • Sustainable Energy **Admission requirements: Minimum requirements** • The Department of Electrical and Computer Engineering requires either (i) a 75% overall standing in the last two years, or equivalent, in a relevant four-year Honours Bachelor's degree or equivalent or (ii) a 75% overall standing or equivalent, in a relevant four-year Honours Bachelor's degree or equivalent, as the minimum requirement for admission to a Master's program for applicants educated at a Canadian institution. A 75% overall standing or equivalent, in a relevant four-year Honours Bachelor's degree or equivalent is the minimum requirement for admission to a Master's program for applicants educated outside of Canada. • English language proficiency (ELP) (if applicable) **Admission requirements: Application materials** • Résumé • Supplementary information form • Transcript(s) **Admission requirements: References** • Number of references: 2 • Type of references: at least 1 academic	• On-campus **Registration option(s)** • Full-time **Program type(s)** • Co-operative • Collaborative **Study option(s)** • Coursework **Length of program** • Full-time: 5-6 terms (20-24 months) ~~**Graduate specializations**~~ ~~• Artificial Intelligence and Machine Learning~~ ~~• Biomedical Engineering~~ ~~• Business Leadership~~ ~~• Computer Networking and Security~~ ~~• Nanoelectronic Circuits and Systems~~ ~~• Nanoelectronic Devices and Materials~~ ~~• Software~~ ~~• Sustainable Energy~~ **Admission requirements: Minimum requirements** • The Department of Electrical and Computer Engineering requires either (i) a 75% overall standing in the last two years, or equivalent, in a relevant four-year Honours Bachelor's degree or equivalent or (ii) a 75% overall standing or equivalent, in a relevant four-year Honours Bachelor's degree or equivalent, as the minimum requirement for admission to a Master's program for applicants educated at a Canadian institution. A 75% overall standing or equivalent, in a relevant four-year Honours Bachelor's degree or equivalent is the minimum requirement for admission to a Master's program for applicants educated outside of Canada. • English language proficiency (ELP) (if applicable) **Admission requirements: Application materials** • Résumé • Supplementary information form • Transcript(s) **Admission requirements: References** • Number of references: 2

Current primary program in the home unit: MEng in Electrical and Computer Engineering - Co-operative Program Graduate Studies Academic Calendar content:	**Proposed MEng in Electrical and Computer Engineering - Health Technologies - Co-operative Program Graduate Studies Academic Calendar content**:

Degree requirements
• Students must complete the course and milestone requirements listed below in addition to the Graduate Academic Integrity Module (Graduate AIM).
• The MEng in Electrical and Computer Engineering - Co-operative Program will enable students to combine graduate studies with work experience. The program will foster professional development, networking and new collaborations while enhancing employment opportunities after degree completion.
• The program will include 1 or 2 work terms. The timing of work and academic terms is fairly flexible, but the program must start and end on an academic term. Students in the program are encouraged to complete WIL 601 Career Foundations for Work-Integrated Learning in the academic term prior to the first work term.
 	
Coursework option: Course requirements
• Students must successfully complete 8 one-term courses (0.50 unit weight) acceptable for credit by the Department.
• Students may register for any ECE course at the 600 or 700 levels.
• A minimum of 5 courses must be taken from within the ECE Department. A maximum of 3 courses may be taken from outside the Department but must be from the faculties of Engineering, Mathematics and Science. Students opting for the Graduate Specialization in Business Leadership are allowed to take a maximum of 4 courses from outside ECE, but from the specified list of BE/BET courses, detailed below.
• A minimum grade of 65% in each of the 8 courses and a minimum cumulative average of 70% are required to remain in the program. Students who receive a grade of less than 65% may be permitted to take a maximum of 2 additional courses to meet the minimum averages for the degree requirements (outlined above).
• Students wishing to complete a Graduate Specialization as part of their MEng program should consult the list of required courses for each Graduate Specialization before selecting courses, as the number of minimum required courses may differ.
• Students in the MEng in Electrical and Computer Engineering - Co-operative Program
	• Type of references: at least 1 academic
	
	Degree requirements
	• Students must complete the course and milestone requirements listed below in addition to the Graduate Academic Integrity Module (Graduate AIM).
	• The MEng in Electrical and Computer Engineering - Health Technologies - Co-operative Program will enable students to combine graduate studies with work experience. The program will foster professional development, networking and new collaborations while enhancing employment opportunities after degree completion.
	• The program will include 1 or 2 work terms. The timing of work and academic terms is fairly flexible, but the program must start and end on an academic term. Students in the program are encouraged to complete WIL 601 Career Foundations for Work-Integrated Learning in the academic term prior to the first work term.
	
	Coursework option: Course requirements
	• Students must successfully complete the following 9 ~~8~~ one-term courses (0.50 unit weight) acceptable for credit by the Department.
	  ○ 2 of the following Health Technologies core courses:
	  ▪ ECON 643 Health Economics
	  ▪ MSE 619 Healthcare Analytics
	  ▪ PHIL 626 Bioethics and Technology
	  ○ 1 of the following Faculty of Engineering Health Technologies elective courses:
	  ▪ BME 600 Design of Biomedical Technologies
	  ▪ BME 602 Foundations in Biomechanical Engineering
	  ▪ CHE 621 Model Building and Response Surface Methodology
	  ▪ ECE 608 Quantitative Methods in Biomedical Engineering
	  ▪ MSE 630 Human-Computer Interaction
	  ○ 2 of the following Health Technologies elective courses:
	  ▪ HLTH 606B Principles of Epidemiology for Public Health

Current primary program in the home unit: MEng in Electrical and Computer Engineering - Co-operative Program Graduate Studies Academic Calendar content:	**Proposed MEng in Electrical and Computer Engineering - Health Technologies - Co-operative Program Graduate Studies Academic Calendar content**:
may choose to pursue one of the following Graduate Specializations: 1. Artificial Intelligence and Machine Learning 2. Biomedical Engineering 3. Business Leadership 4. Computer Networking and Security 5. Nanoelectronic Circuits and Systems 6. Nanoelectronic Devices and Materials 7. Software 8. Sustainable Energy • A Graduate Specialization is a University credential that is recognized on the student's transcript but not on the diploma and is intended to reflect that a student has successfully completed a set of courses that together provide an in-depth study in the area of the Graduate Specialization. A student will only obtain the Graduate Specialization on their transcript if they have completed the requirements associated with the MEng degree and the requirements associated with the Graduate Specialization. • All MEng Graduate Specializations in Electrical and Computer Engineering consist of a set of at least 4 graduate (0.50 weight) level courses and this set is comprised of a mix of compulsory and elective courses. Compulsory courses are those that are prescribed as part of the Graduate Specialization. Elective courses are those that are on a list of courses designated as electives for a given Graduate Specialization. The requirements for each of the Graduate Specializations are described below. • Note: Not all elective courses for any given Graduate Specialization are guaranteed to be offered each year. Students are encouraged to take elective courses when they are offered and should plan accordingly. • Students will be able to complete the Business Leadership Graduate Specialization along with 1 other ECE Graduate Specialization, noting the following: o Each course will only be counted towards one Graduate Specialization and the MEng degree. o The number of required courses for the MEng degree will increase from 8 to 9 or 10 depending on the requirements associated with the Graduate Specializations. • Students must consult with the ECE Masters Coordinator to finalize their plan of study and	▪ HLTH 612 Introduction to Health Information and Data Standards ▪ HLTH 615 Requirements Specifications and Analysis in Health Systems ▪ HLTH 633 Digital Health ▪ HLTH 650A Application of Artificial Intelligence in Health (0.25) and 650B Machine Learning Techniques in Health (0.25) o 4 ECE graduate level courses or HLTH courses from the list above • Students may register for any ECE course at the 600 or 700 levels. • A minimum of ~~5~~ 4 courses must be taken from within the ECE Department. ~~A maximum of 3 courses may be taken from outside the Department but must be from the faculties of Engineering, Mathematics and Science. Students opting for the Graduate Specialization in Business Leadership are allowed to take a maximum of 4 courses from outside ECE, but from the specified list of BE/BET courses, detailed below.~~ • A minimum grade of 65% in each of the ~~8~~ 9 courses and a minimum cumulative average of 70% are required to remain in the program. Students who receive a grade of less than 65% may be permitted to take a maximum of 2 additional courses to meet the minimum averages for the degree requirements (outlined above). ~~• Students wishing to complete a Graduate Specialization as part of their MEng program should consult the list of required courses for each Graduate Specialization before selecting courses, as the number of minimum required courses may differ.~~ ~~• Students in the MEng in Electrical and Computer Engineering - Co-operative Program may choose to pursue one of the following Graduate Specializations:~~ ~~1. Artificial Intelligence and Machine Learning~~ ~~2. Biomedical Engineering~~ ~~3. Business Leadership~~ ~~4. Computer Networking and Security~~ ~~5. Nanoelectronic Circuits and Systems~~ ~~6. Nanoelectronic Devices and Materials~~ ~~7. Software~~ ~~8. Sustainable Energy~~

Current primary program in the home unit: MEng in Electrical and Computer Engineering - Co-operative Program Graduate Studies Academic Calendar content:	**Proposed MEng in Electrical and Computer Engineering - Health Technologies - Co-operative Program Graduate Studies Academic Calendar content**:
to ensure that they are able to meet the degree and Graduate Specialization requirements within the program time limits. 1. Graduate Specialization in Artificial Intelligence and Machine Learning • To receive the Graduate Specialization in Artificial Intelligence and Machine Learning, students must successfully complete 2 compulsory courses and 3 elective courses: o Compulsory courses: ▪ ECE 657 Tools of Intelligent Systems Design ▪ ECE 657A Data and Knowledge Modelling and Analysis o Elective courses (choose 3 from the following list): ▪ ECE 602 Introduction to Optimization ▪ ECE 603 Statistical Signal Processing ▪ ECE 606 Algorithm Design and Analysis ▪ ECE 607 Fundamentals of Ultrasonics ▪ ECE 613 Image Processing and Visual Communication ▪ ECE 659 Intelligent Sensors and Sensor Networks ▪ ECE 700 Topic-7 Game Theory with Engineering Applications ▪ ECE 750 Topic-32 Biology and Computation ▪ ECE 750 Topic-33 Embodied Intelligence ▪ ECE 750 Topic-35 Social Robotics ▪ MSE 718 Statistical Methods for Data Analytics 2. Graduate Specialization in Biomedical Engineering • To receive the Graduate Specialization in Biomedical Engineering, students must successfully complete 3 compulsory courses and 2 elective courses: o Compulsory courses: ▪ ECE 601 Foundations of Biology in Engineering ▪ ECE 608 Quantitative Methods in Biomedical Engineering ▪ ECE 609 Engineering Analysis of Living Cells o Elective courses (choose 2 from the following list):	~~• A Graduate Specialization is a University credential that is recognized on the student's transcript but not on the diploma and is intended to reflect that a student has successfully completed a set of courses that together provide an in-depth study in the area of the Graduate Specialization. A student will only obtain the Graduate Specialization on their transcript if they have completed the requirements associated with the MEng degree and the requirements associated with the Graduate Specialization.~~ ~~• All MEng Graduate Specializations in Electrical and Computer Engineering consist of a set of at least 4 graduate (0.50 weight) level courses and this set is comprised of a mix of compulsory and elective courses. Compulsory courses are those that are prescribed as part of the Graduate Specialization. Elective courses are those that are on a list of courses designated as electives for a given Graduate Specialization. The requirements for each of the Graduate Specializations are described below.~~ ~~• Note: Not all elective courses for any given Graduate Specialization are guaranteed to be offered each year. Students are encouraged to take elective courses when they are offered and should plan accordingly.~~ ~~• Students will be able to complete the Business Leadership Graduate Specialization along with 1 other ECE Graduate Specialization, noting the following:~~ ~~o Each course will only be counted towards one Graduate Specialization and the MEng degree.~~ ~~o The number of required courses for the MEng degree will increase from 8 to 9 or 10 depending on the requirements associated with the Graduate Specializations.~~ ~~• Students must consult with the ECE Masters Coordinator to finalize their plan of study and to ensure that they are able to meet the degree and Graduate Specialization requirements within the program time limits.~~ ~~1. Graduate Specialization in Artificial Intelligence and Machine Learning~~ ~~• To receive the Graduate Specialization in Artificial Intelligence and Machine Learning, students must successfully complete 2 compulsory courses and 3 elective courses:~~

Current primary program in the home unit: MEng in Electrical and Computer Engineering - Co-operative Program Graduate Studies Academic Calendar content:	**Proposed MEng in Electrical and Computer Engineering - Health Technologies - Co-operative Program Graduate Studies Academic Calendar content**:
▪ ECE 607 Fundamentals of Ultrasonics ▪ ECE 613 Image Processing and Visual Communications ▪ ECE 675 Radiation and Propagation of Electromagnetic Fields ▪ ECE 750 Topic-32 Biology and Computation ▪ ECE 750 Topic-33 Embodied Intelligence ▪ SYDE 677 Medical Imaging 3. Graduate Specialization in Business Leadership • To receive the Graduate Specialization in Business Leadership, students must successfully complete 2 compulsory courses and 2 elective courses: o Compulsory courses: ▪ BE 600 Management and Leadership ▪ BE 601 Introduction to Financial and Managerial Accounting o Elective courses (choose 2 from the following list): Note: not all elective courses may be offered each year. ▪ BE 602 Data Analysis and Management ▪ BE 603 Operations and Supply Chain Management ▪ BE 604 Marketing Management ▪ BE 605 Project Management ▪ BE 606 Entrepreneurship and Innovation ▪ BE 610 Special Topics in Business and Entrepreneurship ▪ BE 660 Negotiations ▪ BE 680 Consulting ▪ ECE 657A Data & Knowledge Modelling & Analysis ▪ ECE 699 Master of Engineering Project o Note: A maximum of 4 courses from outside the Department of ECE is permitted to satisfy both the MEng in ECE and Graduate Specialization in Business Leadership requirements. 4. Graduate Specialization in Computer Networking and Security • To receive the Graduate Specialization in Computer Networking and Security, students must successfully complete 3 compulsory courses and 2 elective courses: o Compulsory courses:	~~o Compulsory courses:~~ ~~▪ ECE 657 Tools of Intelligent Systems Design~~ ~~▪ ECE 657A Data and Knowledge Modelling and Analysis~~ ~~o Elective courses (choose 3 from the following list):~~ ~~▪ ECE 602 Introduction to Optimization~~ ~~▪ ECE 603 Statistical Signal Processing~~ ~~▪ ECE 606 Algorithm Design and Analysis~~ ~~▪ ECE 607 Fundamentals of Ultrasonics~~ ~~▪ ECE 613 Image Processing and Visual Communication~~ ~~▪ ECE 659 Intelligent Sensors and Sensor Networks~~ ~~▪ ECE 700 Topic-7 Game Theory with Engineering Applications~~ ~~▪ ECE 750 Topic-32 Biology and Computation~~ ~~▪ ECE 750 Topic-33 Embodied Intelligence~~ ~~▪ ECE 750 Topic-35 Social Robotics~~ ~~▪ MSE 718 Statistical Methods for Data Analytics~~ ~~2. Graduate Specialization in Biomedical Engineering~~ ~~• To receive the Graduate Specialization in Biomedical Engineering, students must successfully complete 3 compulsory courses and 2 elective courses:~~ ~~o Compulsory courses:~~ ~~▪ ECE 601 Foundations of Biology in Engineering~~ ~~▪ ECE 608 Quantitative Methods in Biomedical Engineering~~ ~~▪ ECE 609 Engineering Analysis of Living Cells~~ ~~o Elective courses (choose 2 from the following list):~~ ~~▪ ECE 607 Fundamentals of Ultrasonics~~ ~~▪ ECE 613 Image Processing and Visual Communications~~ ~~▪ ECE 675 Radiation and Propagation of Electromagnetic Fields~~ ~~▪ ECE 750 Topic-32 Biology and Computation~~

Current primary program in the home unit: MEng in Electrical and Computer Engineering - Co-operative Program Graduate Studies Academic Calendar content:	Proposed MEng in Electrical and Computer Engineering - Health Technologies - Co-operative Program Graduate Studies Academic Calendar content:
▪ ECE 610 Broadband Communication Networks ▪ ECE 628 Computer Network Security ▪ ECE 655 Protocols, Software, and Issues in Mobile Systems ○ Elective courses (choose 2 from the following list): ▪ ECE 606 Algorithm Design and Analysis ▪ ECE 611 Digital Communications ▪ ECE 612 Information Theory ▪ ECE 656 Database Systems ▪ ECE 657 Tools of Intelligent Systems Design ▪ ECE 659 Intelligent Sensors & Wireless Sensor Network ▪ ECE 715 Wireless Communication Networks ▪ ECE 716 Communication Security 5. Graduate Specialization in Nanoelectronic Circuits and Systems • To receive the Graduate Specialization in Nanoelectronic Circuits and Systems, students must successfully complete 2 compulsory project courses, and 5 elective courses: • Note: Students are required to complete the 5 elective courses prior to enrolling in the ECE 699A project course. • The Graduate Specialization in Nanoelectronic Circuits and Systems is primarily designed for students starting in the Fall term. Therefore, if a student starts in the Spring or Winter term the Graduate Specialization may not be guaranteed, due to the sequencing of elective courses. ○ Compulsory courses: ▪ ECE 699A Master of Engineering Project 1 ▪ ECE 699B Master of Engineering Project 2 ○ Elective courses: Choose 5 total between Set-A and Set-B. A minimum of 2 of the 5 electives must be taken from Set-A. ▪ Set-A: ▪ ECE 621 Computer Organization ▪ ECE 627 Register-transfer-level Digital Systems	▪ ~~ECE 750 Topic-33 Embodied Intelligence~~ ▪ ~~SYDE 677 Medical Imaging~~ ~~3. Graduate Specialization in Business Leadership~~ • ~~To receive the Graduate Specialization in Business Leadership, students must successfully complete 2 compulsory courses and 2 elective courses:~~ ○ ~~Compulsory courses:~~ ▪ ~~BE 600 Management and Leadership~~ ▪ ~~BE 601 Introduction to Financial and Managerial Accounting~~ ○ ~~Elective courses (choose 2 from the following list): Note: not all elective courses may be offered each year.~~ ▪ ~~BE 602 Data Analysis and Management~~ ▪ ~~BE 603 Operations and Supply Chain Management~~ ▪ ~~BE 604 Marketing Management~~ ▪ ~~BE 605 Project Management~~ ▪ ~~BE 606 Entrepreneurship and Innovation~~ ▪ ~~BE 610 Special Topics in Business and Entrepreneurship~~ ▪ ~~BE 660 Negotiations~~ ▪ ~~BE 680 Consulting~~ ▪ ~~ECE 657A Data & Knowledge Modelling & Analysis~~ ▪ ~~ECE 699 Master of Engineering Project~~ ○ ~~Note: A maximum of 4 courses from outside the Department of ECE is permitted to satisfy both the MEng in ECE and Graduate Specialization in Business Leadership requirements.~~ ~~4. Graduate Specialization in Computer Networking and Security~~ • ~~To receive the Graduate Specialization in Computer Networking and Security, students must successfully complete 3 compulsory courses and 2 elective courses:~~ ○ ~~Compulsory courses:~~ ▪ ~~ECE 610 Broadband Communication Networks~~ ▪ ~~ECE 628 Computer Network Security~~ ▪ ~~ECE 655 Protocols, Software, and Issues in Mobile Systems~~ ○ ~~Elective courses (choose 2 from the following list):~~

Current primary program in the home unit: MEng in Electrical and Computer Engineering - Co-operative Program Graduate Studies Academic Calendar content:	**Proposed MEng in Electrical and Computer Engineering - Health Technologies - Co-operative Program Graduate Studies Academic Calendar content**:
▪ ECE 630 Physics & Models Semiconductor Devices ▪ ECE 631 Microelectronic Processing Technology ▪ ECE 636 Advanced Analog Integrated Circuits ▪ ECE 637 Digital Integrated Circuits ▪ ECE 642 Radio Frequency IC Design ▪ ECE 671 Microwave & RF Engineering ▪ Set-B: ▪ ECE 606 Algorithm Design and Analysis ▪ ECE 638 CMOS Sensor Integrated Circuits ▪ ECE 730 Topic-9 VLSI Quality, Reliability and Yield Engineering ▪ ECE 730 Topic-16 Embedded Semiconductor RAM ▪ ECE 730 Topic-30 Advanced VLSI Devices ▪ ECE 738 VLSI Circuits for Wireless Communication ▪ ECE 740 Topic-3 CMOS Data Converters ▪ ECE 770 Topic-22 Radio and Wireless Systems 6. Graduate Specialization in Nanoelectronic Devices and Materials • To receive the Graduate Specialization in Nanoelectronic Devices and Materials, students must successfully complete 2 compulsory courses and 3 elective courses: ○ Compulsory courses: ▪ ECE 630 Physics and Models of Semiconductor Devices ▪ ECE 631 Microelectronic Processing Technology ○ Elective courses (choose 3 from the following list): ▪ ECE 632 Photovoltaic Energy Conversion ▪ ECE 633 Nanoelectronics ▪ ECE 634 Organic Electronics	~~▪ ECE 606 Algorithm Design and Analysis~~ ~~▪ ECE 611 Digital Communications~~ ~~▪ ECE 612 Information Theory~~ ~~▪ ECE 656 Database Systems~~ ~~▪ ECE 657 Tools of Intelligent Systems Design~~ ~~▪ ECE 659 Intelligent Sensors & Wireless Sensor Network~~ ~~▪ ECE 715 Wireless Communication Networks~~ ~~▪ ECE 716 Communication Security~~ ~~5. Graduate Specialization in Nanoelectronic Circuits and Systems~~ ~~• To receive the Graduate Specialization in Nanoelectronic Circuits and Systems, students must successfully complete 2 compulsory project courses, and 5 elective courses:~~ ~~• Note: Students are required to complete the 5 elective courses prior to enrolling in the ECE 699A project course.~~ ~~• The Graduate Specialization in Nanoelectronic Circuits and Systems is primarily designed for students starting in the Fall term. Therefore, if a student starts in the Spring or Winter term the Graduate Specialization may not be guaranteed, due to the sequencing of elective courses.~~ ~~○ Compulsory courses:~~ ~~▪ ECE 699A Master of Engineering Project 1~~ ~~▪ ECE 699B Master of Engineering Project 2~~ ~~○ Elective courses: Choose 5 total between Set-A and Set-B. A minimum of 2 of the 5 electives must be taken from Set-A.~~ ~~▪ Set-A:~~ ~~• ECE 621 Computer Organization~~ ~~• ECE 627 Register-transfer-level Digital Systems~~ ~~• ECE 630 Physics & Models Semiconductor Devices~~ ~~• ECE 631 Microelectronic Processing Technology~~

Current primary program in the home unit: MEng in Electrical and Computer Engineering - Co-operative Program Graduate Studies Academic Calendar content:	**Proposed MEng in Electrical and Computer Engineering - Health Technologies - Co-operative Program Graduate Studies Academic Calendar content**:
▪ ECE 635 Fabrication in the Nanoscale: Technology and Applications ▪ ECE 672 Optoelectronic Devices ▪ NANO 600 Introduction to Nanotechnology 7. Graduate Specialization in Software • To receive the Graduate Specialization in Software, students must successfully complete 3 compulsory courses and 2 elective courses: o Compulsory courses: ▪ ECE 650 Methods and Tools for Software Engineering ▪ ECE 651 Foundations of Software Engineering ▪ ECE 653 Software Testing, Quality Assurance and Maintenance o Elective courses (choose 2 from the following list): ▪ ECE 606 Algorithm Design and Analysis ▪ ECE 655 Protocols, Software, Issues in Mobile Systems ▪ ECE 656 Database Systems ▪ ECE 657 Tools of Intelligent Systems Design ▪ ECE 658 Component Based Software 8. Graduate Specialization in Sustainable Energy • To receive the Graduate Specialization in Sustainable Energy, students must successfully complete 1 compulsory course and 4 elective courses: o Compulsory course: ▪ ECE 660 Operation and Control of Future Integrated Energy Systems o Elective courses (choose 4 from the following list): ▪ ECE 632 Photovoltaic Energy Conversion ▪ ECE 662 Power System Analysis and Control ▪ ECE 663 Energy Processing ▪ ECE 665 High Voltage Engineering Applications ▪ ECE 666 Power Systems Operation ▪ ECE 668 Distribution System Engineering ▪ ECE 669 Dielectric Materials	~~▪ ECE 636 Advanced Analog Integrated Circuits~~ ~~▪ ECE 637 Digital Integrated Circuits~~ ~~▪ ECE 642 Radio Frequency IC Design~~ ~~▪ ECE 671 Microwave & RF Engineering~~ ~~▪ Set-B:~~ ~~▪ ECE 606 Algorithm Design and Analysis~~ ~~▪ ECE 638 CMOS Sensor Integrated Circuits~~ ~~▪ ECE 730 Topic-9 VLSI Quality, Reliability and Yield Engineering~~ ~~▪ ECE 730 Topic-16 Embedded Semiconductor RAM~~ ~~▪ ECE 730 Topic-30 Advanced VLSI Devices~~ ~~▪ ECE 738 VLSI Circuits for Wireless Communication~~ ~~▪ ECE 740 Topic-3 CMOS Data Converters~~ ~~▪ ECE 770 Topic-22 Radio and Wireless Systems~~ ~~6. Graduate Specialization in Nanoelectronic Devices and Materials~~ ~~• To receive the Graduate Specialization in Nanoelectronic Devices and Materials, students must successfully complete 2 compulsory courses and 3 elective courses:~~ ~~o Compulsory courses:~~ ~~▪ ECE 630 Physics and Models of Semiconductor Devices~~ ~~▪ ECE 631 Microelectronic Processing Technology~~ ~~o Elective courses (choose 3 from the following list):~~ ~~▪ ECE 632 Photovoltaic Energy Conversion~~ ~~▪ ECE 633 Nanoelectronics~~ ~~▪ ECE 634 Organic Electronics~~ ~~▪ ECE 635 Fabrication in the Nanoscale: Technology and Applications~~ ~~▪ ECE 672 Optoelectronic Devices~~

Current primary program in the home unit: MEng in Electrical and Computer Engineering - Co-operative Program Graduate Studies Academic Calendar content:	Proposed MEng in Electrical and Computer Engineering - Health Technologies - Co-operative Program Graduate Studies Academic Calendar content:
▪ ECE 761 HVDC and FACTS ▪ ECE 762 Power System Components and Modelling ▪ ECE 763 Sustainable Distributed Power Generation ▪ ECE 765 Power System Protection and Relaying ▪ ECE 768 Power System Quality **Coursework option: Milestone requirements** **Graduate Studies Work Report** • Students must complete one or two work-term placements. A work report must be submitted to the Department for review and credit by the end of each work term. • Students are responsible for following the regulations and procedures of Co-operative and Experiential Education (CEE).	▪ ~~NANO 600 Introduction to Nanotechnology~~ ~~7. Graduate Specialization in Software~~ • ~~To receive the Graduate Specialization in Software, students must successfully complete 3 compulsory courses and 2 elective courses:~~ ○ ~~Compulsory courses:~~ ▪ ~~ECE 650 Methods and Tools for Software Engineering~~ ▪ ~~ECE 651 Foundations of Software Engineering~~ ▪ ~~ECE 653 Software Testing, Quality Assurance and Maintenance~~ ○ ~~Elective courses (choose 2 from the following list):~~ ▪ ~~ECE 606 Algorithm Design and Analysis~~ ▪ ~~ECE 655 Protocols, Software, Issues in Mobile Systems~~ ▪ ~~ECE 656 Database Systems~~ ▪ ~~ECE 657 Tools of Intelligent Systems Design~~ ▪ ~~ECE 658 Component Based Software~~ ~~8. Graduate Specialization in Sustainable Energy~~ • ~~To receive the Graduate Specialization in Sustainable Energy, students must successfully complete 1 compulsory course and 4 elective courses:~~ ○ ~~Compulsory course:~~ ▪ ~~ECE 660 Operation and Control of Future Integrated Energy Systems~~ ○ ~~Elective courses (choose 4 from the following list):~~ ▪ ~~ECE 632 Photovoltaic Energy Conversion~~ ▪ ~~ECE 662 Power System Analysis and Control~~ ▪ ~~ECE 663 Energy Processing~~ ▪ ~~ECE 665 High Voltage Engineering Applications~~ ▪ ~~ECE 666 Power Systems Operation~~ ▪ ~~ECE 668 Distribution System Engineering~~ ▪ ~~ECE 669 Dielectric Materials~~ ▪ ~~ECE 761 HVDC and FACTS~~ ▪ ~~ECE 762 Power System Components and Modelling~~ ▪ ~~ECE 763 Sustainable Distributed Power Generation~~

Current primary program in the home unit: MEng in Electrical and Computer Engineering - Co-operative Program Graduate Studies Academic Calendar content:	Proposed MEng in Electrical and Computer Engineering - Health Technologies - Co-operative Program Graduate Studies Academic Calendar content:
	~~ECE 765 Power System Protection and Relaying~~ ~~ECE 768 Power System Quality~~ **Coursework option: Milestone requirements** **Graduate Studies Work Report** • Students must complete one or two work-term placements. A work report must be submitted to the Department for review and credit by the end of each work term. • Students are responsible for following the regulations and procedures of Co-operative and Experiential Education (CEE).

How will students currently registered in the program be impacted by these changes?

Current students will not be impacted. The program will be open to new students once it goes into effect.

Department/School approval date (mm/dd/yy):
Reviewed by GSPA (for GSPA use only) ☒ date (mm/dd/yy): 02/06/25
Faculty approval date (mm/dd/yy):
Senate Graduate & Research Council (SGRC) approval date (mm/dd/yy):
Senate approval date (mm/dd/yy) (if applicable):

UNIVERSITY OF WATERLOO

GRADUATE PROPOSAL

COLLABORATIVE HEALTH TECHNOLOGIES PROGRAM

MASTER OF ENGINEERING IN SYSTEMS DESIGN ENGINEERING – HEALTH TECHNOLOGIES (CO-OP)

For submission to the
Ontario Universities Council on Quality Assurance

VOLUME I - PROPOSED BRIEF

NOVEMBER 2024

*The Quality Council will normally require only an Expedited Approval process where:

a) there is a proposal for a **new Collaborative Program** at the graduate level; or
b) there is a proposal for **a new for-credit graduate diploma**.

NOTE: This template **must** be used for submission of a new program proposal.
Please consult the University of Waterloo Institutional Quality Assurance Process and the Quality Assurance Framework (QAF) for details or the Quality Assurance Office.
****Volumes I, II must be reviewed and approved by the Quality Assurance Office, GSPA and IAP prior to submission to your Faculty Council****

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1. Introduction

Brief Listing of the Program

The Collaborative Health Technologies Program offers students professional Master of Engineering (MEng) degree with mandatory co-op, as preparation to enter the broad and rapidly evolving field of *Health Technology*. Not only is co-op highly beneficial to students while completing this program, it also offers an important opportunity to those students who *never* had co-op experience during their undergraduate degree. The program is centered around a collaborative and interdisciplinary suite of courses offered by six departments in Engineering and supported by the Faculties of Arts and Health. In addition to coursework, the mandatory co--op program serves to enrich the learning of students with practical experience in industrial settings. This is a full-time, on-campus program, with an expected duration of 4-6 terms, based on the co-op and study sequence selected by particular students. Program tuition follows the existing UW graduate home program tuition structure.

To enroll in the Collaborative Health Technologies Program, students must meet the admission requirements of, and register in, the department of Systems Design Engineering (SYDE). Students must complete the Collaborative Health Technologies Program requirements that are structured as a combination SYDE department's MEng degree requirement, and the additional Collaborative Health Technologies Program requirements (i.e., the completion of sufficient courses from specified pools, and successful co-op work terms/reports).

The degree conferred will be that of the participating program (i.e. Systems Design Engineering), with the completion of the Collaborative Health Technologies Program indicated by a transcript notation to the degree and adjunct qualification to the degree (i.e. Master of Engineering in Systems Design Engineering – Health Technologies). The proposed collaborative program also offers a platform to allow future participation of other Faculties.

Method Used for Preparation of the Brief

The Collaborative Health Technologies Program was conceptualized by the Dean of Engineering and the Associate Dean Graduate Studies – Engineering. In April 2023, the initiative to develop the program received support from the New Interdisciplinary Networks, Programs, and Initiatives Fund from the University. The proposal was developed following consultations by the Associate Dean with Graduate Associate Chairs of the departments of Chemical Engineering, Civil and Environmental Engineering, Electrical and Computer Engineering, Management Science and Engineering, Mechanical and Mechatronics Engineering, and Systems Design Engineering. The Associate Dean also had discussions with counterparts in other Faculties (e.g., Arts, Health, and Science). The general proposal was presented to the departments in Engineering for consideration within the unit. Following approval, this departmental proposal brief to participate in the collaborative program evolved, incorporating the specific requirements of the home unit.

2. Objectives of the Program (QAF 2.1.2.1)

The Collaborative Health Technologies Program is timely and justified not only based on the critical need for skilled professionals at the intersection of healthcare and technology, but also by the University of Waterloo's own goals, e.g. Waterloo at 100, Global Futures. The following are some of the compelling reasons that justify the establishment of a Collaborative Health Technologies Program:

1. **Rapid Technological Advancements in Healthcare**: The healthcare industry is experiencing an unprecedented transformation due to rapid advancements in technology. Innovations such as artificial intelligence, telemedicine, wearable devices, and data analytics are reshaping healthcare delivery, diagnosis, treatment, and patient care. A dedicated program will equip future professionals with leading-edge skills needed to leverage and drive innovations in this field.
2. **Increasing Demand for Health Technology Experts**: There is a growing demand for professionals who possess a deep understanding of both healthcare and technology. This demand arises from the need to bridge the gap between traditionally siloed fields and create holistic solutions that address complex healthcare challenges. Graduates of a Collaborative Health Technology Program will fill this talent gap and drive innovation in healthcare settings.
3. **Addressing Healthcare Challenges**: The global healthcare landscape faces numerous challenges, including rising costs, an aging population, chronic diseases, disparities in healthcare access, and pandemics. A Collaborative Health Technologies Program will empower students to develop innovative solutions to address these challenges, improve healthcare access, and enhance patient outcomes.
4. **Opportunity for Interdisciplinary Collaboration**: A program that combines healthcare and technology will foster interdisciplinary collaboration. Students will learn to collaborate with healthcare professionals, engineers, data scientists, ethicists, and policymakers, fostering a diverse and comprehensive approach to problem-solving.
5. **Industry-Relevant Skill Development**: Employers in the healthcare and technology sectors seek professionals with specialized skills in areas such as health data analytics, digital health, telemedicine, medical device development, regulatory compliance, and AI applications in healthcare. Both the course-based components and the mandatory co-op of this Collaborative Health Technologies Program combine to ensure that graduates are well-prepared with these in-demand skills.
6. **Economic and Innovation Impact**: Investing in a Collaborative Health Technologies Program aligns with the current market demand and presents an opportunity to contribute to economic growth and innovation. Graduates equipped with the skills to develop and implement Health Technology solutions can drive entrepreneurship, create job opportunities, and contribute to the expansion of healthcare technology sectors.
7. **Addressing Future Healthcare Needs**: With the evolving landscape of healthcare and technology, preparing future professionals to navigate and lead in this dynamic environment is essential. Establishing a Collaborative Health Technologies Program now ensures that the workforce is ready to address the future needs and challenges of the healthcare industry.

Program Learning Outcomes and Graduate Degree Level Expectations (GDLE):

1. **Depth and Breadth of Knowledge**
    a. Understand the principles, concepts, terminology and tools of health technology
    b. Demonstrate awareness of key elements of both the ethical considerations and impacts of health technologies
    c. Interpret, understand, and critically assess state-of-the-art methods, theories, and advances in health technology
2. **Research & Scholarship**
    a. Integrate complex engineering concepts related to the breadth of health technology, and the underlying and associated sciences.
3. **Level of Application of Knowledge**
    a. Interpret, critically assess and apply state-of-the-art methods, theories, and advances in health technology
    b. Understand current issues faced by the health technology industry
4. **Professional Capacity / Autonomy**
    a. Independently recognize, define, and solve complex real-world health technology needs and associated challenges
    b. Engage in self-directed professional development and life-long learning
    c. Develop an ability to recognize, appreciate, consider and apply appropriate ethics, law, regulations, and accountability to the field of health technologies
    d. Understand the value of engaging in inter-disciplinary collaboration in health technology as well as the complexity of knowledge & limitations of different fields
    e. Adopt a mindset for collaboration (work effectively in interdisciplinary teams including healthcare professionals, engineers, designers, business developers, etc.)
5. **Level of Communication Skills**
    a. Effectively communicate complex concepts in health technology to a wide audience ranging from general public to experts in the field. Concepts may include health technology needs and associated challenges (includes GDLE 6 Awareness of Limits of Knowledge)
    b. The ability to communicate ideas, issues and conclusions clearly.
6. **Awareness of Limits of Knowledge**
    a. Cognizance of the complexity of knowledge and of the potential contributions of other interpretations, methods, and disciplines.
    b. Understand the value of inter-disciplinarity in the field of health technologies.

How does this Program align with the University of Waterloo Strategic Plan and Strategic Mandate Agreement?

The Collaborative Health Technologies Program aligns well with the University of Waterloo's strategic plan in several ways:

1. **Interdisciplinary Collaboration:** The program's collaboration between the departments in Engineering as well as the support by Arts and Health, demonstrate a commitment to

interdisciplinary collaboration, a key focus area of the strategic plan. This collaboration brings together diverse perspectives and expertise, fostering innovation in health technology by integrating engineering skills with insights from health, social sciences, and humanities.

2. **Work-integrated Learning through Co-op:** The mandatory co-op component of the program aligns with the strategic plan's emphasis on experiential learning. This practical work experience allows students to apply their knowledge in real-world settings, contributing to their professional development while addressing real challenges in health technology.
3. **Benefits of Innovation and Research:** The program's focus on Health Technologies aligns with the strategic plan's emphasis on fostering innovation. Even though this is a course-based program, it does enable students to connect with faculty from various departments to engage with cutting-edge technologies and understand solutions to real-world problems.
4. **Community Partnerships:** Collaboration between different departments within Engineering, along with the support, through course offering, by Faculties of Arts and Health, opens opportunities for partnership with external organizations, hospitals, and industry players. This engagement aligns with the strategic plan's focus on strengthening community partnerships. Co-op placements also will play a key role in this aspect.
5. **Technology and Global Challenges:** By addressing healthcare challenges through technology and innovation, the program contributes to addressing global challenges, which is in line with the University's strategic goal of leveraging technology for positive societal impact.
6. **Commitment to Excellence and Diversity:** The collaborative nature of the program reflects the University's commitment to excellence in education and research. Furthermore, by integrating diverse perspectives from multiple departments and faculties, the program contributes to promoting diversity and inclusion, a priority area in the strategic plan.

Overall, the Collaborative Health Technologies Program embodies many key pillars of the University of Waterloo's Strategic Plan by promoting interdisciplinary collaboration, experiential learning, innovation, community engagement, and a commitment to excellence and diversity.

3. Admission Requirements (QAF 2.1.2.5)

Admission into the Collaborative Health Technologies Program is through direct application to the program offered through the home administrative unit, i.e. SYDE. Admission requirements for the program will be the same as those existing for the Master of Engineering degree in SYDE.

The minimum academic requirements – including admissions requirements, minimum overall averages, and timelines for any milestones – in the program will be consistent with the requirements of the primary existing master's program for each participating department.

In detail, the admission requirements for MEng in the department of Systems Design Engineering are:

- A 4-year Honours Bachelor's degree in engineering. For applicants whose previous degree was completed in Canada, a 75% overall standing in the last two years, or equivalent (at the sole discretion of the University of Waterloo, in all cases), in a four-year Honour's Bachelor's degree in engineering is the minimum requirement for admission to a Master's program.
- Due to the variable nature of international credentials, for applicants whose previous degree was completed outside of Canada, a 75% overall standing in a four-year Honours Bachelor's degree in engineering or equivalent is the minimum requirement for admission.
- Applicants who do not hold a Honours Bachelor's degree in engineering must justify their suitability by demonstrating formal or informal training in engineering through the supplementary information form (SIF), their resume/CV, or other supporting material.
- Required application materials include, Resume, SIF, Academic Transcript(s); Proof of English language Proficiency (if applicable); Minimum two reference letters.
  Minimum English Language Proficiency requirement: TOEFL 80 (writing 22, speaking 20, reading 20, listening 18), or IELTS 6.5 (writing 6.0, speaking 6.0).
  Type of references: A minimum of 1 academic reference. Applicants who complete their degree five or more years before the application date may submit 2 professional references.

These admission requirements are appropriate given the precedent of existing co-op Master's programs in the Faculty of Engineering. The level of required academic performance is indicative of what will be required of students during their studies within this proposed program and serves to select only students who will be capable of meeting course expectations and overall program learning outcomes. Furthermore, the Supplementary Information Form, resume, and reference letters will allow for recognition of the prior work, experience, aspirations, and career trajectory of applicants.

4. Structure (QAF 2.1.2.2)

The Collaborative Health Technologies Program is a co-op only, course-based program. Completion of 9 courses will be required to meet the coursework requirement of the program. Selection of courses will be as follows:

1 Compulsory core course, BME 601: Physiological Systems and Biomedical Design

1 course from the following University-level courses (ARTS, ENG):

- PHIL 626: Bioethics and Technology
- ECON 643: Health Economics
- MSE 619: Healthcare Analytics

2 courses, inclusive of BME 600, from the following Faculty-level courses (6 ENG depts):

- BME 600: Design of Biomedical Technologies
- BME 602: Foundations in Biomechanical Engineering
- CHE 621: Model Building and Response Surface Methodology
- ENVE 585: Air Quality Engineering and Impacts
- ECE 608: Quantitative Methods in Biomedical Engineering
- MSE 630: Human-Computer Interaction

1 course from:

- SYDE 660A: Systems Design Graduate Workshop 1 - AI and Machine Learning
- SYDE 660B: Systems Design Graduate Workshop 1 – Biomedical Systems
- SYDE 660C: Systems Design Graduate Workshop 1 – Human Factors

4 courses selected from other SYDE graduate courses and from the following Faculty of Health courses:

- HLTH 612: Introduction to Health Information and Data Standards
- HLTH 633: Digital Health
- HLTH 605B: Quantitative Methods and Analysis
- HLTH 650A/650B: Application of Artificial Intelligence in Health (0.25) / Machine Learning Techniques in Health (0.25)
- HLTH 606B: Principles of Epidemiology for Public Health
- HLTH 615: Requirements Specifications and Analysis in Health Systems

Of the 9 courses there must be a minimum of 3 SYDE courses, with at most 2 at the 500 level.

The program study / co-op sequence is illustrated below. Having co-op during the program both allows students to apply what they have learned in school to their co-op employment, but also the reverse: apply what has been learned during co-op terms to their in-school experiences. This model allows for bidirectional inspiration and gives students an important *context* for what they are learning.

Term-1	Term-2	Term-3	Term-4	Term-5	Term-6
study	study	Co-op	Co-op	study	(study)
study	study	Co-op	study	(study)	

Rationale and Justification

The structure and regulations of the Collaborative Health Technologies Program align with the program learning outcomes and Degree-Level Expectations. More detail is given below.

Alignment with Program Learning Outcomes:

1. **Diversity of Course Offerings:** The coursework structure ensures a breadth of courses from various levels (University, Faculty, Department) covering different aspects of health technologies, such as ethics, analytics, biomedical engineering, rehabilitation engineering, human-computer interaction, health-care systems, epidemiology, systems theory etc. The proposed program is designed in such a way that potential future participation of additional Faculties with their own master's program model is both possible and would further enrich the program content.
2. **Integration of Practical Experience:** The mandatory incorporation of co-op allows students to apply theoretical knowledge gained in the classroom to real-world scenarios, and vice versa. This aligns with the objective of the program to foster practical application and real-world learning.

Meeting Degree Level Expectations:

1. **Depth and Breadth of Knowledge:** The variety of courses spanning different Departments and Faculties suggests a comprehensive coverage of topics relevant to health technologies, meeting the depth and breadth of knowledge expected at the master's level.
2. **Professional Skills Development:** The incorporation of co-op experiences facilitates the development of professional skills, preparing students for practical challenges in the field.

Rationale for Program Length:

The proposed program length is reasonable for several reasons:

1. **Course Load and Requirements:** 9 courses within the program, structured across different units and levels, can be reasonably completed within three to four study terms.
2. **Integration of Co-op Experience:** The inclusion of co-op necessitates a program duration that allows students to engage in these practical experiences without significantly extending the program length.
3. **Balancing Academic and Practical Learning:** The program aims to balance academic learning with real-world application. A structured timeframe enables students to attain both theoretical knowledge and practical skills within a manageable period.

5. Program Content (QAF 2.1.2.3)

Health Technologies represent the dynamic intersection of healthcare and cutting-edge technology, encompassing a diverse array of innovations designed to revolutionize patient care, improve healthcare accessibility, and enhance overall well-being. Embracing a multidisciplinary approach, Health Technologies integrate advancements in artificial intelligence, data analytics, telemedicine, medical imaging, ethics, and more, to drive transformative changes in the diagnosis, treatment, and management of health conditions.
The Collaborative Health Technologies Program is a muti-disciplinary course-based program in the Faculty of Engineering with mandatory co-op, integrated within the timeline of the program. Its multi-disciplinarity is derived on the basis of the participation, through course offerings, of the Faculties of Arts and Health. Additionally, the enrolled students will also take appropriate courses across several departments within Engineering. All courses taken are at the graduate level. An overview of the program's course structure was given in Section 4. Here, additional information on the courses is given.

A brief description of the University-level courses, from which a student would be required to take one course, is given below:

- **PHIL 626: Bioethics and Technology** (Arts)
  Students will grapple with a sample of ethical issues related to advanced and emerging medical technologies and/or biotechnologies. The primary goals of doing so are: (1) To gain familiarity with key ethical concepts and values, which may include patient autonomy, beneficence, justice, care, anti-ableism, inclusion, and others; and (2) to enhance core critical thinking skills needed for ethics, which will help improve each student's self-understanding (of not only what they think is right and wrong, but, more importantly, why) and their capacity to engage with different perspectives on the "whats" and "whys" of ethics in a spirit of open-mindedness, mutual respect, and constructive cooperation. Frequent in-class discussion is typically an important element of student learning in this course.
- **ECON 643: Health Economics** (Arts)
  This course introduces students to the role of economics in health care and health policy. It is meant to be a survey of major topics in health economics and an introduction to the ongoing debate over health care policy. Topics include the economic determinants of health and health policy, the market for medical care, the market for health insurance, and the role of the government in health care, and health care reform.
- **MSE 619: Healthcare Analytics** (Engineering)
  This course provides an introductory course on health analytics including such topics as data acquisition, modelling, and predictive analytics. The course focuses on the practical application of the concepts to improve the quality of the analyses often found in the health sector. Application areas will be concentrated on topics found in health systems and may include topics such as planning and scheduling, disease diagnosis, and treatment planning. The learning outcomes include the ability to identify and apply appropriate analytical methods and models for healthcare.

A brief description of the Faculty-level courses, from which a student would be required to take two courses, is given below:

- **BME 600: Design of Biomedical technologies** (SYDE)
  Systems theory and formulation of system dynamics problems. Design and research methods for biomedical technologies. Problem formulation and definition, stakeholder engagement, needs analysis, generation of alternative solutions, feasibility analysis, optimization, selection, and solution implementation.
- **BME602: Foundations in Biomechanical Engineering** (MME)
  This course focuses on equipping students with foundational knowledge in the biomechanics of human physiology, pathology and treatment. The overarching aim of this course is to develop students' literacy in applying biomechanics principles and modern tools towards understanding the human body. The course will build on existing knowledge in mathematics

and physics to develop new expertise and hands-on experience in the biomechanical modeling and analysis of physiological systems.

- **CHE 621: Model Building and Response Surface Methodology** (CHE)
  This course teaches process / product optimization based on design of experiments, empirical modelling, and non-linear mechanistic models. These methodologies aid in refining healthcare processes and products, ensuring they meet stringent standards of efficiency, safety, and effectiveness.
- **ENVE 585: Air Quality Engineering and Impacts** (CEE)
  This course introduces air quality design of engineering solutions and associated health and economic impacts. It includes topics focused on the indoor environment, the outdoor environment, or both, such as: air pollution sources, emission estimation, control strategies, measurement, modeling methods, health impact assessment, cost-benefit analysis, technical policy analysis, and co-impacts with climate change.
- **ECE 608: Quantitative Methods in Biomedical Engineering** (ECE)
  This course focuses on topics related to the use of quantitative tools in biomedical engineering research studies. Educational emphasis will be placed on developing students' core competence in biostatistics and biomedical computing, so as to prepare them to pursue biomedical engineering investigations that are backed by quantitative reasoning and numerical insights.
- **MSE 630: Human Computer Interaction** (MSE)
  This course concentrates on the theoretical and practical issues related to the design of the human-computer interfaces. Aspects of human perception, cognition and various models of task analysis are discussed.

A brief description of the Faculty of Health courses that are part of the department-specific and health-specific list of electives is given below:

- **HLTH 612: Introduction to Health Information and Data Standards**
  This course focuses on health data as a key component of all health informatics systems. Topics include ontologies and other classification taxonomies found in health systems, data standards (with a focus on Canadian implementations of international standards), privacy and security of health data, client/patient assessment tools, and ethical considerations.
- **HLTH 633: Digital Health**
  The wide adoption of mobile technology presents a new opportunity. Leveraging this existing technology, healthcare systems can deliver remote care and collect real-time data on patients outside of health centres, minimizing unnecessary visits to hospitals and providing healthcare access to remote populations. In this course, we will explore how digital health technology has been designed, evaluated, and deployed in different countries. Case studies will be used to demonstrate how institutional and governmental constraints have a strong impact on the success of the deployment. The course will address the different digital health technologies in the market, such as Telehealth, remote patient monitoring, tele radiology, consumer health informatics, and mHealth. Important aspects of technology development like patient confidentiality, privacy, standards, communication and security protocols,

regulatory requirements, among others, will be discussed when presenting the development of each digital health solution. By the end of this course, students will be prepared to design, evaluate, and deploy a digital health intervention and will have a solid understanding of the barriers and requirements for deploying digital health technology.

- **HLTH 605B: Quantitative Methods and Analysis**
  This course is a rigorous introduction to biostatistics for those planning a career in public health. Students will learn various biostatistical techniques, how to apply those techniques in the analysis of data from health studies, and how to interpret the results from those analyses. After a brief review of material from a basic statistics course, topics covered will include simple and multiple linear regression, analysis of categorical data, simple and multiple logistic regression, and survival analysis. Emphasis will be on (i) conceptual understanding of topics, including literacy necessary for understanding scientific papers in public health, as well as (ii) carrying out various data analysis applications.
- **HLTH 650A / 650B: Application of Artificial Intelligence in Health (0.25) / Machine Learning Techniques in Health (0.25)**
  HLTH 650A focuses on the application of machine learning (ML) and artificial intelligence (AI) techniques in the field of healthcare and public health settings. Big data sources available for population health studies will be introduced to students and challenges related to AI in health data will also be discussed. The learning activities consist of lectures, student-led journal club discussions and a term paper to propose the application of ML techniques to solve population health or public health problems.
  HLTH 650B focusses on the techniques of machine learning (ML) commonly used to solve healthcare and public health problems. Various analytics techniques, including data wrangling, visualization, unsurprised and supervised learning, will be introduced to students. Challenges and strategies related to missing data, imbalanced data and model selections will also be discussed. The learning activities consist of lectures, labs, and a final project to demonstrate the proficiency of ML techniques to solve population health or public health problems.
- **HLTH 606B: Principles of Epidemiology for Public Health**
  This course introduces the principles, methods, and uses of epidemiology in the practice of public health. After completion of this course, students will be able to critically read and interpret epidemiologic research and clearly communicate epidemiologic findings. They will be familiar with health status measurement, data sources, screening, surveillance, outbreak investigation, and methods to support program planning and evaluation. Students will have a sound understanding of basic epidemiologic concepts, including prevalence, incidence, study designs, measures of association, bias, confounding and causal inference.
- **HLTH 615: Requirements Specifications and Analysis in Health Systems**
  This course introduces students to the requirements of definition phase of software development. Models, notations, and processes for software requirements identification, representation, validation, and analysis are discussed, as are mechanisms to evaluate the efficacy and efficiency of health information systems.

6. Mode of Delivery (QAF 2.1.2.2)

Courses made available for students of the Collaborative Health Technologies Program use a wide variety of teaching and learning methodologies (e.g., lectures, case-studies, student presentations, in-class group discussion, etc.) designed to provide students with an engaging learning experience. Though not specific to this program, at the University of Waterloo, instructors from all faculties are encouraged to make use of the Center for Teaching Excellence, which offers many resources to aid instructors in improving their teaching, course design, and delivery, emphasising *Active Learning* techniques. Instructors of courses offered to Collaborative Health Technologies Program students will be reminded of these resources.

Following program approval and implementation, the faculty-level administrative staff will ensure the program is continually meeting both intended learning outcomes and degree-level expectations.

7. Assessment of Teaching and Learning (QAF 2.1.2.4)

The performance of students will be assessed both on conventional and existing methods stipulated by the courses they will take, but also based on input from the co-operative education component of this program.

Assessment of teaching and learning will be conducted at the *student* and *program* levels. The program will be assessed at the program level by the Graduate Program Committee and program director. As part of this assessment, the Program Committee will review statistics, such as program performance versus learning objectives, student success rates and teaching evaluations – as provided through both student perception surveys and peer-assessment of teaching. The committee will identify opportunities to improve performance, such as enriching course content or teaching.

Performance indicators that will be considered by the Program Committee will include:

- Applications to and enrollment within the program;
- Student evaluations of courses;
- Student graduation rates;
- Surveys of alumni; and
- Surveys of employers/industry partners.

At the student level, there will be the following types of activities with assessments:

a) Coursework: Students will be assigned a grade based on typical assessment methods used in other graduate courses, such as papers, reports, tests, projects, and presentations.
b) Co-operative Education Work-Term Reports.

Refer to the table in Appendix A for more specific information on how assessments will be made, both for course-based and co-operative education components of this program.

8. Resources for All Programs (QAF 2.1.2.6)

For the anticipated enrolment numbers of the Collaborative Health Technologies Program, the additional students enrolling into pre-existing courses will not present a significant burden on the University's resources (i.e., students take courses from large pools and therefore, there will likely not be so many additional students per course that additional sections and having more instructors would be necessary – in fact, in some cases, the additional grad students enrolling may help improve the instructor utilization efficiency for courses that typically have too low of enrollment numbers). The program would not necessitate hiring any new faculty members and instead would rely on existing known-to-be qualified faculty members already teaching courses. In addition, students will have access to the University's facilities and spaces, including library resources, working spaces, access to existing resources for student well-being and counselling, as well as technology support from their home department. This program is not expected to impose additional student costs for use of resources. Program coordination can be handled by existing staff resources in the home departments with the Faculty of Engineering providing additional support as needed, as is the case for other existing collaborative programs.

9. Resources for Graduate Programs (QAF 2.1.2.7)

Given the course-based nature of the Collaborative Health Technologies Program, an assessment of the research-related and supervisory expertise of faculty is not required for this program to function. The breadth of courses available for students to take is immense and course instructors may change from term-to-term. Therefore, nearly *all* faculty from the participating units may serve this program through the teaching of courses in which Health Technology students may enroll. On a course-by-course /offering-to-offering basis, ensuring instructor competence is left to the discretion of the corresponding department. Following the precedent of existing professional master's programs in Engineering, no financial assistance will be provided to students. Ensuring the quality of incoming students, will be left to the discretion of the home departments and will be put into action through the standard program admission requirements, as are described in Section 3.

10. Quality and Other Indicators (QAF 2.1.2.8)

To ensure the quality of the program a Program Committee will be created to oversee and regularly evaluate the program, to ensure all program requirements and course related graduate-level degree requirements are met. This committee will consist of a Program Director, the Course Coordinator, a faculty member from each participating department, and a graduate student representative. Furthermore, the co-op office will principally oversee all co-op related activities and components of this program. Within each department of Engineering, Graduate Associate Chairs will monitor the progress of their constituent students from this program, as is already their responsibility for existing professional programs. Specifically, student progression through the program, grades, and successful completion of co-op terms will be tracked. Where needed, remedial action will be taken to ensure students remain on-track and able to maximally benefit from participation in this program.

Appendix A - Summary of Learning Outcomes Mapped to Courses and Assessment Methods

Specific GDLEs and Associated Learning Outcomes	Courses											Co-operative Education			Assessment method							
	Core BME	**University-level** ARTS | ENG			**Faculty-level** SYDE | MME | CHE | CIVE | ECE | MSE						**Dept-level** SYDE | HEALTH										
	BME 601: Physiological Systems and Biomedical Design	PHIL 626: Bioethics & Technology	ECON 643: Health Economics	MSE 619: Healthcare Analytics	BME 600: Design of Biomedical Technologies	BME 602: Foundations in Biomechanical Engineering	CHE 621: Model Building and Response Surface Methodology	ENVE 585: Air Quality Engineering & Impact	ECE 608: Quantitative Methods in Biomedical Engineering	MSE 630: Human-Computer Interaction	Dept-specific and Health-specific Elective Courses	Employer Input	Co-op Office Evaluation	Work Term Report	Forum communication	Multi-part assignments	Quizzes / Tests	Written assignments / arguments / policy briefs	Data interpretation, synthesis, visualization	Technical reports / plans	Slide decks / presentations	Video production
1. Depth and Breadth of Knowledge																						
Understand the principles, concepts, terminology, tools of health technology	C	A	A	A	C	A	A	A	A	A	AC	NA	NA	A	NA	A	A	A	A	A	A	NA
Demonstrate awareness of key elements of both the ethical considerations and impacts of health technologies	NA	A	A	A	NA	C	NA	NA	NA	C	AC	A	NA	A	NA	A	A	A	A	A	A	NA
Interpret, understand, and critically assess state-of-the-art methods, theories, and advances in health technology	NA	C	C	A	NA	A	C	C	A	A	AC	NA	NA	C	NA	A	A	A	A	A	A	NA
2. Research & Scholarship																						
Integrate complex engineering concepts related to the breadth of health technology, and the underlying and associated sciences.	C	NA	NA	A	C	A	A	A	A	A	AC	C	NA	C	NA	A	A	A	A	A	A	NA

Specific GDLEs and Associated Learning Outcomes	Courses											Co-operative Education			Assessment method							
	Core BME	**University-level** ARTS | ENG			**Faculty-level** SYDE | MME | CHE | CIVE | ECE | MSE						**Dept-level** SYDE | HEALTH										
	BME 601: Physiological Systems and Biomedical Design	PHIL 626: Bioethics & Technology	ECON 643: Health Economics	MSE 619: Healthcare Analytics	BME 600: Design of Biomedical Technologies	BME 602: Foundations in Biomechanical Engineering	CHE 621: Model Building and Response Surface Methodology	ENVE 585: Air Quality Engineering & Impact	ECE 608: Quantitative Methods in Biomedical Engineering	MSE 630: Human-Computer Interaction	Dept-specific and Health-specific Elective Courses	Employer Input	Co-op Office Evaluation	Work Term Report	Forum communication	Multi-part assignments	Quizzes / Tests	Written assignments / arguments / policy briefs	Data interpretation, synthesis, visualization	Technical reports / plans	Slide decks / presentations	Video production
3. Level of Application of Knowledge																						
Interpret, critically assess and apply state-of-the-art methods, theories, and advances in health technology	C	A	A	A	C	A	A	A	A	A	AC	NA	NA	A	NA	A	A	A	A	A	A	NA
Understand current issues faced by the health technology industry	C	A	A	C	C	A	NA	NA	C	A	AC	A	C	A	NA	A	A	A	A	A	A	NA
4. Professional Capacity / Autonomy																						
Independently recognize, define, and solve complex real-world health technology needs and associated challenges	C	A	A	NA	C	C	C	C	C	C	AC	A	A	A	NA	AC	AC	AC	AC	C	AC	NA
Engage in self-directed professional development and life-long learning	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	C	C	A	NA	NA	NA	NA	NA	A	NA	NA
Develop an ability to recognize, appreciate, consider and apply appropriate ethics, law, regulations, and accountability to the field of health technologies	C	A	A	C	C	C	NA	NA	C	C	AC	A	C	A	NA	A	A	A	A	A	A	NA

Specific GDLEs and Associated Learning Outcomes	Courses											Co-operative Education			Assessment method							
	Core BME	**University-level** ARTS | ENG			**Faculty-level** SYDE | MME | CHE | CIVE | ECE | MSE						**Dept-level** SYDE | HEALTH										
	BME 601: Physiological Systems and Biomedical Design	PHIL 626: Bioethics & Technology	ECON 643: Health Economics	MSE 619: Healthcare Analytics	BME 600: Design of Biomedical Technologies	BME 602: Foundations in Biomechanical Engineering	CHE 621: Model Building and Response Surface Methodology	ENVE 585: Air Quality Engineering & Impact	ECE 608: Quantitative Methods in Biomedical Engineering	MSE 630: Human-Computer Interaction	Dept-specific and Health-specific Elective Courses	Employer Input	Co-op Office Evaluation	Work Term Report	Forum communication	Multi-part assignments	Quizzes / Tests	Written assignments / arguments / policy briefs	Data interpretation, synthesis, visualization	Technical reports / plans	Slide decks / presentations	Video production
Understand the value of engaging in inter-disciplinary collaboration in health technology as well as the complexity of knowledge & limitations of different fields	C	C	C	C	C	NA	NA	NA	NA	NA	AC	NA	NA	A	NA	NA	NA	C	NA	A	C	NA
Adopt a mindset for collaboration (work effectively in interdisciplinary teams including healthcare professionals, engineers, designers, business developers, etc.)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	A	A	C	NA	NA	NA	NA	NA	C	NA	NA
5. Level of Communications Skills																						
Effectively communicate complex concepts in health technology to a wide audience ranging from general public to experts in the field. Concepts may include health technology needs and associated challenges (includes GDLE 6 Awareness of Limits of Knowledge)	NA	C	C	C	NA	NA	NA	NA	NA	NA	NA	C	C	C	NA	NA	NA	NA	NA	C	C	NA
The ability to communicate ideas, issues and conclusions clearly.	NA	C	C	NA	NA	NA	NA	NA	NA	NA	NA	C	C	A	NA	NA	NA	NA	NA	A	C	NA

Specific GDLEs and Associated Learning Outcomes	Courses											Co-operative Education			Assessment method							
	Core BME	**University-level** ARTS | ENG			**Faculty-level** SYDE | MME | CHE | CIVE | ECE | MSE						**Dept-level** SYDE | HEALTH										
	BME 601: Physiological Systems and Biomedical Design	PHIL 626: Bioethics & Technology	ECON 643: Health Economics	MSE 619: Healthcare Analytics	BME 600: Design of Biomedical Technologies	BME 602: Foundations in Biomechanical Engineering	CHE 621: Model Building and Response Surface Methodology	ENVE 585: Air Quality Engineering & Impact	ECE 608: Quantitative Methods in Biomedical Engineering	MSE 630: Human-Computer Interaction	Dept-specific and Health-specific Elective Courses	Employer Input	Co-op Office Evaluation	Work Term Report	Forum communication	Multi-part assignments	Quizzes / Tests	Written assignments / arguments / policy briefs	Data interpretation, synthesis, visualization	Technical reports / plans	Slide decks / presentations	Video production
6. Awareness of Limits of Knowledge																						
Cognizance of the complexity of knowledge and of the potential contributions of other interpretations, methods, and disciplines.	C	A	A	C	C	C	C	C	C	C	AC	A	A	A	NA	C	NA	NA	NA	A	A	NA
Understand the value of inter-disciplinarity in the field of health technology.	C	C	C	C	C	C	C	C	C	C	AC	C	C	C	NA	C	NA	C	NA	C	C	NA

Table Legend:

Assessed (A) ..... The outcome is addressed and is formally assessed.
Covered (C) ..... The outcome is addressed but not assessed.
Assessed or Covered (AC)..... The outcome may be addressed and assessed but is at least covered (depending on selected courses).
Not addressed (NA) ..... The outcome is not addressed.

Graduate Studies
Program Revision Template

Prior to form submission, review the content revision instructions and information regarding major/minor modifications. For questions about the form submission, contact Trevor Clews, Graduate Studies and Postdoctoral Affairs (GSPA).

Faculty: Engineering

Program: Master of Engineering (MEng) in Systems Design Engineering - Health Technologies - Co-operative Program

Program contact name(s): Nasser Lashgarian Azad, Siva Sivoththaman

Form completed by:

Description of the proposed new program option:
Note: changes to courses and milestones also require the completion/submission of the SGRC Graduate Studies Course/Milestone Form.

The Department of Systems Design Engineering is joining the inaugural Collaborative Health Technologies Program and is thus adding a Master of Engineering (MEng) in Systems Design Engineering - Health Technologies - Co-operative Program (direct entry).

Is this a major modification to the program? Yes

Rationale for change(s):

Please refer to the attached brief for full details.

Proposed effective date: Term: Fall Year: 2025

Current Graduate Studies Academic Calendar (GSAC) page (include the link to the web page where the changes are to be made):

https://uwaterloo.ca/academic-calendar/graduate-studies/catalog#/programs?group=Systems%20Design%20Engineering

Current primary program in the home unit: MEng in Systems Design Engineering Program Graduate Studies Academic Calendar content:	**Proposed MEng in Systems Design Engineering - Health Technologies - Co-operative Program Graduate Studies Academic Calendar content**:
Master of Engineering (MEng) in Systems Design Engineering **Admit term(s)** • Fall • Winter • Spring **Delivery mode** • On-campus	**Master of Engineering (MEng) in Systems Design Engineering - Health Technologies – Co-operative Program** **Admit term(s)** • Fall • Winter • Spring **Delivery mode**

Current primary program in the home unit: MEng in Systems Design Engineering Program Graduate Studies Academic Calendar content:	Proposed MEng in Systems Design Engineering - Health Technologies - Co-operative Program Graduate Studies Academic Calendar content:
Registration option(s) • Full-time • Part-time **Study option(s)** • Coursework **Length of program** • Full-time: 4 terms (16 months) • Part-time: 8 terms (32 months) **Graduate specializations** • Artificial Intelligence and Machine Learning • Biomedical Systems • Human Factors • Mechatronics and Physical Systems • Vision, Image and Signal Processing **Admission requirements: Minimum requirements** • An Honours Bachelor's degree (or equivalent) with at least an overall 75% standing from a recognized university. • A Graduate Record Examination (GRE) score is required for all students whose undergraduate degree is not from Canada or the USA. • English language proficiency (ELP) (if applicable) **Admission requirements: Application materials** • Résumé • Supplementary information form • Transcript(s) **Admission requirements: References** • Number of references: 2 • Type of references: a minimum of 1 academic reference. Applicants who complete their degree five or more years before the application date may submit 2 professional references. **Degree requirements** • Students must complete the course requirements listed below in addition to the Graduate Academic Integrity Module (Graduate AIM). **Coursework option: Course requirements**	• On-campus **Registration option(s)** • Full-time • ~~Part-time~~ **Program type(s)** • Co-operative • Collaborative **Study option(s)** • Coursework **Length of program** • Full-time: 4-5 terms (16-20 months) • ~~Part-time: 8 terms (32 months)~~ ~~**Graduate specializations**~~ • ~~Artificial Intelligence and Machine Learning~~ • ~~Biomedical Systems~~ • ~~Human Factors~~ • ~~Mechatronics and Physical Systems~~ • ~~Vision, Image and Signal Processing~~ **Admission requirements: Minimum requirements** • An Honours Bachelor's degree (or equivalent) with at least an overall 75% standing from a recognized university. • A Graduate Record Examination (GRE) score is required for all students whose undergraduate degree is not from Canada or the USA. • English language proficiency (ELP) (if applicable) **Admission requirements: Application materials** • Résumé • Supplementary information form • Transcript(s) **Admission requirements: References** • Number of references: 2 • Type of references: a minimum of 1 academic reference. Applicants who complete their degree five or more years before the application date may submit 2 professional references. **Degree requirements** • Students must complete the course and milestone requirements listed below in addition

Current primary program in the home unit: MEng in Systems Design Engineering Program Graduate Studies Academic Calendar content:	**Proposed MEng in Systems Design Engineering - Health Technologies - Co-operative Program Graduate Studies Academic Calendar content**:

• Students must complete the following 2 core Systems Design Engineering graduate courses:
  ○ SYDE 600 Systems Theory, Models, Research & Design
  ○ 1 of:
  ▪ SYDE 660A Systems Design Graduate Workshop 1 - AI and Machine Learning,
  ▪ SYDE 660B Systems Design Graduate Workshop 1 - Biomedical Systems,
  ▪ SYDE 660C Systems Design Graduate Workshop 1 - Human Factors,
  ▪ SYDE 660D Systems Design Graduate Workshop 1 - Mechatronic & Physical Systems,
  ▪ SYDE 660E Systems Design Graduate Workshop 1 - Vision, Image & Signal Processing, or
  ▪ SYDE 660 Systems Design Graduate Workshop 1
• In addition to the 2 core courses, students must complete 6 Engineering graduate courses (0.50 unit weight per course) counting towards degree credit from the University of Waterloo satisfying the following criteria:
  ○ At least 2 Systems Design Engineering courses at the 500, 600 or 700 level.
  ○ At most 2 courses at the 500 level.
• Students in the MEng in Systems Design Engineering program may also choose to pursue one of the following five Graduate Specializations:
1. Artificial Intelligence and Machine Learning
2. Biomedical Systems
3. Human Factors
4. Mechatronics and Physical Systems
5. Vision, Image and Signal Processing
• A Graduate Specialization is a University credential that is recognized on the student's transcript but not on the diploma and is intended to reflect that a student has successfully completed a set of courses that together provide an in-depth study in the area of the Graduate Specialization. A student will only obtain the Graduate Specialization on their transcript if they have completed the requirements associated with the MEng degree
	to the Graduate Academic Integrity Module (Graduate AIM).
	• The MEng in Systems Design Engineering – Health Technologies - Co-operative Program will enable students to combine graduate studies with work experience. The program includes completion of 1-2 required work terms. The work term(s) typically takes place in term 3 (or terms 3 and 4). The work term(s) must meet CEE standard work term requirements and Departmental requirements. Students should apply to jobs related to their program of study. Note: the program must start and end on an academic term. Students in the program are encouraged to complete WIL 601 Career Foundations for Work-Integrated Learning in the academic term prior to the first work term.
	
	Coursework option: Course requirements
	• Students must complete the following ~~2 core Systems Design Engineering~~ graduate courses:
	  ○ ~~SYDE 600 Systems Theory, Models, Research & Design~~
	  ○ 1 of:
	  ▪ SYDE 660A Systems Design Graduate Workshop 1 - AI and Machine Learning,
	  ▪ SYDE 660B Systems Design Graduate Workshop 1 - Biomedical Systems,
	  ▪ SYDE 660C Systems Design Graduate Workshop 1 - Human Factors,
	  ▪ ~~SYDE 660D Systems Design Graduate Workshop 1 - Mechatronic & Physical Systems,~~
	  ▪ ~~SYDE 660E Systems Design Graduate Workshop 1 - Vision, Image & Signal Processing, or~~
	  ▪ ~~SYDE 660 Systems Design Graduate Workshop 1~~
	  ○ BME 600 Design of Biomedical Technologies
	  ○ BME 601 Physiological Systems and Biomedical Design
	  ○ 1 of the following Health Technologies core courses:
	  ▪ ECON 643 Health Economics
	  ▪ MSE 619 Healthcare Analytics

Current primary program in the home unit: MEng in Systems Design Engineering Program Graduate Studies Academic Calendar content:	**Proposed MEng in Systems Design Engineering - Health Technologies - Co-operative Program Graduate Studies Academic Calendar content**:
and the requirements associated with the Graduate Specialization. • All MEng Graduate Specializations in Systems Design Engineering consist of a set of 4 graduate (0.50 weight) level courses and this set is comprised of a mix of specified and elective courses. Specified courses are those that are prescribed as part of the Graduate Specialization. Elective courses are those that are on a list of courses designated as electives for a given Graduate Specialization. The requirements for each of the five Graduate Specializations are described below. 1. Graduate Specialization in Artificial Intelligence and Machine Learning • Students must satisfy the following: • 3 Specified courses: o SYDE 522 Machine Intelligence or SYDE 552 Computational Neurosciences o SYDE 660A Systems Design Graduate Workshop 1 – AI and Machine Learning o SYDE 675 Pattern Recognition • Elective courses (at least 1 course from the following list): o SYDE 662 Systems Design Graduate Workshop 2 o SYDE 671 Advanced Image Processing o SYDE 672 Statistical Image Processing o SYDE 673 Video Processing & Analytics o SYDE 674 3D Computer Vision & Imaging 2. Graduate Specialization in Biomedical Systems • Students must satisfy the following: • 3 Specified courses: o SYDE 660B Systems Design Graduate Workshop 1 – Biomedical Systems o At least 2 from the following list: ▪ SYDE 544 Biomed Measure & SIP ▪ SYDE 684 Materials Biocompatability ▪ SYDE 750 Topic 20 Topics in Systems Modelling: Modeling of Biomechanical Systems ▪ SYDE 750 Topic 36 Topics in Systems Modelling: Assistive Tech and Rehab Eng	▪ PHIL 626 Bioethics and Technology o 1 of the following Faculty of Engineering Health Technologies elective courses: ▪ BME 602 Foundations in Biomechanical Engineering ▪ CHE 621 Model Building and Response Surface Methodology ▪ ECE 608 Quantitative Methods in Biomedical Engineering ▪ ENVE 585 Air Quality Engineering and Impacts ▪ MSE 630 Human-Computer Interaction o 4 from SYDE graduate courses and the following list of Health Technologies elective courses: ▪ HLTH 605B Quantitative Methods and Analysis ▪ HLTH 606B Principles of Epidemiology for Public Health ▪ HLTH 612 Introduction to Health Information and Data Standards ▪ HLTH 615 Requirements Specifications and Analysis in Health Systems ▪ HLTH 633 Digital Health ▪ HLTH 650A Application of Artificial Intelligence in Health (0.25) and 650B Machine Learning Techniques in Health (0.25) • ~~In addition to the 2 core courses,~~ Students must complete ~~6 Engineering~~ graduate courses (0.50 unit weight per course) counting towards degree credit from the University of Waterloo satisfying the following criteria: o ~~At least 2 Systems Design Engineering courses at the 500, 600 or 700 level.~~ o At most 2 courses at the 500 level. o At least 3 SYDE courses. • ~~Students in the MEng in Systems Design Engineering program may also choose to pursue one of the following five Graduate Specializations:~~ ~~1. Artificial Intelligence and Machine Learning~~ ~~2. Biomedical Systems~~ ~~3. Human Factors~~ ~~4. Mechatronics and Physical Systems~~ ~~5. Vision, Image and Signal Processing~~

Current primary program in the home unit: MEng in Systems Design Engineering Program Graduate Studies Academic Calendar content:	**Proposed MEng in Systems Design Engineering - Health Technologies - Co-operative Program Graduate Studies Academic Calendar content**:

• Elective courses (at least 1 from the following list or an additional course from the Specified course list)
  ○ SYDE 552 Computational Neurosciences
  ○ SYDE 556 Simulating Neurobiological Systems
  ○ SYDE 652 Dynamics of Multibody Systems
  ○ SYDE 662 Systems Design Graduate Workshop 2
  ○ SYDE 677 Medical Imaging
• Note that only one 500 level course may be used to satisfy the requirements of a Graduate Specialization. Therefore, if SYDE 544 is taken as a Specified course, then SYDE 552 and SYDE 556 cannot be taken to satisfy the Elective course requirement.
3. Graduate Specialization in Human Factors
• Students must satisfy the following:
• 3 Specified courses:
  ○ SYDE 660C Systems Design Graduate Workshop 1 – Human Factors
  ○ At least 2 from the following list:
  ▪ SYDE 542 Interface Design or SYDE 543 Cognitive Ergonomics
  ▪ SYDE 642 Cognitive Engineering Methods
  ▪ SYDE 644 Human Factors Testing
• Elective courses (at least 1 from the following list or an additional course from the Specified course list):
  ○ SYDE 533 Conflict Resolution
  ○ SYDE 662 Systems Design Graduate Workshop 2
  ○ SYDE 740 Advanced Cognitive Ergonomics
• Note that only one 500 level course may be used to satisfy the requirements of a Graduate Specialization. Therefore, if SYDE 542 or SYDE 543 is taken as a Specified course, then SYDE 533 cannot be taken to satisfy the Elective course requirement.
4. Graduate Specialization in Mechatronic and Physical Systems
• Students must satisfy the following:
• 3 Specified courses:
  ○ SYDE 660D Systems Design Graduate Workshop 1 - Mechatronic & Physical Systems
	~~• A Graduate Specialization is a University credential that is recognized on the student's transcript but not on the diploma and is intended to reflect that a student has successfully completed a set of courses that together provide an in-depth study in the area of the Graduate Specialization. A student will only obtain the Graduate Specialization on their transcript if they have completed the requirements associated with the MEng degree and the requirements associated with the Graduate Specialization.~~
	~~• All MEng Graduate Specializations in Systems Design Engineering consist of a set of 4 graduate (0.50 weight) level courses and this set is comprised of a mix of specified and elective courses. Specified courses are those that are prescribed as part of the Graduate Specialization. Elective courses are those that are on a list of courses designated as electives for a given Graduate Specialization. The requirements for each of the five Graduate Specializations are described below.~~
	~~1. Graduate Specialization in Artificial Intelligence and Machine Learning~~
	~~• Students must satisfy the following:~~
	~~• 3 Specified courses:~~
	~~○ SYDE 522 Machine Intelligence or SYDE 552 Computational Neurosciences~~
	~~○ SYDE 660A Systems Design Graduate Workshop 1 – AI and Machine Learning~~
	~~○ SYDE 675 Pattern Recognition~~
	~~• Elective courses (at least 1 course from the following list):~~
	~~○ SYDE 662 Systems Design Graduate Workshop 2~~
	~~○ SYDE 671 Advanced Image Processing~~
	~~○ SYDE 672 Statistical Image Processing~~
	~~○ SYDE 673 Video Processing & Analytics~~
	~~○ SYDE 674 3D Computer Vision & Imaging~~
	~~2. Graduate Specialization in Biomedical Systems~~
	~~• Students must satisfy the following:~~
	~~• 3 Specified courses:~~
	~~○ SYDE 660B Systems Design Graduate Workshop 1 – Biomedical Systems~~
	~~○ At least 2 from the following list:~~
	~~▪ SYDE 544 Biomed Measure & SIP~~

Current primary program in the home unit: MEng in Systems Design Engineering Program Graduate Studies Academic Calendar content:	**Proposed MEng in Systems Design Engineering - Health Technologies - Co-operative Program Graduate Studies Academic Calendar content**:
○ At least 2 from the following list: ▪ SYDE 553 Advanced Dynamics ▪ SYDE 652 Dynamics of Multibody Systems ▪ SYDE 655 Optimal Control ▪ SYDE 682 Advanced MEMS, Physics, Design & Fabrication ▪ SYDE 683 Modelling, Simulation & Design of MEMS ▪ SYDE 750 Modelling Continuum Systems • Elective courses (at least 1 from the following list or an additional course from the Specified course list): ○ SYDE 531 Design Opt. under Probabilistic Uncertainty ○ SYDE 631 Time Series Modelling ○ SYDE 661 Model-based robust design ○ SYDE 662 Systems Design Graduate Workshop 2 • Note that only one 500 level course may be used to satisfy the requirements of a Graduate Specialization. Therefore, if SYDE 553 is taken as a Specified course, then SYDE 531 cannot be taken to satisfy the Elective course requirement. 5. Graduate Specialization in Vision, Image and Signal Processing • Students must satisfy the following: • 3 Specified courses: ○ SYDE 660E Systems Design Graduate Workshop 1 - Vision, Image & Signal Processing ○ At least 2 from the following list: ▪ SYDE 575 Image Processing ▪ SYDE 671 Advanced Image Processing ▪ SYDE 677 Medical Imaging • Elective courses (at least 1 from the following list or an additional course from the Specified course list): ○ SYDE 544 Biomed Measure & SIP ○ SYDE 633 Remote Sensing Systems ○ SYDE 662 Systems Design Graduate Workshop 2 ○ SYDE 672 Statistical Image Processing ○ SYDE 673 Video Processing & Analytics ○ SYDE 674 3D Computer Vision & Imaging ○ SYDE 675 Pattern Recognition	~~▪ SYDE 684 Materials Biocompatability~~ ~~▪ SYDE 750 Topic 20 Topics in Systems Modelling: Modeling of Biomechanical Systems~~ ~~▪ SYDE 750 Topic 36 Topics in Systems Modelling: Assistive Tech and Rehab Eng~~ ~~• Elective courses (at least 1 from the following list or an additional course from the Specified course list)~~ ~~○ SYDE 552 Computational Neurosciences~~ ~~○ SYDE 556 Simulating Neurobiological Systems~~ ~~○ SYDE 652 Dynamics of Multibody Systems~~ ~~○ SYDE 662 Systems Design Graduate Workshop 2~~ ~~○ SYDE 677 Medical Imaging~~ ~~• Note that only one 500 level course may be used to satisfy the requirements of a Graduate Specialization. Therefore, if SYDE 544 is taken as a Specified course, then SYDE 552 and SYDE 556 cannot be taken to satisfy the Elective course requirement.~~ ~~3. Graduate Specialization in Human Factors~~ ~~• Students must satisfy the following:~~ ~~• 3 Specified courses:~~ ~~○ SYDE 660C Systems Design Graduate Workshop 1 – Human Factors~~ ~~○ At least 2 from the following list:~~ ~~▪ SYDE 542 Interface Design or SYDE 543 Cognitive Ergonomics~~ ~~▪ SYDE 642 Cognitive Engineering Methods~~ ~~▪ SYDE 644 Human Factors Testing~~ ~~• Elective courses (at least 1 from the following list or an additional course from the Specified course list):~~ ~~○ SYDE 533 Conflict Resolution~~ ~~○ SYDE 662 Systems Design Graduate Workshop 2~~ ~~○ SYDE 740 Advanced Cognitive Ergonomics~~ ~~• Note that only one 500 level course may be used to satisfy the requirements of a Graduate Specialization. Therefore, if SYDE 542 or SYDE 543 is taken as a Specified course, then~~

Current primary program in the home unit: MEng in Systems Design Engineering Program Graduate Studies Academic Calendar content:	Proposed MEng in Systems Design Engineering - Health Technologies - Co-operative Program Graduate Studies Academic Calendar content:
• Note that only one 500 level course may be used to satisfy the requirements of a Graduate Specialization. Therefore, if SYDE 575 is taken as a specified course, then SYDE 544 cannot be taken to satisfy the Elective course requirement. • All course selections are arranged by the student. • Note: these requirements are in addition to satisfactory completion of any transitional courses that may be specified at the time of admission.	~~SYDE 533 cannot be taken to satisfy the Elective course requirement.~~ ~~4. Graduate Specialization in Mechatronic and Physical Systems~~ ~~• Students must satisfy the following:~~ ~~• 3 Specified courses:~~ ~~○ SYDE 660D Systems Design Graduate Workshop 1 - Mechatronic & Physical Systems~~ ~~○ At least 2 from the following list:~~ ~~▪ SYDE 553 Advanced Dynamics~~ ~~▪ SYDE 652 Dynamics of Multibody Systems~~ ~~▪ SYDE 655 Optimal Control~~ ~~▪ SYDE 682 Advanced MEMS, Physics, Design & Fabrication~~ ~~▪ SYDE 683 Modelling, Simulation & Design of MEMS~~ ~~▪ SYDE 750 Modelling Continuum Systems~~ ~~• Elective courses (at least 1 from the following list or an additional course from the Specified course list):~~ ~~○ SYDE 531 Design Opt. under Probabilistic Uncertainty~~ ~~○ SYDE 631 Time Series Modelling~~ ~~○ SYDE 661 Model-based robust design~~ ~~○ SYDE 662 Systems Design Graduate Workshop 2~~ ~~• Note that only one 500 level course may be used to satisfy the requirements of a Graduate Specialization. Therefore, if SYDE 553 is taken as a Specified course, then SYDE 531 cannot be taken to satisfy the Elective course requirement.~~ ~~5. Graduate Specialization in Vision, Image and Signal Processing~~ ~~• Students must satisfy the following:~~ ~~• 3 Specified courses:~~ ~~○ SYDE 660E Systems Design Graduate Workshop 1 - Vision, Image & Signal Processing~~ ~~○ At least 2 from the following list:~~ ~~▪ SYDE 575 Image Processing~~ ~~▪ SYDE 671 Advanced Image Processing~~ ~~▪ SYDE 677 Medical Imaging~~ ~~• Elective courses (at least 1 from the following list or an additional course from the Specified course list):~~ ~~○ SYDE 544 Biomed Measure & SIP~~ ~~○ SYDE 633 Remote Sensing Systems~~

Current primary program in the home unit: MEng in Systems Design Engineering Program Graduate Studies Academic Calendar content:	Proposed MEng in Systems Design Engineering - Health Technologies - Co-operative Program Graduate Studies Academic Calendar content:
	~~SYDE 662 Systems Design Graduate Workshop 2~~ ~~SYDE 672 Statistical Image Processing~~ ~~SYDE 673 Video Processing & Analytics~~ ~~SYDE 674 3D Computer Vision & Imaging~~ ~~SYDE 675 Pattern Recognition~~ • ~~Note that only one 500 level course may be used to satisfy the requirements of a Graduate Specialization. Therefore, if SYDE 575 is taken as a specified course, then SYDE 544 cannot be taken to satisfy the Elective course requirement.~~ • All course selections are arranged by the student. • Note: these requirements are in addition to satisfactory completion of any transitional courses that may be specified at the time of admission. • **Graduate Studies Work Report** ○ Students must complete one or two work-term experiences. For each work experience, a work report must be submitted to the Department for review to earn credit for the work report. ○ Students are responsible for following the roles and responsibilities of Cooperative and Experiential Education (CEE).

How will students currently registered in the program be impacted by these changes?

Current students will not be impacted. The program will be open to new students once it goes into effect.

Department/School approval date (mm/dd/yy):
Reviewed by GSPA (for GSPA use only) ☒ date (mm/dd/yy): 12/05/24
Faculty approval date (mm/dd/yy):
Senate Graduate & Research Council (SGRC) approval date (mm/dd/yy):
Senate approval date (mm/dd/yy) (if applicable):

INDUSTRY AND JOB ANALYSIS FOR MASTER OF HEALTH TECHNOLOGIES

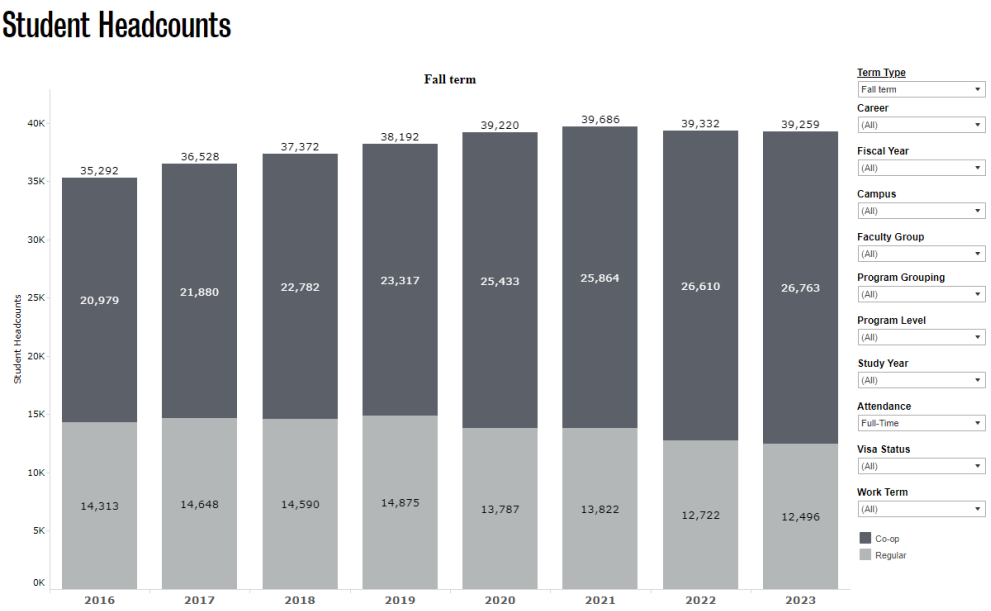
Prepared by Justin Kieffer, Faculty Relations Manager, Math & Eva Skuza, Faculty Relations Manager, Engineering

July 3, 2024

Introduction

Labour market and employment trends are volatile and may change quickly. While this report is a snapshot in time, Co-operative and Experiential Education (CEE) actively monitors labour market and employment changes. Additional insights will be provided through regular updates at the faculty and program level and more detailed data is provided in Cyclical Program Reviews.

As of fall 2023, approximately 68% or roughly 26,800 students at the University of Waterloo are enrolled in co-operative education programs. Both the number of students in co-op and the proportion of students in co-op programs have continued to increase annually (68% in 2023 vs 60% in 2017).



Graduate students in co-op programs currently represent a small proportion (~1.5%) of total co-op enrollment, with 390 total students as of fall 2023. The Faculty of Engineering has expanded its master level programs that include co-operative education as part of degree requirements. The most recently added programs are:

- Chemical Engineering
- Civil and Environmental Engineering
- Mechanical and Mechatronics Engineering
- Electrical and Computer Engineering

Upcoming programs are:

- Systems Design Engineering

Enrolment in these programs has increased the number of Engineering masters co-op students by approximately 100 students in 2024; an increase of approximately 26% in the number of masters co-op students at the University of Waterloo.

The proposed Master of Health Technologies program is expected to add an additional 50 co-op students.

To ensure that masters students are set up to succeed in co-op, Co-operative and Experiential Education (CEE) has conducted a competitive analysis to understand co-op employment trends, job opportunities, external labour markets, and surveyed employer interest in Master of Engineering co-op students.

Employment Trends

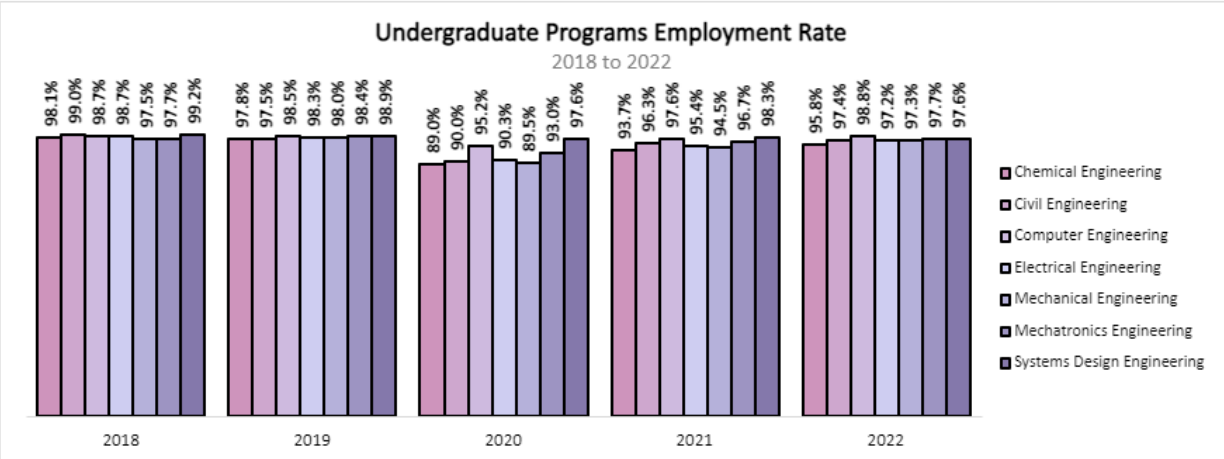
To get a sense of expected employment success for students in the Health Technologies program, CEE analyzed recent employment rates of comparable undergraduate Engineering co-op programs at Waterloo and existing master's co-op programs in the faculties of Engineering and Mathematics.

The list of programs used for comparison are listed below. While most data is summarized at the aggregate level, program level data is available upon request.

Undergraduate	Graduate
Chemical Engineering	Applied Mathematics
Civil Engineering	Computer Science
Computer Engineering	Data Science & Artificial Intelligence
Electrical Engineering	Management Sciences Engineering
Mechanical Engineering	Mechanical & Mechatronics Engineering
Mechatronic Engineering	
Systems Design Engineering	

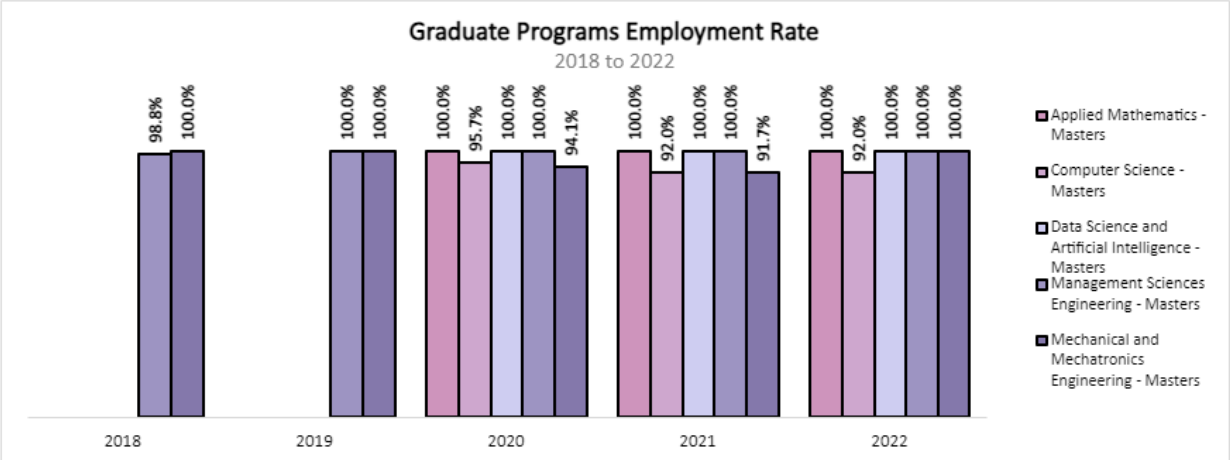
Employment rates in 2020 and 2021 were heavily impacted by the Covid-19 pandemic, the included undergraduate co-op programs in Engineering averaged an employment rate of 96.6% over the reporting period, representing more than 30,000 employed work terms. Undergraduate students in Chemical and Mechatronic Engineering programs were slightly less successful from an overall employment perspective than the other listed programs.

Shifting labour markets and economic downturns may indicate that additional focus on supporting these students in their job search by ensuring they access specific workshops and appointments offered by the Centre for Career Development to expand their work search would be beneficial. By searching for jobs both in and outside of WaterlooWorks, Undergraduate and Graduate students would uncover more work opportunities.



Unlike the undergraduate programs, co-op is not a requirement of all M. Eng degrees and students can

switch out of the co-op program, which impacts employment rates. Master's students in existing co-op programs have historically been very successful from an employment perspective, with employment rates often outperforming those at the undergraduate level. M. Eng co-op students are strongly competitive from an employment standpoint due to smaller program sizes, expertise and skills of students, different support models and increased flexibility in work term scheduling contributing to employment rate differences.



Where Students Work

Analysis by industry indicates strong alignment between the skills developed by students in the specific undergraduate Engineering programs and the sectors in which they worked. Computer systems, Architectural/building engineering, software development, universities and motor vehicle manufacturing are the five largest industries by volume of the specified undergraduate Engineering employment. Substantial growth has been observed in the Management, Scientific and Technical Consulting Services industry and its related organizations.

Overall Top 10 NAICS Codes by Employed Count for Compareable Undergraduate Programs from 2018 to 2022

Employer NAICS Code	2018 # Emp. / Rank	2019 # Emp. / Rank	2020 # Emp. / Rank	2021 # Emp. / Rank	2022 # Emp. / Rank	Overall 2018 to 2022	2018 to 2022	Overall Net Change
5415 - Computer Systems Design and Related Services	703 1	686 ▭ 1	601 ▭ 1	626 ▭ 1	679 ▭ 1	3295		0
5413 - Architectural, Engineering and Related Services	620 2	577 ▭ 2	444 ▼ 3	459 ▭ 3	534 ▲ 2	2634		0
5112 - Software Publishers	366 3	395 ▭ 3	375 ▼ 4	409 ▭ 4	440 ▲ 3	1985		0
6113 - Universities	333 4	326 ▭ 4	498 ▲ 2	520 ▭ 2	276 ▼ 5	1953		-1
3361 - Motor Vehicle Manufacturing	223 5	206 ▭ 5	245 ▭ 5	239 ▭ 5	319 ▲ 4	1232		1
5416 - Management, Scientific and Technical Consulting Services	164 9	181 ▲ 6	216 ▭ 6	210 ▭ 6	217 ▭ 6	988		3
5614 - Business Support Services	206 6	161 ▼ 7	141 ▼ 8	142 ▲ 7	122 ▼ 10	772		-4
3344 - Semiconductor and Other Electronic Component Manufacturing	182 7	133 ▼ 12	142 ▲ 7	131 ▼ 8	166 ▲ 7	754		0
3342 - Communications Equipment Manufacturing	128 12	143 ▲ 9	137 ▭ 9	125 ▭ 9	111 ▼ 11	644		1
3363 - Motor Vehicle Parts Manufacturing	165 8	126 ▼ 14	97 ▲ 12	124 ▲ 10	123 ▲ 9	635		-1

For graduate students, the landscape is slightly different in terms of industries that students are most likely to work in, which could be attributed to the skills and interests of the students in the sample list of programs used for comparison.

Overall Top 10 NAICS Codes by Employed Count for Compareable Graduate Programs from 2018 to 2022

Employer NAICS Code	2018 # Emp. / Rank	2019 # Emp. / Rank	2020 # Emp. / Rank	2021 # Emp. / Rank	2022 # Emp. / Rank	2018 to 2022	2018 to 2022	Overall Net Change
5415 - Computer Systems Design and Related Services	7 4	5 ▲ 3	10 ▼ 4	11 ▲ 3	28 ▲ 2	61		▲ 2
5221 - Depository Credit Intermediation	9 3	11 ▲ 2	7 ▼ 6	6 ▭ 6	8 ▲ 5	41		▼ -2
5173 - Telecommunications Resellers	47	▲ 38	19 ▲ 2	12 ▭ 2	7 ▼ 7	38		▲ 40
4451 - Grocery Stores	2 18	1 ▼ 19	11 ▲ 3	4 ▼ 8	18 ▲ 3	36		▲ 15
5241 - Insurance Carriers	4 11	1 ▼ 19	7 ▲ 6	7 ▲ 5	6 ▼ 8	25		▲ 3
9120 - Provincial and Territorial Public Administration	47	1 ▲ 19	▼ 37	8 ▲ 4	9 ▭ 4	18		▲ 43
3361 - Motor Vehicle Manufacturing	5 5	4 ▲ 4	▼ 37	3 ▲ 12	6 ▲ 8	18		▼ -3
5112 - Software Publishers	5 5	2 ▼ 8	3 ▼ 9	4 ▲ 8	4 ▼ 11	18		▼ -6
5412 - Accounting, Tax Preparation, Bookkeeping and Payroll Services	5 5	▼ 38	2 ▲ 12	2 ▼ 20	8 ▲ 5	17		▭ 0
6113 - Universities	47	▲ 38	8 ▲ 5	6 ▼ 6	2 ▼ 23	16		▲ 24

Focusing on industries related to health technologies, CEE analyzed recent co-op hiring data to understand the potential to source relevant employment opportunities for students in this program from

within the existing hiring base. More than 2,500 organizations by NAICS are actively participating in the co-op hiring process in relevant professional, scientific/technical services and health care industries.

UW Data - Count WW Organiations with NAICS Codes	Active
Professional, scientific and technical services	**1,979**
5415 - Computer Systems Design and Related Services	1,007
5416 - Management, Scientific and Technical Consulting Services	454
5417 - Scientific Research and Development Services	188
5419 - Other Professional, Scientific and Technical Services	330
Health care and social assistance	**554**
6211 - Offices of Physicians	36
6212 - Offices of Dentists	19
6213 - Offices of Other Health Practitioners	223
6214 - Out-Patient Care Centres	29
6215 - Medical and Diagnostic Laboratories	21
6216 - Home Health Care Services	19
6219 - Other Ambulatory Health Care Services	5
6221 - General Medical and Surgical Hospitals	56
62211 - Paediatric Hospitals	2
6222 - Psychiatric and Substance Abuse Hospitals	3
6223 - Specialty (except Psychiatric and Substance Abuse) Hospitals	7
6231 - Nursing Care Facilities	17
6232 - Residential Developmental Handicap, Mental Health and Substance Abuse Facilitie	17
6233 - Community Care Facilities for the Elderly	15
6239 - Other Residential Care Facilities	13
6241 - Individual and Family Services	56
6242 - Community Food and Housing, and Emergency and Other Relief Services	12
6243 - Vocational Rehabilitation Services	4
Overall Total	**2,533**

Speifically, within the Healthcare industry, by volume of students hired, the 10 largest organizations have accounted for 377 work terms since 2019 (587 hires by all organizations in these NAICS).

Organization Name	Top 10 Organizations by Work Terms (2019 to 2023)
University Health Network	107
Unity Health Toronto	87
The Hospital for Sick Children	60
Sunnybrook Health Sciences Centre	31
Swift Medical Inc	18
Scispot.io	16
Centre For Addiction and Mental Health	13
William Osler Health System	12
Grand River Hospital	9
London Health Sciences Centre	8
Mount Sinai Hospital	8
Mackenzie Health	8
Grand Total	**377**

Some of the most common job titles held by students in these positions include: Project Coordinator, Research Assistant, QA Tester, Special Project Engineering Assistant, Software Engineering and Software Developer.

Overall co-op hiring has grown in these industries since 2019, with recent hiring peaking in 2022.

UW Hiring Data (All Students)	2019	2020	2021	2022	2023	Trend 2019 to 2023	Net Growth/Decline
Professional, scientific and technical services	**3,125**	**2,690**	**3,489**	**3,714**	**3,421**		**296**
5415 - Computer systems design and related services	2,060	1,697	2,098	2,195	1,910		**-150**
5416 - Management, scientific and technical consulting services	621	634	815	858	787		**166**
5417 - Scientific research and development services	234	213	342	399	383		**149**
5419 - Other professional, scientific and technical services	210	146	234	262	341		**131**
Health care and social assistance	**787**	**779**	**942**	**1,140**	**1,130**		**343**
6211 - Offices of physicians	14	10	40	58	78		**64**
6212 - Offices of dentists	2	10	12	17	18		**16**
6213 - Offices of other health practitioners	156	175	243	256	298		**142**
6214 - Out-patient care centres	69	78	44	60	50		**-19**
6215 - Medical and diagnostic laboratories	28	34	43	51	41		**13**
6216 - Home health care services	21	26	36	19	25		**4**
6219 - Other ambulatory health care services	6	4	2	2	4		**-2**
6221 - General medical and surgical hospitals	310	283	310	453	351		**41**
62211 - Paediatric Hospitals	44	33	42	31	46		**2**
6222 - Psychiatric and substance use hospitals	8	1	3	3	3		**-5**
6223 - Specialty hospitals (except psychiatric and substance use)	19	16	18	11	21		**2**
6231 - Nursing care facilities	28	20	27	26	48		**20**
6232 - Residential facilities for persons with an intellectual or developmental disability, a mental health or substance use condition	43	58	63	75	72		**29**
6233 - Community care facilities for the elderly	11	18	24	22	17		**6**
6239 - Other residential care facilities	2	3	6	4	4		**2**
6241 - Individual and family services	21	3	19	42	45		**24**
6242 - Community food and housing, and emergency and other relief services	2	4	2	4	2		**0**
6243 - Vocational rehabilitation services	3	3	8	6	7		**4**

Hiring of Engineering students, specifically within the health care and social assistance NAICS have remained relatively flat, indicating opportunities to enhance and promote these roles to students in Engineering as well as to further promote the skills and knowledge of health technologies students to these organizations.

UW Hiring Data (Eng Only)	2019	2020	2021	2022	2023	Trend 2019 to 2023	Net Growth/Decline
Professional, scientific and technical services	**1,448**	**1,364**	**1,510**	**1,710**	**1,537**		**89**
5415 - Computer systems design and related services	978	874	918	1,036	865		**-113**
5416 - Management, scientific and technical consulting services	263	321	343	354	319		**56**
5417 - Scientific research and development services	96	105	147	198	185		**89**
5419 - Other professional, scientific and technical services	111	64	102	122	168		**57**
Health care and social assistance	**115**	**110**	**90**	**156**	**114**		**-1**
6211 - Offices of physicians		2	3	7	10		**10**
6212 - Offices of dentists				2	2		**2**
6213 - Offices of other health practitioners	14	10	10	6	4		**-10**
6214 - Out-patient care centres	10	10	1	6	2		**-8**
6215 - Medical and diagnostic laboratories	5	11	9	19	11		**6**
6216 - Home health care services	3	3	4	2			**-3**
6219 - Other ambulatory health care services	3				1		**-2**
6221 - General medical and surgical hospitals	54	60	49	99	67		**13**
62211 - Paediatric Hospitals	23	13	10	8	11		**-12**
6222 - Psychiatric and substance use hospitals	1						**-1**
6223 - Specialty hospitals (except psychiatric and substance use)			2	2	2		**2**
6231 - Nursing care facilities					1		**1**
6232 - Residential facilities for persons with an intellectual or developmental disability, a mental health or substance use condition	1			1			**-1**
6233 - Community care facilities for the elderly		1	2				**0**
6239 - Other residential care facilities							**0**
6241 - Individual and family services	1			4	3		**2**
6242 - Community food and housing, and emergency and other relief services							**0**
6243 - Vocational rehabilitation services							**0**

Analysis of the relevant occupation codes (NOCS) that Health Technologies are well suited to pursue indicate ongoing overall growth, but also indicate a need for further exploration on ways to increase Engineering student participation in these occupations.

UW Hiring Data (All Students)	2019	2020	2021	2022	2023	Trend 2019 to 2023	Net Growth/Decline
1122 – Professional occupations in business management consulting	1543	1445	1923	1899	1793		250
1211 – Court reporters, transcriptionists, records management technicians and statistical officers	45	47	66	62	72		27
2147 – Computer engineers (except software engineers and designers)	851	680	646	932	775		-76
2171 – Information systems analysts and consultants	820	643	776	807	764		-56
2172 – Database analysts and data administrators	395	472	589	656	657		262
2174 – Computer programmers and interactive media developers	774	709	726	744	678		-96
2211 – Chemical technologists and technicians	87	65	54	83	89		2
2281 – Computer network technicians	44	34	16	27	37		-7
4165 – Health policy researchers, consultants and program officers	60	43	78	69	75		15

UW Hiring Data (Eng Only)	2019	2020	2021	2022	2023	Trend 2019 to 2023	Net Growth/Decline
1122 – Professional occupations in business management consulting	348	422	468	459	418		70
1211 – Court reporters, transcriptionists, records management technicians and statistical officers	13	9	11	9	9		-4
2147 – Computer engineers (except software engineers and designers)	494	424	368	518	417		-77
2171 – Information systems analysts and consultants	307	280	303	324	328		21
2172 – Database analysts and data administrators	106	160	142	188	174		68
2174 – Computer programmers and interactive media developers	379	366	307	322	276		-103
2211 – Chemical technologists and technicians	38	36	28	45	40		2
2281 – Computer network technicians	20	17	6	14	24		4
4165 – Health policy researchers, consultants and program officers	3	1	2	0	11		8

As well as analyzing the current co-op landscape pertaining to relevant graduate and undergraduate co-op programs as a proxy for the upcoming Health Technologies program, CEE also analyzed external labour market data to understand relevant industry trends and business development opportunities to support co-op program growth.

Statistics Canada Labour Force data shows growth from 2019 to 2023 in terms of the number of people employed in the Professional, scientific, and technical services and the health care and social assistance industries.

NAICS Data (Canada)

NAICS Sector	2019	2020	2021	2022	2023	Trend 2019 to 2023	Net Growth/Decline
Professional, scientific and technical services [54]	1,343,400	1,358,900	1,470,200	1,581,900	1,645,500		302,100
Health care and social assistance [62]	1,937,900	1,908,000	1,982,300	2,061,900	2,131,000		193,100

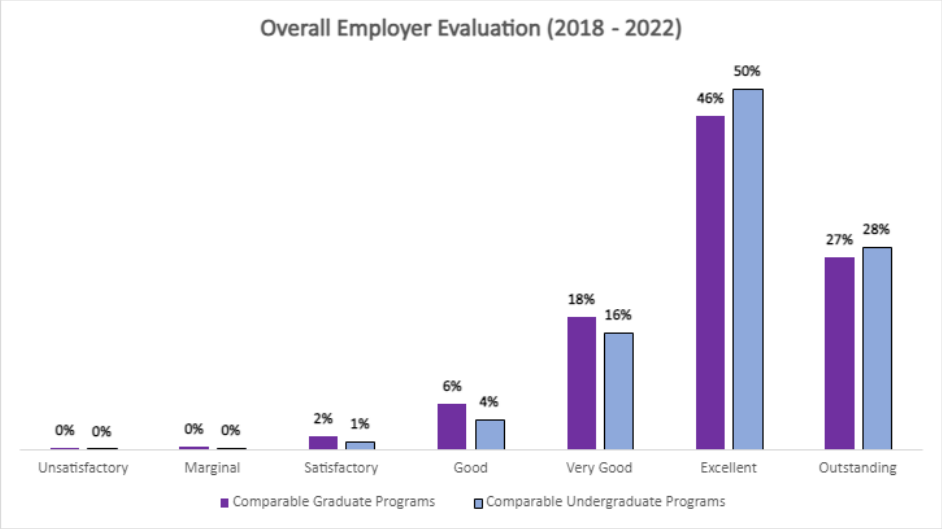
Similarly, growth in the number of Canadians working in occupations relevant to health technologies have also continued to grow over this time period.

NOCS Data

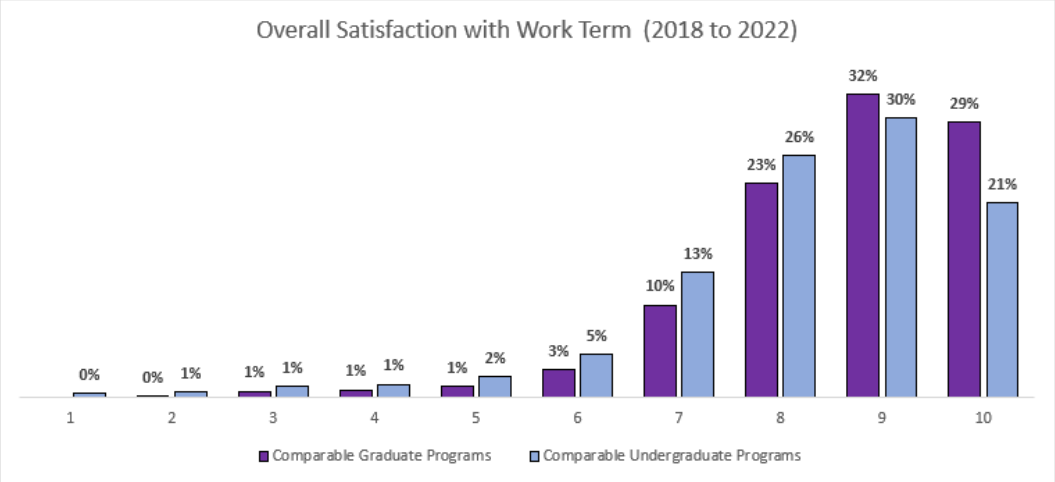
NOC	2019	2020	2021	2022	2023	Trend 2019 to 2023	Net Growth/Decline
Professional occupations in business [112]	334,500	365,900	398,700	421,600	429,700		95,200
Administrative and financial supervisors and specialized administrative occupations [12]	530,200	526,300	596,700	601,100	654,900		124,700
Professional occupations in applied sciences (except engineering) [212]	586,000	660,900	733,200	791,900	778,000		192,000
Professional occupations in engineering [213]	236,700	232,400	265,000	275,100	277,900		41,200
Technical occupations related to natural and applied sciences [22]	533,400	541,700	512,400	544,400	543,700		10,300
Health treating and consultation services professionals [311]	196,100	204,300	208,700	206,300	203,900		7,800
Therapy and assessment professionals [312]	67,200	71,800	71,800	71,800	84,300		17,100
Technical occupations in health [32]	257,200	263,700	270,900	283,200	301,900		44,700
Professional occupations in government services [414]	190,900	189,400	224,000	235,300	250,000		59,100

Student Experience

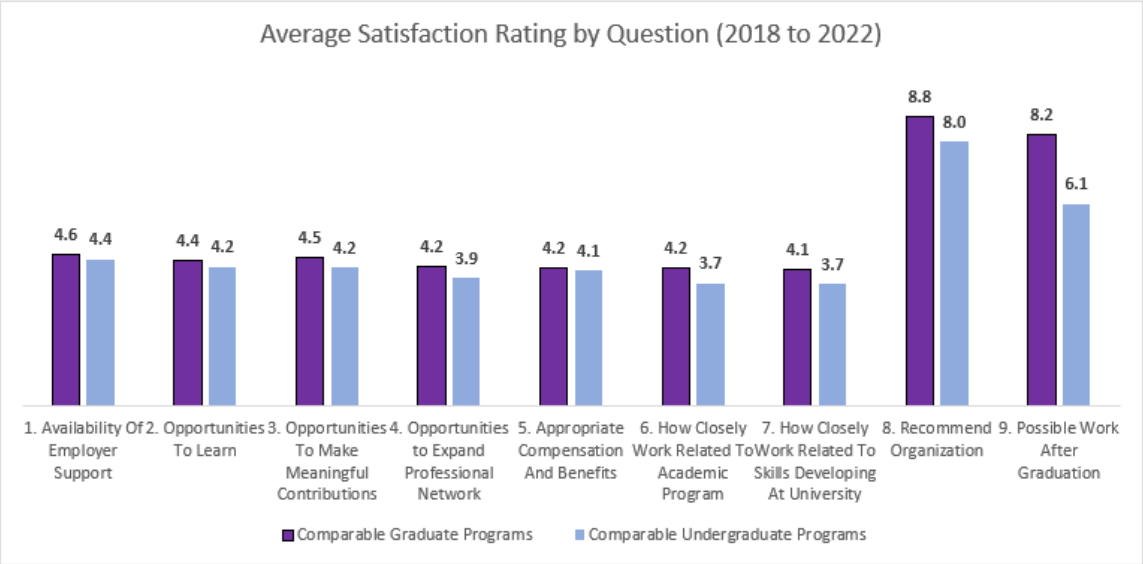
Analysis of evaluation data for comparable co-op programs reveals that undergraduate and graduate students received similar, strong overall evaluation ratings from their employers. The percentage of undergraduate students in comparable programs who received a 'Very Good' to 'Outstanding' rating was slightly higher than that of graduate co-op students (95% vs 92%).



Graduate students do appear to be more satisfied with their work term experiences compared to undergraduate students in comparable programs, with 84% of students rating their overall satisfaction an '8' or above, compared to 76% of undergraduate students (the undergraduate average is on par with the overall distribution for all students over this timeframe). This may indicate that students in graduate co-op programs are more likely to find employment in jobs that strongly align with their expectations.



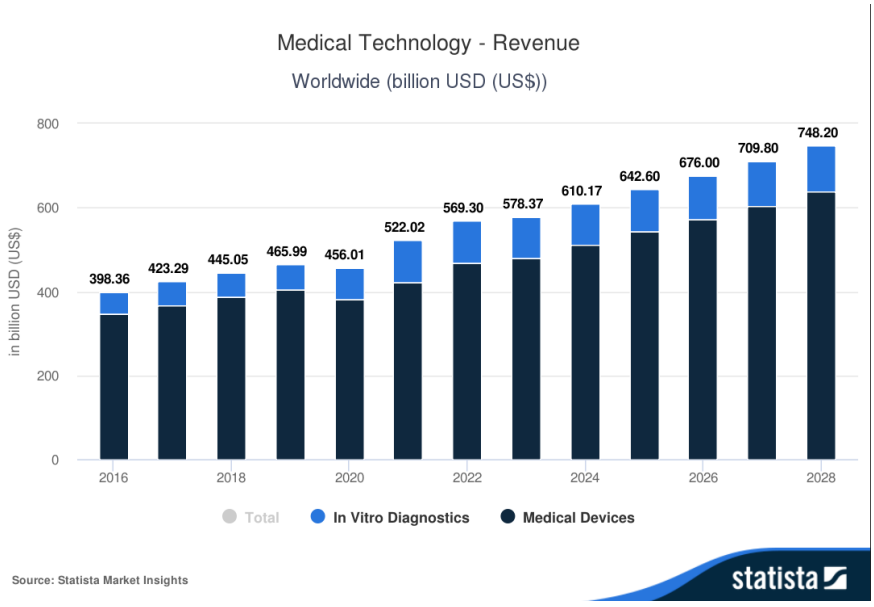
Graduate students also rate their overall average satisfaction on each of the individual work term attributes slightly higher than undergraduate students in comparable programs. Graduate co-op students are significantly more likely to rate the possibility of working with their employer post-graduation higher than undergraduate students. This may be indicative of a different employment approach or strategy by the organizations hiring graduate co-op students and the fact that these students are closer to program completion.



External Industry Projections

To understand the outlook of the medical and health technologies market, CEE analyzed industry projections conducted by Statista, which project continued growth out to 2028.

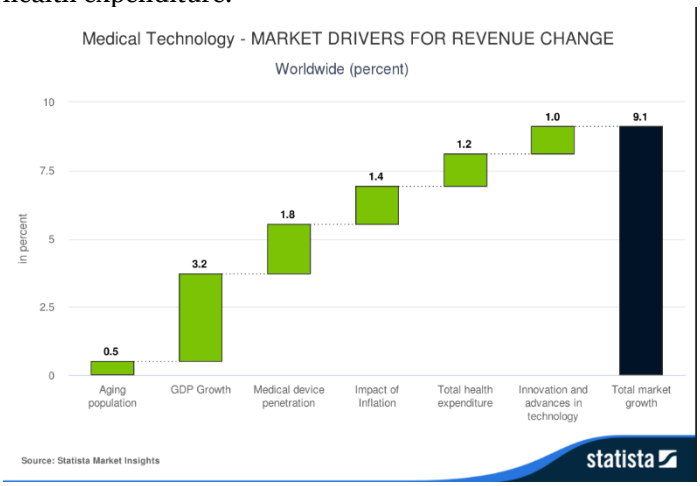
Medical Technology – The Medical Technology market, which encompasses various markets, including Medical Devices, is anticipated to witness significant revenue growth in the coming years. By 2024, the market is projected to reach a staggering US$610.20bn worldwide.



Among these markets, Medical Devices are expected to dominate, with a projected market volume of US$511.20bn by 2024. Furthermore, the Medical Technology market is expected to demonstrate a steady annual growth rate of 5.23% from 2024 to 2028.

As a result, the market volume is estimated to reach US$748.20bn by 2028. In terms of global comparison, the United States is poised to generate the highest revenue in the Medical Technology market.

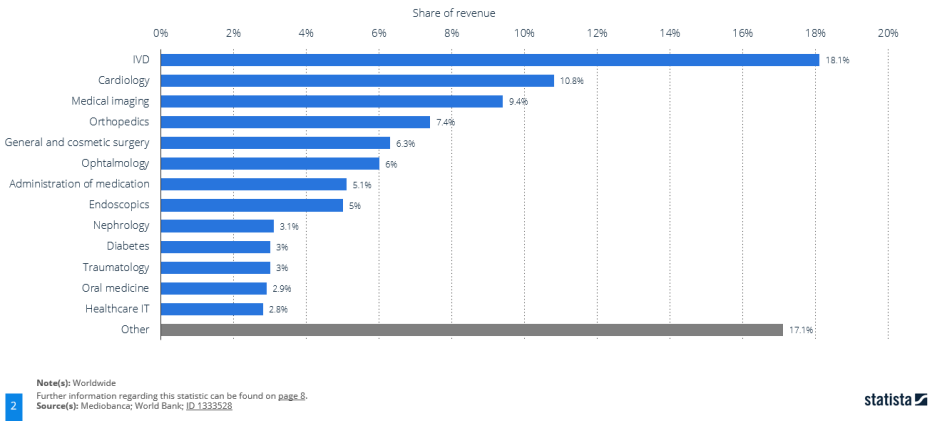
This growth is expected to be driven by overall GDP growth, increased device penetration globally, inflation and increased health expenditure.



In 2021, the medical technology industry generated revenue of approximately C$793 billion. The below statistic shows how global MedTech revenue was distributed across categories of different products. According to the data, in-vitro diagnostics generated 18.1 percent of the total MedTech revenue, while medical devices represented the remaining 81.9 percent of it. Among medical devices, the most important category was that of devices related to cardiology, which accounted for 10.8 percent of the total revenue of this industry.

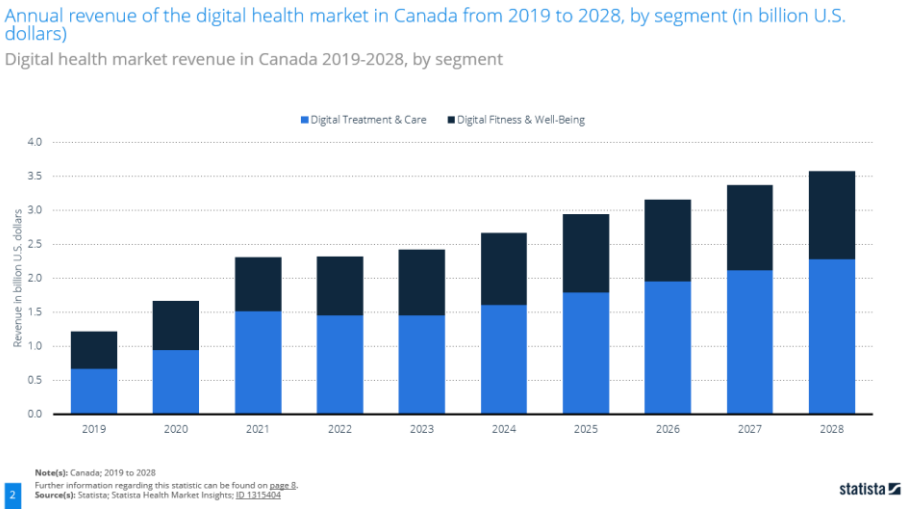
Distribution of the global revenue of medical technology industry in 2021, by category

Distribution of global revenue of MedTech industry 2021, by category



Digital Health in Canada

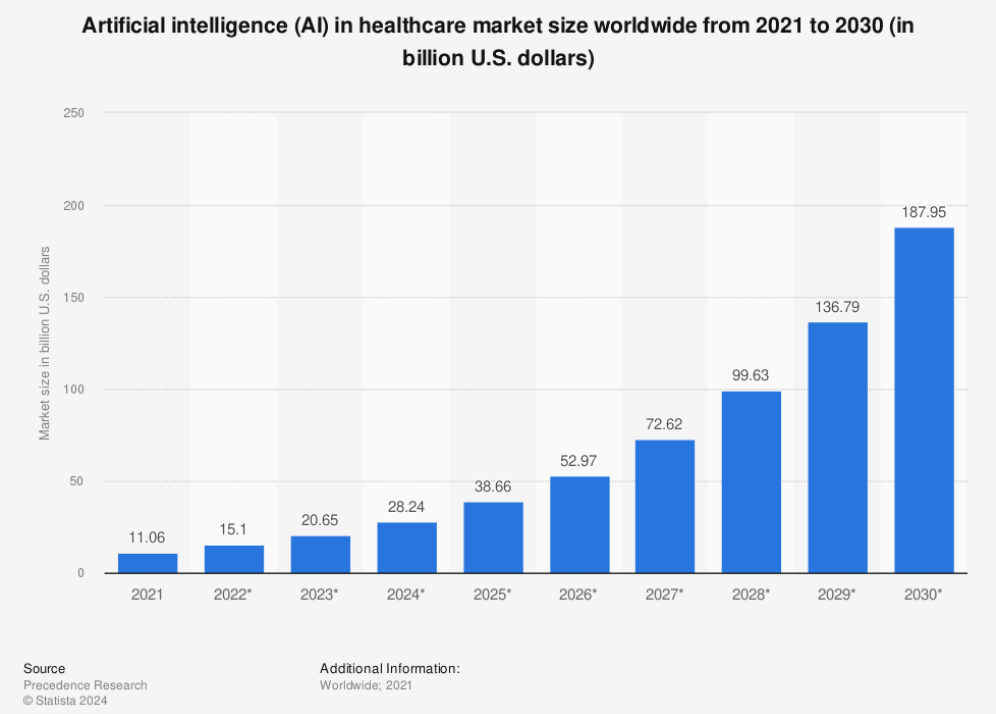
In 2022, the digital health market in Canada was forecast to reach revenues of approximately 2.4 billion U.S. dollars. This would represent a nine percent growth from the preceding year. When broken down, this market was projected to be made up of revenues of 1.4 billion U.S. dollars in the eHealth segment and 970 million U.S. dollars from the digital fitness and well-being division. The eHealth segment within digital health encompasses such things as doctor consultations which take place via technologies (such as video or online) rather than in-person, and devices that track the health metrics of a person.



Uses of AI in healthcare

As of 2021, around a fifth of healthcare organizations worldwide, which were surveyed, indicated they were in an early stage of adoption in regard to AI models. This meant that their models had been in production for less than two years. Fewer than ten percent of healthcare organizations had been utilizing AI for more than five years. The most common type of AI software in use in healthcare was functions related to healthcare data integration and natural language processing (NLP). The main intended users of AI among organizations in the mature stage of adoption were clinicians and providers, although 60 percent also reported that patients should be able to use the AI technologies implemented.

In 2021, the artificial intelligence (AI) in healthcare market was worth around 11 billion U.S. dollars worldwide. It was forecast that the global healthcare AI market would be worth almost 188 billion U.S. dollars by 2030, increasing at a compound annual growth rate of 37 percent from 2022 to 2030.



Labour Force Analysis

Employment and Social Development Canada (ESDC) uses the Canadian Occupational Projection System (COPS) and the National Occupational Classification (NOC, 2016 version) to identify occupations that may face labour shortage or labour surplus conditions over the projection period. The latest projections cover the 2022 to 2031 period. Their analysis of occupations expected to align with the Health Technologies program indicates:

Computer and information system managers – **SHORTAGE**: Over the period 2022-2031, the number of job openings (arising from expansion demand and replacement demand) are expected to total **42,600**, while the number of job seekers (arising from school leavers, immigration and mobility) is expected to total **53,400**.

This gap is not considered statistically significant, which means the number of job openings and seekers is projected to be similar over the 2022-2031 period. As such, the labour shortage conditions seen in recent years will not clear and are expected to persist over the projection period. Job openings are expected to arise equally from employment growth and retirements.

Health information management occupations – BALANCE: Over the period 2022-2031, the number of job openings (arising from expansion demand and replacement demand) are expected to total 10,500, while the number of job seekers (arising from school leavers, immigration, and mobility) is expected to total 10,600.

As job openings and job seekers are projected to be at relatively similar levels over the 2022-2031 period, the balance between labour supply and demand seen in recent years is expected to continue over the projection period.

Software engineers and designers – SHORTAGE: Over the period 2022-2031, the number of job openings (arising from expansion demand and replacement demand) for Software engineers and designers are expected to total 44,300, while the number of job seekers (arising from school leavers, immigration and mobility) is expected to total 48,800.

This gap is not considered statistically significant, which means the number of job openings and seekers is projected to be similar over the 2022-2031 period. As such, the labour shortage conditions seen in recent years will not clear and are expected to persist over the projection period. Employment is projected to grow at a significantly higher rate than the average of all occupations. As a result, job creation will represent around 68% of all openings, a proportion that is substantially above the average of all occupations (about 37% of openings). Most of these workers are employed in the computer systems design and related services industry; in telecommunications, information, and culture services; as well as in finance, insurance, real estate, and leasing services. Computer systems design will continue to outperform most industries in terms of production and employment growth, as demand is expected to be supported by technological changes. Demand for workers in this occupation will continue to be driven by the need for businesses and governments to upgrade their ICT systems to keep up with the most recent technologies and remain competitive.

Strategic Planning at UWaterloo

Part of the "Waterloo at 100" strategic plan includes Global Futures, which focuses on what lies ahead for humanity and the planet and inspires collaborative and interdisciplinary approaches in educational programs, research, and innovation activities. Under Global Futures are specific calls to action regarding Health Futures. As a result of these initiatives, we will be seeking to make connections with the Health Futures council to work alongside them, leverage partnerships and develop co-op opportunities for students.

Employer and Employment Relations Feedback

CEE reached out to selected, relevant employers as well as UWaterloo faculty members who have established connections to the health tech sector, by introducing the proposed program and soliciting feedback on the level of interest in future Health Technologies program students.

No faculty members and only one employer provided feedback at this time, therefore, more engagement both within Waterloo and outside of Waterloo will be necessary to identify new connections as well as those that already exist so that we can build a robust employment market for these students.

Employer Feedback

Employers were asked the same eight questions and one responded; their answers are listed below. Overall, the interest in the Health Technologies program seems to be positive, however, the employer noted that they are more interested in health sciences skills rather than engineering or business skills. It will be prudent for students in this program to focus on honing their specialized health sciences skills and to ensure they are able to differentiate themselves from other Engineering students.

Employer Survey Questions and Response from One Employer

1. Based on the introduction to the program provided, would you be interested in hiring co-op students from this program? (why or why not)

Possibly from the Electrical & Computer or Systems Design programs. We have had good bioinformatics undergraduate co-op students from both CS and Systems Design Engineering in the past. I would not be interested in students from the Chemical, Management Science, or Mechanical & Mechatronics programs.

2. What additional information about this program would be helpful for you to know?

Since Health Informatics is listed as an Area of Employment Interest, I would want to know what background the students have in the health sciences as opposed to engineering.

3. What specific skills would you expect students in this program to have?

Exceptional computer programming and scripting skills, experience with high-performance (i.e., cluster) computing and/or cloud computing, proficiency in scripting language (Python), advanced statistical analysis (likely proficiency in R/Bioconductor). These are more skills I would LIKE them to have, rather than EXPECT them to have, though.

4. Are there specific roles or job titles that you feel would be a good fit for Health Technologies co-op student within your organization?

Bioinformatician would be the most likely fit, or Programmer/Analyst. Not interested in business skills.

5. Which term(s) would you be most interested in hiring co-op students from this program? (Fall, Winter, Spring)

Any or all, we hire students continuously. The schedule above says only Spring or Fall though. The program might be more attractive if students were also available in Winter.

6. What length of time would you prefer to hire these co-op students for? (4, 8, 12 months)

8 months has usually worked well for us. 12 seems like too long a commitment, whereas 4 is often just enough time to bring a student up to speed. That works out well if they are returning, so if the intent is to have multiple terms, then 4-month terms would be ok if the student returns.

7. Is there anything else you'd like to add regarding the potential addition of the Bachelor of Business and Applied Science co-op program at the University of Waterloo?

I don't really understand the need to include the business part in here. There is an undergraduate Science & Business co-op program and I have never been impressed with the skills that these students have (and have rarely interviewed them).

8. Finally, do you have any suggestions on how Co-operative and Experiential Education at the University of Waterloo could better engage companies in your industry/sector?

You're doing a great job with us. Not sure if hitting the Toronto teaching hospitals (i.e., TAHSN network) at a higher level might get you more traction than interacting with individual institutions.

UWaterloo Employment Relations Team Feedback

The Employment Relations team within CEE was consulted and provided feedback on interactions they've had with other co-op employers as well as changes they've noticed in hiring patterns and in the current labour market.

The Employment Relations team stated that although there is demand for these kinds of specialized skillsets, this is a relatively new area of employment that is still developing, particularly in the private sector. As a result, competition between the faculties of Health and Engineering as well as competition with other universities in Ontario and Quebec suggests that students will need to engage early and often in their job search with a strong sense of independence. Employers have shared that the work in this sector does not lend itself to 4-month work terms since the responsibilities are complex and project-based and there is a strong interest to hire students for longer, 8-month work terms.

Students should also be aware that pay rates may not be as attractive as in the traditional "tech" sector. They should be encouraged to plan accordingly for remuneration to be more modest than in the tech sector.

GradWIL Pilot

Building on Waterloo's tradition and strength in experiential learning, students in graduate programs are encouraged to think beyond the classroom through engagement in work-integrated learning (WIL) opportunities. WIL provides students with crucial professional development, networking, funding, and opportunities to build skills for transition to the workforce. Through a partnership between Graduate Studies and Postdoctoral Affairs (GSPA) and Co-operative and Experiential Education (CEE), which began in 2020, the university continues to further develop graduate WIL opportunities.

Co-op is in the midst of a Graduate Work Integrated Learning pilot and in 2024 will be proposing an enhanced student support model and new program requirements for graduate students. It will leverage existing resources and infrastructure and provide customized resources and supports for programs and students. MEng programs and students involved in pilots are providing feedback and input to these changes.

Currently, the project team is also in the process of consulting with the campus community, including students, faculty, staff and senior leadership, to gather feedback on proposed models of grad WIL.

Conclusion

External industry data projects that the medical/health technologies sector will continue to grow over the next five years, driven by increases in automation, artificial intelligence, and research. This appears to

position the Health Technologies program well to address this market's needs, however, Health Technologies students will need to engage early and often in their job search with a strong sense of independence. These students will need to have clarity about their sense of purpose and their intended contributions to the sector so that CEE can support them in their job search. The planned student support model that has emerged from the GradWIL pilots will provide students with resources, programming, and advising to enable meaningful engagement with the health technologies sector.

The health technologies sector has not been an area of specific focus of opportunity development for CEE. The Health Technologies program will need engagement from those leading in Health Futures (researchers, faculty members and staff) so that relationships can be built in the sector to create opportunities for work terms and other WIL experiences for the M. Eng Health Technologies program.

CEE will leverage relationships with health-related organizations to identify potential health technology jobs, noting that historically, co-op hiring has been focused on patient care and research. To date, relatively few Engineering students are employed in health-related organizations, presenting both a challenge and opportunity for CEE and Waterloo to further investigate opportunities that would align with the skills students in the Health Technologies program would acquire.

CEE, the program, Health Futures researchers, faculty, staff, and students will need to partner to develop a plan to build a robust market of jobs for Health Technologies co-op students.

FACULTY OF ENVIRONMENT - GRADUATE STUDIES COMMITTEE

REPORT TO SENATE GRADUATE & RESEARCH COUNCIL March

17, 2025 (Major Modifications)

1. Program Revisions for Approval

a. Master of Climate Change (MCC)
   i. *Removing the Master's Research Paper study option.*
   ii. *Adding a new Coursework study option that does not require a Graduate Studies Internship. (Note: the new Coursework study option will appear as a separate program page in the Calendar.)*

Graduate Studies
Program Revision Template

Prior to form submission, review the content revision instructions and information regarding major/minor modifications. For questions about the form submission, contact Trevor Clews, Graduate Studies and Postdoctoral Affairs (GSPA).

Faculty: Environment

Program: Master of Climate Change (MCC)

Program contact name(s): Daniel Scott, Wesley Van Wychen, Teresa Wilson

Form completed by:

Description of proposed changes:
Note: changes to courses and milestones also require the completion/submission of the SGRC Graduate Studies Course/Milestone Form.

1) *Removing the Master's Research Paper study option.*
2) *Adding a new Coursework study option that does not require a Graduate Studies Internship.*
   Note: the new Coursework study option will appear as a separate program page in the Calendar.

Is this a major modification to the program? Yes

Rationale for change(s):

Based on input from students, faculty, and program administrative staff the recently completed cyclical review made a recommendation (number 5) to revise the Master's Research Paper (MRP) study option to address noted administrative challenges (i.e., Reviewers noted the concentrated service and supervisor load on limited faculty members, difficulties finding suitable supervisors when faculty get no teaching/supervision credit for MPRs and in the Spring term when many are away for research, conferences and annual leave) and pedagogical value (i.e., Reviewers suggested to integrate the MRP milestone into a course to increase instructional support). The program undertook a review of options to address this recommendation and after consultation with the MCC program instructors and the Department, removing the MRP study option and replacing it with an alternative coursework study option that includes an additional course was deemed the best option to improve the learning experience of students in terms of professional skills development and the program's learning outcomes.

Pedagogically the MRPs are limited value because many students enter this study option at the last possible moment (when the search for an internship is not successful) which reduces their time to develop a topic and find a suitable supervisor. The limited time for the MRP means research ethics is not possible, which restricts topic scope/methods available during an MRP. The written format of the MRP is standardized and is not a format that students found valuable for career development. Some students noted that other written products would be more valuable from a career skills perspective (i.e., the flexibility of outputs in the 'Climate Change Projects' course was noted by some as more career oriented).

As part of this program change, the program is also enhancing the research experience opportunities for students in the new coursework study option by partnering with other professional Masters programs in the Faculty of Environment (MEDI, MDP, SUSM and Planning) to offer an expanded and interdisciplinary 'Applied Research Projects' course in the Spring term when the MRP was offered. This will replace the current 'Climate Change Projects' course which had been offered in the Winter term to MCC and undergraduate students. The new course will provide students with program aligned applied projects (i.e., climate change related projects for MCC students), greater team project opportunities (i.e., expected class of 25-30), expanded potential clients (i.e., instructors from each program will bring project concepts from a range of organizations and canvas the

broader Faculty for additional external client-based or faculty research projects), and expanded professional development training (i.e., in areas such as project management, media engagement, and a range of common professional writing such as briefing notes, policy briefs). The new course will also directly address the cyclical reviewer's suggestion to provide non-internship study option MCC students with a class that supports professional research experience.

Proposed effective date: Term: Spring Year: 2025

Current Graduate Studies Academic Calendar (GSAC) page (include the link to the web page where the changes are to be made):

https://uwaterloo.ca/academic-calendar/graduate-studies/catalog#/programs/S176gkR0s3

Current Graduate Studies Academic Calendar content:	**Proposed Graduate Studies Academic Calendar content**:
Master of Climate Change (MCC) **Admit term(s)** • Fall **Delivery mode** • On-campus **Registration option(s)** • Full-time • Part-time **Study option(s)** • Coursework • ~~Master's Research Paper~~ **Length of program** • Full-time: 3 terms (12 months) • Part-time: 8 terms (32 months) **Admission requirements: Minimum requirements** • Students must have completed a four-year honours Bachelor degree (or equivalent) in a humanities, social science, health, engineering, science, or business discipline with an overall average of at least 75% in the final 20 courses (or last 2 years). • English language proficiency (ELP) (if applicable) **Admission requirements: Application materials** • Résumé • Supplementary information form • Transcript(s) **Admission requirements: References** • Number of references: 3 • Type of references: normally from academic sources, but may be from professional	**Master of Climate Change (MCC)** **Admit term(s)** • Fall **Delivery mode** • On-campus **Registration option(s)** • Full-time • Part-time **Study option(s)** • Coursework **Length of program** • Full-time: 3 terms (12 months) • Part-time: 8 terms (32 months) **Admission requirements: Minimum requirements** • Students must have completed a four-year honours Bachelor degree (or equivalent) in a humanities, social science, health, engineering, science, or business discipline with an overall average of at least 75% in the final 20 courses (or last 2 years). • English language proficiency (ELP) (if applicable) **Admission requirements: Application materials** • Résumé • Supplementary information form • Transcript(s) **Admission requirements: References** • Number of references: 3 • Type of references: normally from academic sources, but may be from professional

Current Graduate Studies Academic Calendar content:	Proposed Graduate Studies Academic Calendar content:
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Current Graduate Studies Academic Calendar content:	Proposed Graduate Studies Academic Calendar content:
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~~Master's Research Paper option: Milestone requirements~~ **~~Master's Research Paper~~** • ~~The Master's Research Paper will normally be completed in the Spring (third) term. Each student undertaking the research paper option will identify a topic and a suitable advisor in the first two terms in the program. The student will develop a research proposal for approval by their advisor. The research paper should be approximately 12,000 words/50 pages in length. The research paper is evaluated by the advisor and one reader designated by the Program Director.~~	**Coursework <u>with internship</u> option: Milestone requirements** **Graduate Studies Internship** • All internship students are required to spend the equivalent of one academic term as an intern working on climate change in the public or private sector, at a research institute, or for a non-governmental organization. It is the student's primary responsibility to identify potential organizations with which to undertake their internship, although some employers recruit for positions through the program. The work-term will normally take place in the third term of the program. The internship must be approved as being a suitable practical learning experience having sufficient climate change focus to be eligible. Students will be required to submit a short proposal outlining how the work of the organization and the internship position relates to the climate change program curriculum, the student's professional interests, and the professional experience sought through the internship. A final written report arising out of the internship experience will be required and will be evaluated.
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How will students currently registered in the program be impacted by these changes?

Full time students will not be impacted by these changes. Full time students typically complete the program in 12 months, so that those who entered in September 2024 will have completed the program under the existing study options before the revised program options are available in September 2025.

The very few part time students in the program will be given the option to complete the program with the options available when they entered (i.e., the coursework with Internship or MRP option) or opt for the new option available (i.e., the coursework study option with 8 courses instead of the MRP option).

Department/School approval date (mm/dd/yy): 10/25/24
Reviewed by GSPA (for GSPA use only) ☒ date (mm/dd/yy): 10/15/24
Faculty approval date (mm/dd/yy): 01/16/25
Senate Graduate & Research Council (SGRC) approval date (mm/dd/yy):
Senate approval date (mm/dd/yy) (if applicable):