Course Information

Overview

All Engineering Science students are required to complete a thesis. Your thesis provides an opportunity to conduct, document, and experience engineering related research as an undergraduate student. This course is structured to provide resources to support that process, in particular with the documentation of your research.

Students may select a project with any faculty member at the University of Toronto, as long as the proposed research topic is relevant to engineering *(when in doubt, please contact the thesis coordinator listed below).* Consider whether you want to work in a theoretical, clinical, design or laboratory setting, and a topic that you will enjoy exploring for a full semester or full year. Information on selecting a thesis topic and supervisor can be found on the ESC499 Quercus page (https://q.utoronto.ca).

While your final thesis document will be the main deliverable, the course has three other requirements; namely a proposal, an interim report and a presentation. Both the proposal and interim report will be directly applicable to your final thesis document and will help you build that final document throughout the year. The proposal will also give students applying for an NSERC graduate scholarship the opportunity to write a sample application. The presentation requirement gives you an opportunity to share your work and practice the communication of research and presentation skills. The Division publishes guidelines for all of these documents, but encourages students and supervisors to negotiate specific requirements that suit the nature of the thesis project.

COVID-19 Contingency Planning:

In planning your project with your supervisor, although we are planning for an in person experience, please develop a remote only contingency plan, in case we are unable to continue in person activities for a period of time. If you are performing work on site in a lab or other setting, you MUST adhere to the external site's COVID-19 policies and procedures.

Course Staff

In addition to your supervisor, course teaching and coordination staff will be available to provide support for the thesis research and writing process.

Thesis Coordinators

Alan Chong, Associate Professor, Teaching, Engineering Communication Program, ISTEP
Office: SF B670
Email: alan.chong@utoronto.ca

Majors Covered: Machine Intelligence, Electrical and Computer Engineering, Engineering Mathematics, Statistics, and Finance, Physics

Lisa Romkey, Associate Professor, Teaching, ISTEP
Office: BA2110
Email: lisa.romkey@utoronto.ca

Majors Covered: Biomedical Systems Engineering, Aerospace Engineering, Robotics, Energy Systems, Infrastructure

Thesis Teaching Assistant
TBA

Administration

Electronic Resources:

Quercus: available through https://q.utoronto.ca

Electronic resources, such as detailed requirements for each deliverable, links to research guides, and writing instruction will be made available on the ESC499 page on Quercus. Please log into Quercus and check your email regularly to ensure that you remain aware of the course requirements. Please ensure your Quercus notifications are turned on (to receive announcements by email), or check Quercus regularly for updates.

Additional introductory information is also available on the EngSci InfoHub Thesis page: https://q.utoronto.ca/courses/63598/pages/thesis-information .

Relevant Course Policies:

The policies described in this section are in addition to those described in the Engineering Calendar and on the University of Toronto web site. Students are reminded that they are expected to adhere to the "Code of Behaviour on Academic Matters", available online at: http://www.governingcouncil.utoronto.ca/Assets/Governing+Council+Digital+Assets/Policies/PDF/ppjun011995.pdf

They are also expected to adhere to the "Code of Student Conduct" available online at: http://www.governingcouncil.utoronto.ca/Assets/Governing+Council+Digital+Assets/Policies/PDF/ppjul012002.pdf

Students are also encouraged to explore and consult with the University of Toronto Academic Integrity Office, their thesis supervisors, or divisional thesis coordinator if they have any questions or concerns regarding academic integrity, and in particular plagiarism. Further information on the Integrity Office can be found online at: academicintegrity.utoronto.ca

Switching Between Full and Half-Year Thesis:

Students in the biomedical, energy systems, robotics, machine intelligence and physics options are required to complete a full year thesis, while students in the aerospace, electrical & computer, and engineering mathematics, statistics & finance options may complete a full (Y) or half (H:F/S) year thesis. If you are in an option in which you may choose a half or full year thesis and you decide to switch between the two, you must contact the year 3 & 4 advisor (engsci34@utoronto.ca), for approval. The deadlines are as follows:

- Switch from F or S to Y: September 21, 2022
- Switch from Y to F: September 21, 2022
- Switch from Y to S: January 22, 2023

Public Disclosure and Intellectual Property:

Students agree that by taking this course, a copy of your final thesis document will be submitted to the Division of Engineering Science and future students, faculty and staff will be permitted to review your work. In exceptional cases, such as where a patent is pending, this policy can be waived upon request, for a period of up to one year.

If your research includes an industrial partner or co-supervisor, you and your supervisor must review the University's policies on Intellectual Property: https://experientiallearning.utoronto.ca/guidelines-procedures/#IP and Non-Disclosure Agreements: https://experientiallearning.utoronto.ca/guidelines-procedures/#NDA

Submission and Late Policy:

Students are expected to submit all deliverables on time to the Division of Engineering Science AND their thesis supervisor (see Deliverables section for details). A deduction will apply to any students who submit their final thesis document late to the Division of Engineering Science. The final thesis document is due on the last day of classes (Dec. 7, 2022 for F, or April 14, 2023 for Y/S) by 11:59PM. A soft copy must be submitted to Quercus; please supply a copy to your supervisor in their preferred format (hard or soft copy). Students who submit their final thesis after the due date: **3% deduction per day.**

Please, plan your research and writing accordingly; exemptions will **only** be granted for medical reasons or other extenuating circumstances, with appropriate documentation.

Learning Outcomes

The thesis course is defined by six major learning outcomes, which reflect the Faculty's Graduate Attribute frameworks for investigation and communication:

1. Write a strong research proposal
   - Identify a gap or a problem in a science/engineering related field for the purposes of investigation
   - Clearly state the objective of the work
   - Develop a plan/method for addressing that gap/problem
2. Conduct and write a literature review, summarizing the state of a science/engineering related field
3. Execute a major, independent research project in a relevant field of study
   - Select a set of tests to be conducted
   - Select, plan and apply the methods for collecting the information
   - Identify limitations of the tests and methods used and their impact on results
4. Generate and analyze data as part of a major research project
   - Analyze the results
   - Formulate the conclusions
   - Compare conclusions with previous work
5. Present research gap/problem, objectives, methods, designs, results, and claims effectively
   - Structure a logical argument in an engineering context
   - Organize communication for an intended audience
   - Develop clear, correct and cohesive sentence and paragraph structures
   - Deliver oral communication effectively to an intended audience
   - Create clear and appropriate visuals to represent engineering ideas
6. Incorporate feedback from a variety of audiences to help improve the research approach, and the communication of scientific and engineering ideas

Activities and Workload

While the official course description lists the thesis course as including 3 hours lecture/week and 2 hours lab/week, the vast majority of contact and work time will be scheduled by you and your individual supervisor (or other laboratory personnel, if applicable), and depends greatly on the nature of your thesis

topic. Support for each of the thesis deliverables will be provided online through screencasts and synchronous workshops.

Time management is an important part of the thesis process. Many students spend a significant amount of time generating and analyzing data, and not enough time organizing and writing the thesis document. The thesis deliverables are designed to help students with this potential problem; however, the thesis process is a self-directed one. Keeping a thesis journal and setting deadlines for yourself can help you keep your work on track. You also need to carefully consider logistical issues in your timing – for example, when can your supervisor provide you with time to review your work, and how long will it take to order equipment and materials necessary for your research project.

Deliverables and Composition of Final Grade

There are multiple deliverables in this course; however, they should not be considered distinct documents. Rather, they should be treated as iterative, building towards the final document. Students will be revising previous documents for inclusion in future deliverables, and presenting thesis work in multiple media. More specific requirements for all deliverables will be published on the Quercus course website.

*(F) Fall Term Thesis (S) Spring Term Thesis (Y) Full Year Thesis Dates

Due Date	Deliverable	Weight
(F/Y) Sept. 23, 2022 (S) Nov. 14, 2022	**Thesis Topic & Supervisor Request Form:** This form outlines the proposed thesis topic and supervisor name for divisional approval. Students who submit this form late will receive a 1% deduction from their final thesis course grade.	Pass/ Fail
(F) Oct. 17, 2022 (Y) Oct. 17, 2022 (S) Jan. 23, 2023	**Thesis Proposal:** This 1 page document, modeled after part of the NSERC PGS-M Application, outlines the motivation and provides an overview of the proposed work. One copy must be submitted to the Division of Engineering Science, and one copy will be submitted directly to the supervisor. *Late submissions will be subject to a penalty of 10% per day.*	5%
(F) Nov. 7, 2022* (Y) Jan. 16, 2023* (S) Mar. 6, 2023*	**Interim Report:** This 10-15 page document includes a revised proposal as an introduction, a literature review, a summary of the work completed and work plan for next term (Y) or remainder of the thesis. One copy must be submitted to the Division of Engineering Science, and one copy will be submitted directly to the supervisor. *These are final due dates; depending on the nature of your own work, your supervisor may choose to set an earlier due date. Late submissions will be subject to a penalty of 10% per day.*	10%
(F) Dec. 1 - 7, 2022 (Y/S) Mar. 27 – Apr. 6, 2023	**Final Thesis Presentation:** This 10 minute talk, followed by 5 minutes of questions, presents the results of your thesis to a group of your peers and instructors. The assessment will focus on the communication of your research. Presentations will be open to faculty, staff, students and the public. Students will be asked to submit a copy of their presentation visuals to the Division of Engineering Science. *Parameters of this assignment may change depending on COVID-19 protocols.*	10%
(F) Dec. 7, 2022 (Y/S) Apr. 14, 2023	**Final Thesis Document:** This document includes an introduction, literature review (revised from your previous documents), and outlines the methods and results of your research. *Students who submit their thesis after Dec. 8, 2021 or April 9, 2022 will receive an additional 3% deduction per day.*	75%

Lectures and Workshops

Each of the deliverables will be supported by screencasts, online tutorials and remote, synchronous workshops and Q&A sessions. Times for these activities will be finalized closer to the assignment due dates. Multiple online tutorials have been posted on the course website to help students with components of the proposal, interim report and thesis; some will have a number of variants, for students doing traditional experimental research theses in specific disciplines, others for students doing design based work. Workshops involve small group classes in which students bring drafts of documents and work together, with a communication instructor, to improve their documents and will occur remotely until the University is open for in person activities. Students will have to pre-register for these workshops and bring drafts: registration is limited, especially for the proposal workshops.

Workshop Date	Workshop/Lecture
(F/Y) Early Oct (S) Mid Jan	**Proposal Hands On Workshop:** In these sessions, students will workshop their draft proposals with other students and a communication instructor, with the objective being multiple perspectives and types of feedback to incorporate into a revision of the document.
(F*) By appointment (Y/S) Early Jan	**Literature Review/ Interim Report Hands On Workshop:** In these sessions, students will focus on the organization of their literature review, summary and synthesis of relevant prior work, and defining a clear gap in the research for their own work.
(F*) By Appoinment (Y/S) Late Feb, Early Mar	**Results and Discussion Hands On Workshop:** In these sessions, students will focus on various methods for presenting results (especially visual), and using the data to make credible, qualified claims about their contribution to the field.
(F) Late Nov (Y/S) Mid Mar	**"Dry Run" Presentation Workshops:** This workshop will allow students to practice their oral presentation, and receive feedback on their content, organization, visual design and delivery prior to their actual oral presentation session.
Delivered Online `q.utoronto.ca`	**The Thesis Proposal:** Writing research goals, highlighting relevant literature, proposing methodology.
	The Literature Review: Summarizing and discussing previous work, laying the foundation for your thesis research.
	Writing your Thesis: Writing up methods and results, making credible claims from your results.
	Presenting your Thesis: Condensing your research into a 10 minute presentation, research slide design, and delivery.

Consultations

Additional support will be provided through one-on-one meetings with members of the Engineering Communication Program. These are designed to help students with the specific challenges of their thesis, especially questions about how to adjust the general requirements identified in the Thesis Deliverable assignments to your specific research project. Appointments can be made directly with Prof. Chong via email (alan.chong@utoronto.ca - please send requests with a list of available times and dates), or booked through the Engineering Communication Program's online system at: https://ecp.engineering.utoronto.ca/ecp-tutoring-centre/book-appointments/.

You may also consider making an appointment with the Engineering Librarian for literature review support (Tracy Zahradnik - `tracy.zahradnik@utoronto.ca`).

Pedagogical Research

Student work in ESC499 may be used anonymously in pedagogical research: randomly selected theses will be used to assess the validity and reliability of the thesis rubrics used in this course. All student data will be anonymized and identifying information removed before becoming part of the project. If you wish to be excluded, please indicate your desire to opt-out to Lisa Romkey via email (lisa.romkey@utoronto.ca).