TEP5500: Research Methods and Project Execution

Motivation

Successful completion of your graduate program relies on strong research, critical thinking and communication skills. These qualities will continue to help you achieve success whether you enter industry or pursue a career in academia. This course provides training in these areas while focusing on your current research project, simultaneously providing you with future training and immediately applicable strategies to help you complete your thesis research project. Through facilitated activity-based tutorials you will develop your research and project management skills, acquire strategies to identify and articulate a research hypothesis, set research goals and plan your research approach (including quantification of results and validation of quantitative metrics) and share research findings via oral, written and graphical communication.

Course Learning Objectives

Through this course you will learn how to:

- Define a research problem and justify why it is important
- Effectively design, plan, and conduct a (research) experiment and project
- Effectively communicate the rationale, results and conclusions of a project
- Develop confidence in identifying/making key strategic decisions for your thesis
- Develop a strategic plan for your graduate education and transition into the work force.

Course Administration

Course coordinators: Lydia Wilkinson | lydia.wilkinson@utoronto.ca

Attendance and Instruction

All direct instruction in this course is delivered via your tutorial by your course instructor. Attendance at tutorials is mandatory and tutorials are activity-based. Tutorials will occur in a zoom class room and discussion breakout rooms so **students must come prepared to participate in discussions and should have access to video chat.** It is expected you will have your camera on for group discussions. The table below provides a tentative schedule for classes through this semester as well as key deliverable due dates. Both classes and deliverables are subject to change with notice.

Schedule: The table below provides a tentative schedule for classes through this semester as well as key deliverable due dates. Both classes and deliverables are subject to change with advance notice.

Class	Торіс	Due
1	Introduction - Making the most out of your graduate training and	
	using an Individual Development Plan	
2	Project mind mapping and literature assessment – Identifying your	
	project gap	
3	Reading a paper - How to read an article effectively and efficiently	
4	Argument design and structure for papers and proposals	
5	Outlining your thesis rationale	
6	Planning your project objectives, goals, milestones and deliverables	
7	Communicating the significance of your thesis persuasively	
8	Research project execution – what are your barriers?	IDP

Class schedule

9	Effective communication in research teams	
10	How to achieve your project goals – writing a hypothesis	
11	Feedback on your motivation draft	
12	How to achieve your project goals – designing experiments	Project motivation and objectives
	Alumni interview presentation session	Alumni interview presentations
13	Effectively troubleshooting an experiment	
14	Outlining your research approach	
15	Identifying logic gaps in your research approach	
16	Visual design and caption writing for creating effective figures	
17	Creating a graphical abstract summarizing your thesis 1	
18	Creating a graphical abstract summarizing your thesis 2	
19	Communicating beyond your community - analogies	Graphical abstract
20	Effective slide design	
21	Understanding your presentation style	
22	Storyboarding your final presentation	
	University closed	
23	Research approach presentation	Research project oral presentation
24	Research approach presentation	Research project oral presentation
25	Final reflection – measuring your progress	

Deliverables

Deliverable values and dates

Deliverable	Value	Due Date
Individual Development plan	5%	
Oral report on alumni informational interview	10%	
Research project motivation and objectives: • Written outline	20%	
Research project approach • Graphic of experimental design plan	20%	
Research project oral presentation	30%	
Progress reflection and goal setting	5%	
Participation	10%	Ongoing

Team presentation on alumni interview and plan

Students will identify and interview a non-academic professional whose career path they are interested in. They will then partner with another student and as a team summarize what they learned from their interviews in a 6-minute presentation to the class with an additional 3 minutes for the audience to ask questions.

Research project outline: motivation and objectives

Students will submit a written outline describing in detail their thesis motivation and objectives. See assignment description for more details.

Research project outline: Graphic of experimental design plan

Students will submit a graphical overview of either their thesis project or one aim of their thesis project focusing on communicating the critical aspects of their experimental design and research approach/logic. See assignment description for more details.

Individual presentation on thesis motivation, objectives and approach

Students will share the background rationale and goals of their thesis project with the class, including the current state of the field, the research gap they will address and how their thesis objectives will address this gap. They will also describe how they plan to achieve their objectives, including experimental design and rationale, data quantification and interpretation and what conclusions each experiment will allow them to make. Presentations will be 9 mins with an additional 2 mins for audience questions.

Written reflection

Students will complete a structured reflection to assess their graduate learning and objectives against the graduate outline strategies for success document provided in the first class. This will encourage them to create a personalized graduate study plan moving forward.

Policies

This course was developed to ensure greater equity between all graduate students, by providing everyone with equal access in their first year of study to research methods, academic supports and communication strategies for success. In this course we actively encourage an environment where students are free to share their experiences and insights within a community that is supportive, respectful and engaged; the policies outlined below help to create this environment.

Inclusivity

You belong <u>here</u>. The University of Toronto commits to all students, faculty and staff that you can learn, work and create in a welcoming, respectful and inclusive environment. In this class, we embrace the broadest range of people and encourage their diverse perspectives. This team environment is how we will innovate and improve our collective academic success. You can read the evidence for this approach <u>here</u>.

We expect each of us to take responsibility for the impact that our language, actions and interactions have on others. Engineering denounces discrimination, harassment and unwelcoming behaviour in all its forms. You have rights under the <u>Ontario Human Rights Code</u>. If you experience or witness any form of harassment or discrimination, including but not limited to, acts of racism, sexism, Islamophobia, anti-Semitism, homophobia, transphobia, ableism and ageism, please tell someone so we can intervene. Engineering takes these reports extremely seriously. You can talk to anyone you feel comfortable approaching, including your professor or TA, an <u>academic advisor</u>, our <u>Assistant Dean</u>, <u>Diversity</u>, <u>Inclusion</u> and <u>Professionalism</u>, the <u>Engineering Equity Diversity & Inclusion Action Group</u>, any staff member or a <u>U</u> <u>of T Equity Office</u>.

You are not alone. <u>Here</u> you can find a list of clubs and groups that support people who identify in many diverse ways. Working together, we can all achieve our full potential.

Within this environment we are all expected to adhere to the "Code of Behaviour on Academic Matters", available online at: <u>http://www.governingcouncil.utoronto.ca/policies/behaveac.htm</u>, and to the "Code of Student Conduct" available online at: <u>www.governingcouncil.utoronto.ca/policies/studentc.htm</u>.

Academic Integrity

You are encouraged to explore and consult with the University of Toronto Academic Integrity Office or with a member of the Teaching Team if you have any questions or concerns regarding academic integrity, and in particular plagiarism. Further information on the Integrity Office can be found online at: https://www.academicintegrity.utoronto.ca.

By taking this course you agree that all required papers will be subject to submission for textual similarity review to Turnitin.com for the detection of plagiarism. In doing so, students will allow their papers to be included as source documents in the Turnitin.com reference database, where they will be used solely for the purpose of

detecting plagiarism. The terms that apply to the University's use of the Turnitin.com service are described on the Turnitin.com website.

Plagiarism in any form (copying diagrams or text) is unacceptable and will face serious consequences including documentation in your academic record.

Confidentiality and videorecording

Occasionally we may discuss topics, such as research team dynamics, that are sensitive in nature. Conversations with your peers in this classroom must be respected and should not be shared elsewhere without their express permission. Recording of tutorial sessions for any reason is prohibited. As course instructors we will not be recording any sessions.

Course materials belong to your instructor, the University, and/or other source depending on the specific facts of each situation and are protected by copyright.

Accommodations

The University of Toronto supports accommodations for students with diverse learning needs, which may be associated with mental health conditions, learning disabilities, autism spectrum, ADHD, mobility impairments, functional/fine motor impairments, concussion or head injury, blindness and low vision, chronic health conditions, addictions, deafness and hearing loss, communication disorders and/or temporary disabilities, such as fractures and severe sprains, or recovery from an operation.

If you have a learning need requiring an accommodation the University of Toronto recommends that students register as soon as possible with Accessibility Services at <u>https://studentlife.utoronto.ca/service/accessibility-services-registration-and-documentation-requirements/</u>.

Phone: 416-978-8060 Email: <u>accessibility.services@utoronto.ca</u>

Mental Health

As a university student, you may experience a range of health and/or mental health challenges that could result in significant barriers to achieving your personal and academic goals. Please note, the University of Toronto and the Faculty of Applied Science & Engineering offer a wide range of free and confidential services that could assist you during these times. As a U of T Engineering student, you have an Academic Advisor (in Chemical Engineering Vanessa Andres) who can support you by advising on personal matters that impact your academics. Other resources that you may find helpful are listed on the <u>U of T</u> <u>Engineering Mental Health & Wellness webpage</u>, and a small selection are also included here:

- <u>Accessibility Services</u> & the <u>On-Location Advisor</u>
- Graduate Engineering Council of Students' Mental Wellness Commission
- Health & Wellness and the On-Location Health & Wellness Engineering Counsellor
- Inclusion & Transition Advisor
- · <u>U of T Engineering Learning Strategist</u> and <u>Academic Success</u>
- <u>My Student Support Program (MySSP)</u>
- <u>Registrar's Office</u>
- <u>SKULE Mental Wellness</u>
- <u>Scholarships & Financial Aid Office & Advisor</u>

If you find yourself feeling distressed and in need of more immediate support resources, consider reaching out to the counsellors at <u>My Student Support Program (MySSP)</u> or visiting the <u>Feeling Distressed</u> <u>webpage</u>.