

# SYDE660: Systems Design Graduate Workshop 1

Department of Systems Design Engineering, University of Waterloo.

Course Outline for Spring 2021.

**Instructor.** Jennifer Howcroft, PhD, Professional Engineer.

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Office: E7 6308.

**Professor Howcroft's Office Hours.** Mondays: 2:00 – 3:00 pm Eastern Standard Time (E.S.T.)

Thursdays: 10:00 – 11:00 am Eastern Standard Time (E.S.T.)

For quick questions or concerns, post on Microsoft Teams or send me an email.

**Synchronous Class Time.** Tuesdays: 1:30 – 4:30 pm Eastern Standard Time (E.S.T.)

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## Course Description.

Engineering Design Project course where students work in small groups or individually applying the principles of engineering problem solving, research methods, systems analysis including modelling, simulation, optimization, and design. There is a strong focus on a major design project with regular mentorship, project update reports and presentations, project reviews, and design embodiment demonstrations.

Students enrolled in a specialization version of the course must have a major focus of their design project in the specialization field as follows:

- 660A - Artificial Intelligence (AI) and Machine Learning.
- 660B - Biomedical Systems.
- 660C - Human Factors.
- 660D - Mechatronic & Physical Systems.
- 660E - Vision, Image & Signal Processing.

## Course Objectives.

By the end of the course, students should be able to:

1. Apply the design process to develop solutions to open-ended, complex systems problems,
2. Demonstrate project management skills by appropriately scoping the selected problem space and completing project goals on-time,
3. Perform an in-depth needs assessment from a systems perspective,
4. Select and apply appropriate mathematical modelling, engineering analysis, and mathematical simulation and optimization in support of the design process,
5. Prototype a testable system,
6. Engage in appropriate testing procedures and competently evaluate test results,
7. Provide and respond to meaningful, constructive feedback on design work,
8. Develop and demonstrate functional team dynamics,
9. Communicate design work in a clear, technical manner through both oral and written communication.

## **Instruction.**

This is a project-based course as opposed to a lecture-focused course or readings-focused course. As such, students will be working on a group design project where every individual makes a meaningful contribution that advances their design and technical skills. Students are expected to have already taken SYDE600 (course pre-requisite) and received instructions on the design process. Targeted, review-style lectures will be provided throughout the course paired with regular instructor meetings. The purpose of the instructor meetings is to provide project-specific advice and guidance throughout the term.

## **LEARN.**

Course slides and asynchronous, pre-recorded lecture materials will be posted on LEARN. Students are allowed and encouraged to download materials for their own personal files but are not authorized to post SYDE660 materials on sites other than LEARN. Synchronous activities will also be run through LEARN. Course deliverables will be available and submitted using LEARN.

## **Grade Breakdown.**

Student Survey: 1%

Team Contract: 4%

Design Project: 65%

    Preliminary Project Report & Presentation: 25%

    Final Project Report, Prototype Demonstration, & Presentation: 40%

Peer Review Activities: 20%

Individual Contribution Activities: 10%

## **Course Evaluation.**

1. All evaluated course work (project work, individual contribution activities, peer review, etc.) must be solely the work of the student or students submitting it for credit.
2. Students are required to attend the project presentations. This is necessary to complete the peer review activities. Presentations will occur during Week 6 and Week 12 during the synchronous time: Tuesday from 1:30 to 4:30 pm E.S.T.
3. It is expected that all team members will contribute to the project deliverables and to the overall success of their team project. Any team issues related to non-participating team members should be brought to the attention of Professor Jennifer Howcroft as soon as possible. Individual team members' project grades may be adjusted at the instructor's discretion based on lack of participation. In extreme circumstances, a non-participating team member may be removed from the group and tasked with completing design deliverables individually.
4. Late submissions will not be graded and will receive a grade of zero. Up to three grace days can be used for class deliverables. Students must email the instructor before the assignment deadline to use these grace days.

## Course Schedule.

The course schedule is posted on LEARN and details the following important information:

- Weekly high-level project goals,
- Supporting lectures,
- Synchronous activities,
- Course deliverables.

Students are expected to review the course schedule, familiarize themselves with weekly expectations, and ask questions in advance of activities and associated deadlines to clear up any confusion. Changes to the course schedule will be announced as soon as possible and an updated course schedule will be posted on LEARN.

## Synchronous & Asynchronous Activities.

Synchronous activities are those that will occur during scheduled class times in a live manner.

Asynchronous activities are those that do not have a designated time. They will be available and can be viewed or performed at a time of the student's choosing.

### Synchronous Activities.

- Meet the Class: Week 1 – to assist with project team formation.
- Using the Library: Week 2 – to assist with research associated with needs assessment.
- Weekly meetings with Professor Howcroft: Times will be arranged in collaboration with each project team.
- Project presentations: Week 6 & 12.
- Office Hours: Access using Microsoft Teams. Mondays: 2:00 – 3:00 pm Eastern Standard Time (E.S.T.), Thursdays: 10:00 – 11:00 am Eastern Standard Time (E.S.T.)

### Asynchronous Activities.

- Recorded Lectures: Access using Virtual Classroom & Links in LEARN Content.
- Questions outside of Office Hours: Access using Microsoft Teams.

## Required Textbook.

J. Knapp, J. Zeratsky, and B. Kowitz. *Sprint: How to solve big problems and test new ideas in just five days*. Simon & Schuster: New York, NY. 2016.

## Recommended Textbooks.

There are lots of great books on design, engineering analysis, testing strategies, and more! Professor Zelek shared a lot of textbooks with you in SYDE600. In this course, I'm providing a list of specialization-specific textbooks you may find useful.

### 660A - Artificial Intelligence (AI) and Machine Learning.

S. Russell, P. Norvig. *Artificial Intelligence: A Modern Approach*, 4<sup>th</sup> edition. Pearson Education: New York, NY. 2021.

C.M. Bishop. *Pattern Recognition and Machine Learning*. Springer Science+Business Media: Singapore. 2006.

### 660B - Biomedical Systems.

P.H. King, R.C. Fries, A.T. Johnson. Design of Biomedical Devices and Systems, 4<sup>th</sup> edition. CRC Press: Taylor & Francis Group: Boca Raton, FL. 2019.

P.G. Yock, S. Zenios, J. Makower, T.J. Brinton, U.N. Kumar, F.T. Jay Watkins, L. Denend. Biodesign: The Process of Innovating Medical Technologies, 2<sup>nd</sup> edition. Cambridge University Press: Cambridge, UK. 2015.

### 660C - Human Factors.

J.D. Lee, C.D. Wickens, Y. Liu, L.N. Boyle. Designing for People: An Introduction to Human Factors Engineering, 3<sup>rd</sup> edition. Charleston, SC: CreateSpace. 2017

R.W. Proctor, T. Van Zandt. Human Factors in Simple and Complex Systems, 3<sup>rd</sup> edition. CRC Press: Taylor & Francis Group: Boca Raton, FL. 2018.

### 660D - Mechatronic & Physical Systems.

R.G. Budynas, K.J. Nisbett. Shigley's Mechanical Engineering Design, 11<sup>th</sup> edition. McGraw Hill Education: New York, NY. 2020.

W.L. Cleghorn, N. Dechev. Mechanics of Machines, 2<sup>nd</sup> edition. Oxford University Press: Oxford, UK. 2015.

### 660E - Vision, Image & Signal Processing.

R.C. Gonzalez, R.E. Woods. Digital Image Processing, 4<sup>th</sup> edition. Pearson Education: New York, NY. 2018.

### Email Policy.

Microsoft Teams or email is the best way to get in touch with the instructor or teaching assistant. When sending an email, remember the following:

1. Emails should be sent from your official University of Waterloo email account.
2. Put SYDE660 in the email subject line followed by a brief description of the email subject. For example, "SYDE660: Question concerning Peer Review".
3. Sign your email with your first and last name and your student number.
4. Emails should contain professional and respectful language.
5. While we will do our best to respond to your emails as soon as possible, allow 24 to 48 hours (excluding weekends) for a response to your email.
6. If your question or concern requires a complex answer or warrants a discussion, the instructor may suggest a video meeting through Microsoft Teams.

### Turnitin.com.

Text matching software (Turnitin<sup>®</sup>) may be used to screen assignments in this course. This would be done to verify that use of all material and sources in assignments is documented. Students will be given an option if they do not want to have their assignment screened by Turnitin<sup>®</sup>. Students will be provided about arrangements and alternatives for the use of Turnitin<sup>®</sup> in this course.

**Note:** We are facing unusual and challenging times. The instructor reserves the right to modify course topics and/or assessments with due notice. In the event of further challenges, the instructor will work with the Department to find reasonable and fair solutions.

### Writing and Communication Centre.

The Writing and Communication Centre works with students in all Faculties to help you consider your audience, clarify your ideas, develop your voice, and write in the style appropriate to your discipline. We offer one-on-one support for writing papers, delivering presentations, integrating research, and revising for clarity and coherence. Group appointments for team-based projects, presentations, and papers are also available.

**All of our services are available virtually:** booked appointments, drop-ins, resources, and writing groups. Check out our website for other ways to interact with us, such as open online forums and online “Question and Answers”. Visit us at [www.uwaterloo.ca/wcc](http://www.uwaterloo.ca/wcc).

**Please note** that communication specialists guide you to see your work as readers would. We can teach you revising skills and strategies, but will not change or correct your work for you. Please bring your assignment instructions and any notes or drafts to your appointment.

[Link [Writing and Communication Centre](#)]

## Course and Departmental Expectations

Guiding Principles for our SYDE-BME Community (faculty, staff, and students):

1) Be compassionate. 2) Be accountable. 3) Be patient. 4) Be safe and healthy.

**Compassionate and respectful communication:** Most online communication between the Department and students will be done through LEARN and/or email. Students are reminded that they should now use their email account [name@uwaterloo.ca](mailto:name@uwaterloo.ca). Include an academic signature with your full name, program, student ID. We encourage you to include your preferred pronouns (he/him; she/her; they/them).

**Scheduling of Synchronous (live) online course events:** Due to the COVID-19 pandemic, all University of Waterloo courses components will be delivered online, until further notice. To maintain build supportive teaching environments, instructors may use the time slots (EDT) scheduled “in-class” hours to hold “live-stream” events such as lectures, tutorial help sessions, group activities, and open office hours. To accommodate different time zones, different working/studying conditions and limitations in internet access, all critical course components, including lectures and student support must be made available in asynchronous formats. Any timed component (for example: a test or quiz) must take time zone and internet availability into account.

**SYDE-BME COMMENT ON ACCOMMODATION:** We respect that our SYDE-BME students are independent adult decision-makers, with many opportunities to partake in activities that might be in time conflict with academic deadlines and deliverables. Along with the right to make adult decisions comes the responsibility and accountability for those decisions and any outcomes.

The University of Waterloo’s policy on accommodation for missed deliverables pertains to verifiable health matters, and highly unfortunate events (for example: family tragedies). The Department of Systems Design Engineering follows University of Waterloo’s general policy: students who self-elect to forgo a deliverable receive a “0” for that deliverable. It is preferred practice so that fairness is maintained for members of the same class/course by avoiding preferential treatment, and so that instructors are not burdened with having to create extra quizzes, deliverables, etc. It also reflects professional practice, as failing to show up to work and missing deadlines can be very costly to the company and individual (for example: not submitting a contract proposal, or design review on time). ***Please read the policy here:*** [Link [Accommodation due to illness](#)]

**SYDE-BME Academic Priorities over Co-op Interviews:** With asynchronous schedules, students should be able to arrange co-op interviews that do not conflict with major deliverables (for example: timed course midterms, final exams). For deliverables with longer time windows (for example: 24-48 hours or more), students must manage their time for deliverables and co-op interviews accordingly. If a co-op interview conflicts with a short deliverable time window (for example: 1-3 hours), then students MUST follow the CECA procedure for rescheduling the interview: [Link [CECA rescheduling co-op interviews](#)]

**Compassionate Accommodation:** If you are facing challenges that are affecting more than one course contact the Associate Chair Undergraduate (A.C.U.G. email: [sydeunde@uwaterloo.ca](mailto:sydeunde@uwaterloo.ca)) or the Director of BME (email: [sdbmedir@uwaterloo.ca](mailto:sdbmedir@uwaterloo.ca)). They will review your case and coordinate a reasonable and fair plan in consultation with appropriate others (for example: instructors, Department Undergraduate Studies Committee, Chair, AccessAbility Services, Engineering Counselling services, Registrar's Office).

## FACULTY OF ENGINEERING – MORE FINE PRINT

Faculty of Engineering website: [Link [Academic Support and Policies](#)].

**Academic Integrity:** In order to maintain a culture of academic integrity, members of the University of Waterloo community are expected to promote honesty, trust, fairness, respect, and responsibility.

[Check Academic Integrity website for more information. Link [Office of Academic Integrity](#)].

**Discipline:** A student is expected to know what constitutes academic integrity (see link above) to avoid committing an academic offence, and to take responsibility for their actions. A student who is unsure whether an action constitutes an offence, or who needs help in learning how to avoid offences (for example: plagiarism, cheating) or about expectations for group work/collaboration should seek guidance from the course instructor, academic advisor, or the undergraduate Associate Dean. Relevant documents include:

- University of Waterloo Policy 71 [Link [Policy 71 Student Discipline](#)].
- Academic Penalty Guidelines [Link [Policy 71 Penalty Guidelines](#)].
- Assessment of Unauthorized Collaboration: [Link [Assessment of Unauthorized Collaboration](#)].

**Grievance:** A student who believes that a decision affecting some aspect of their university life has been unfair or unreasonable may have grounds for initiating a grievance. Read Policy 70, Student Petitions and Grievances, Section 4. When in doubt please be certain to contact the **Associate Chair Undergraduate or Academic Advisor** who will provide further assistance.

[Link [Policy 70 Petitions & Grievance](#)].

**Appeals:** A decision made, or penalty imposed under Policy 70 (Student Petitions and Grievances) (other than a petition) or Policy 71 (Student Discipline) may be appealed if there is a ground. A student who believes they have a ground for an appeal should refer to Policy 72 (Student Appeals)

[Link [Policy 72 Student Appeals](#)].

**AccessAbility Services:** AccessAbility Services (A.A.S.) is the University's centralized office for the provision of academic accommodations for students with a known or unknown disability, illness, or condition. Even if students are unsure of whether they qualify for A.A.S. support, an A.A.S. consultant can talk them through next steps, and refer them elsewhere if appropriate.

[Link [AccessAbility Services](#)].