



ENGG*4110 Biological Engineering Design IV

01

Winter 2020

Section(s): C01

School of Engineering

Credit Weight: 1.00

Version 1.00 - January 05, 2020

1 Course Details

1.1 Calendar Description

This is the capstone design course for the Biological Engineering program. Teams normally of 3-4 students apply engineering analysis and design principles to a problem in a biological system or process. A completely specified solution at the level of preliminary or final design is required, including assessment of socio-economic and environmental impact. This is a small group design that requires reports and a poster presentation to a professional standard. Ethics and legal case studies relevant to professional engineering practice are presented during the lectures. Only students currently registered in ENGG*4000 will be permitted to select this course.

Pre-Requisites:

All 1000 and 2000 level core courses and ENGG*4000

Restrictions:

Registration in semester 8 (last semester) of the BENG program and in a maximum of 3.25 credits registration. Students must have a minimum cumulative average of 60% or higher in ALL ENGG courses. Restriction waiver requests are handled by the Director, School of Engineering, or designate.

1.2 Course Description

This is the capstone design course for the Engineering program. Teams of normally 3-4 students apply engineering analysis and design principles to an engineering problem in their discipline. A completely specified solution at the level of preliminary or final design is required, including assessment of socio-economic and environmental impact. This is a small group design that requires reports and a poster presentation to a professional standard. Ethics and legal case studies relevant to professional engineering practice are presented during the lectures.

1.3 Timetable

Lectures: Tuesday from 07:00 pm to 08:50 pm

ALEX 200

Poster Presentation: Design Day - Thursday, April 2, 2020 from 10:00 am to 2:00 pm

Engineering Complex

1.4 Final Exam

Friday April 17, 2020; 08:30 - 10:30 AM. Location TBD

Exam time and location is subject to change. Please see WebAdvisor for the latest information.

2 Instructional Support

2.1 Instructional Support Team

Course Co-ordinator:	Richard G. Zytner Ph.D., P.Eng., FEC, FCSCE
Email:	rzytner@uoguelph.ca
Telephone:	+1-519-824-4120 x53859
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3 Learning Resources

3.1 Required Resources

Course Website (Website)

<https://courselink.uoguelph.ca>

Course material, news, announcements, and grades will be posted to the **ENGG*41X** Courselink site. You are responsible for checking the site regularly. As per University regulations, all students are required to check their <mail.uoguelph.ca> e-mail account regularly; e-mail is the official route of communication between the University and students.

Law for Professional Engineers (Textbook)

Marston, D.L. *Law for Professional Engineers (2019 - Fifth Edition)*. McGraw-Hill Ryerson. Toronto. ISBN 978-1-260-13590-9

Canadian Professional Engineering and Geoscience (Textbook)

Andrews, G.C., Shaw, P. and McPhee, J. (2019) **Canadian Professional Engineering and**

Geoscience, Practice and Ethics (Sixth Edition), Nelson, ISBN 13: 978-0-17-676467-8

3.2 Recommended Resources

Practical Law of Architecture, Engineering and Geoscience (Textbook)

Samuels, B. M and Sanders, D. R. (2011) *Practical Law of Architecture, Engineering and Geoscience*, Pearson, ISBN 978-0-13-700408-9

3.3 Additional Resources

Other Resources (Other)

Lecture: Notes with blanks are available in Courselink.

Memos: Download the memo requirements according to the schedule given in this handout and posted on Courselink.

Projects: Download the assignments according to the schedule given in this handout and posted on Courselink.

School: Students are encouraged to design and build components or prototypes of devices if possible. Facilities of the School machine shop, access to all undergraduate laboratories and associated instruments and equipment are available subject to approval. The need for, and costs of, materials, special services or use of other facilities should be foreseen. Small grants may be available to purchase materials or components which are essential to the project but cannot be sourced within the School. These requests are normally made to the ENGSOC Lab Fund. Please follow instructions for timeline. The funds available depend upon ENGSOC rules and procedures and are not guaranteed.

4 Learning Outcomes

The goal is to prepare students to deal with open-ended, multi-faceted design problems similar to those that they will encounter as working professionals.

4.1 Course Learning Outcomes

By the end of this course, you should be able to:

1. Apply their academic knowledge to work on a complex engineering problem identified in ENGG*4000.
2. Collect and analyze information and synthesize solutions taking into account significant technological, commercial, social and environmental factors.
3. Apply design principles to a complex engineering problem.
4. Summarize and communicate the design solution, including project management, economic, social, and environmental factors.
5. Exhibit effective teamwork and leadership skills at all stages of the project

6. Explain the responsibilities of engineers to society and demonstrate the expectations in professional practice through class discussions, report submission and the final exam.
7. Demonstrate life long learning values consistent with what is expected of a Professional Engineer

4.2 Engineers Canada - Graduate Attributes (2018)

Successfully completing this course will contribute to the following:

#	Outcome	Learning Outcome
1	Knowledge Base	1
1.1	Recall, describe and apply fundamental mathematical principles and concepts	1
1.2	Recall, describe and apply fundamental principles and concepts in natural science	1
1.3	Recall, describe and apply fundamental engineering principles and concepts	1
1.4	Recall, describe and apply program-specific engineering principles and concepts	1
2	Problem Analysis	1, 2
2.1	Formulate a problem statement in engineering and non-engineering terminology	1, 2
2.2	Identify, organize and justify appropriate information, including assumptions	1, 2
2.3	Construct a conceptual framework and select an appropriate solution approach	1, 2
2.4	Execute an engineering solution	1, 2
2.5	Critique and appraise solution approach and results	1, 2
3	Investigation	1, 2
3.1	Propose a working hypothesis	1, 2
3.2	Design and apply an experimental plan/investigative approach (for example, to characterize, test or troubleshoot a system)	1, 2
3.3	Analyze and interpret experimental data	1, 2
3.4	Assess validity of conclusions within limitations of data and methodologies	1, 2

#	Outcome	Learning Outcome
4	Design	3
4.1	Describe design process used to develop design solution	3
4.2	Construct design-specific problem statements including the definition of criteria and constraints	3
4.3	Create a variety of engineering design solutions	3
4.4	Evaluate alternative design solutions based on problem definition	3
4.5	Develop and refine an engineering design solution, through techniques such as iteration, simulation and/or prototyping	3
5	Use of Engineering Tools	1, 2
5.1	Select appropriate engineering tools from various alternatives	1, 2
5.2	Demonstrate proficiency in the application of selected engineering tools	1, 2
5.3	Recognize limitations of selected engineering tools	1, 2
6	Individual & Teamwork	5
6.1	Describe principles of team dynamics and leadership	5
6.2	Understand all members' roles and responsibilities within a team	5
6.3	Execute and adapt individual role to promote team success through, for example, timeliness, respect, positive attitude	5
6.4	Apply strategies to mitigate and/or resolve conflicts	5
6.5	Demonstrate leadership through, for example, influencing team vision and process, promoting a positive team culture, and inspiring team members to excel	5
7	Communication Skills	4
7.1	Identify key message(s) and intended audience in verbal or written communication as both sender and receiver	4
7.2	Interpret technical documentation such as device specification sheets, drawings, diagrams, flowcharts, and pseudocode	4
7.3	Construct the finished elements using accepted norms in English, graphical standards, and engineering conventions, as appropriate for the message and audience	4

#	Outcome	Learning Outcome
7.4	Substantiate claims by building evidence-based arguments and integrating effective figures, tables, equations, and/or references	4
7.5	Demonstrate ability to process oral and written communication by following instructions, actively listening, incorporating feedback, and formulating meaningful questions	4
8	Professionalism	5, 6
8.1	Demonstrate an understanding of what it means to be a professional engineer and distinguish between legislated and non-legislated professions	6
8.2	Effectively describe engineering law and its impact on professional engineering practice	6
8.3	Demonstrate professional behaviour	5, 6
9	Impact of Engineering on Society and the Environment	2, 4
9.1	Analyze the safety, social, environmental, and legal aspects of engineering activity	2, 4
9.2	Evaluate the uncertainties and risks associated with engineering activities	4
9.3	Anticipate the positive and negative impacts of introducing innovative technologies to solve engineering problems	4
10	Ethics & Equity	6
10.1	Summarize ethical theories and equity, diversity, and inclusivity principles	6
10.2	Determine an ethical course of action by applying ethical theories and the PEO Code of Ethics	6
10.3	Demonstrate values consistent with good ethical practice, including equity, diversity, and inclusivity	6
11	Economics and Project Management	4
11.1	Apply project management techniques and manage resources within identified constraints	4
11.2	Identify risk and change management techniques, in the context of effective project management	4
11.3	Estimate economic impact and feasibility of an engineering project or	4

#	Outcome	Learning Outcome
	design using techniques such as cost benefit analysis over the life of the project or design	
12	Life Long Learning	7
12.1	Identify personal career goals and opportunities for professional development	7
12.2	Self-assess skills relative to career goals and SOE defined learning outcomes	7
12.3	Demonstrate capability for continuous knowledge and skill development in a changing world	7

5 Teaching and Learning Activities

Course Format

Classes are scheduled for each week on Tuesday. In addition to classroom time, where active learning is being promoted, it is expected that each team member will spend an average of 15 to 20 h per week on the design project over the semester, as this course is equivalent to two regular senior engineering science courses. The active learning component will require group discussions and presentations on material related to the lecture material.

Students work in teams of three or four persons. Smaller (or larger) groups are only considered by the course coordinator under extraordinary circumstances, and approval is conditional on availability of sufficient resources. Inter-disciplinary groups are encouraged if a particular problem has sufficient scope to provide appropriate experience to all team members. ***It is expected that the selection of the team, the project and the faculty advisor was arranged during ENGG4000.***

Teams are encouraged to use the design studios scattered throughout the Engineering Complex. Access to these rooms can be facilitated through the faculty advisor.

Each team is advised by a School faculty member responsible for helping to delineate the terms of reference for the project, providing guidance where necessary, and evaluating all written reports. The projects are self-administered: each team must carry out planning and execution of the project on its own. Accordingly, team members are required to keep a log book on the activities each individual completes. ***Team members and their faculty advisor should discuss and record concerns about the group's progress at the interim report stage and take appropriate action.*** The respective log books will be reviewed in deciding the appropriate action.

The following is a planned schedule of lectures, which is subject to change.

5.1 Lecture

Topics: Intellectual property

Topics: History of the profession

Iron Ring, Quebec Bridge, Self Regulation, the Seal

Topics: Engineering Code of Ethics and definitions of Professional Misconduct

Intro to case studies

Topics: Key issues in Engineering Ethics

Whistleblowing and Conflict of Interest

Topics: Introduction to Canadian Law

Common Law, the Constitution, and the Charter

Topics: Introduction to Tort Law

Unintentional Tort, Negligence, and Duty of Care

Topics: Tort

Professional duty of care, Duty to warn

Topics: Introduction to Contract law

Five elements, Contract A&B

Topics: Contract interpretation

Topics: Completing Contracts

Rescinding, Discharge, and Breach

Topics: Equity and Diversity

5.2 Other Important Dates

Please see the University of Guelph schedule of important dates:

<https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c03/c03-fallsem.shtml>

5.3 Student Design Activity and Milestones

Week No.	Task
1	Confirm terms of reference and schedule faculty advisor meeting times.
2 - 6	Analyze and research problem, develop design alternatives, evaluate and specify prime contender. Before Friday February 14, 2020, 17:00 h., submit hard copy of interim report to faculty advisor (if requested) and post electronic copy to Dropbox. In addition, an Interim Memo is needed that includes a Distribution of Contribution statement. Complete details in Courselink.
7 - 11	Develop final design/prototype, evaluate and refine.
12	Prepare design report, present findings with the poster and complete Exit Survey. (i) Poster presentation - Design Day, Thursday April 2, 2020, 10:00-14:00 h. Location Engineering Complex. Note! Attendance of all group members at the final poster presentation and evaluation is a course requirement. (ii) Saturday April 4, 2020, 09:00 h, submit hard copy of final report to faculty advisor (if required) and post electronic copy to Dropbox. In addition, a Final Memo is needed that includes a Distribution of Contribution statement. Complete details in Courselink. (iii) Before Saturday April 4, 2020, 12 midnight, complete the confidential on-line Exit Survey. Further details in Courselink.

6 Assessments

6.1 Assessment Details

Proposal Memo (0%)

Date: Fri, Jan 10, 12:00 PM

Memo is a formative one. It addresses two items as noted in CourseLink.

Item 1: 300 word summary outlining your project. What are you working on and what are the expected deliverables.

Item 2: A short description of a strength of the group. Plus a short description of a weakness or area that the group needs to work on to make the project successful.

Quiz 1 (0%)

Date: Fri, Jan 31, 12:00 PM, CourseLink

Quiz on assigned readings from course text. Taken until passed. If not, INC given for course.

Interim Memo 2 (2%)

Date: Fri, Feb 14, 5:00 PM

Learning Outcome: 4, 5, 7, 7, 7

Memo addresses two items as noted in CourseLink.

Item 1: 300 word summary outlining the progress in the project addressing the items noted in the rubric.

Item 2: Attestation by all group members that everyone contributed equally to the project and everyone deserves the same grade. Plus a short description of what worked well for the group since the beginning of the course, and a short description of what did not work well for the group since the beginning of the course.

Interim Report (20%)

Date: Fri, Feb 14, 5:00 PM

Learning Outcome: 1, 2, 3, 4, 5

Reflection (5%)

Date: Fri, Feb 28, 5:00 PM

Learning Outcome: 4, 5, 7, 7, 7

Every student will prepare an individual reflection that relates a work/volunteer experience to PEO's work experience requirements. The information will be helpful when the student applies for licensure.

Quiz 2 (0%)

Date: Fri, Mar 6, 12:00 PM, CourseLink

Quiz on assigned readings from course text. Taken until passed. If not, INC given for course. Pass/Fail

Quiz 3 (0%)

Date: Fri, Mar 27, 12:00 PM, CourseLink

Quiz on assigned readings from course text. Taken until passed. If not, INC given for course. Pass/Fail

Poster Presentation (10%)

Date: Thu, Apr 2, 10:00 AM - , 2:00 PM

Learning Outcome: 4, 5

Each team will create a poster presenting their work. Members of the faculty, the University community and local engineers will be invited to view the posters, discuss them with the participants and offer comments to the course coordinator who will evaluate both the

poster and the group's verbal support of their work. **Marking of the models and prototypes is not part of the judges mandate.** Models and prototypes are to be graded by the advisor.

Attendance at the poster presentation is mandatory for the entire time for every group member.

Final Memo (3%)

Date: Sat, Apr 4, 9:00 AM

Learning Outcome: 4, 6, 7, 7

Memo addresses two items as noted in CourseLink.

Item 1: 300 word summary outlining the deliverables in the project addressing the items noted in the rubric.

Item 2: Attestation by all group members that everyone contributed equally to the project and everyone deserves the same grade. Plus a short description of what worked well for the group since the interim report, and a short description of what did not work well for the group since the interim report.

Final Report (40%)

Date: Sat, Apr 4, 9:00 AM

Learning Outcome: 1, 1, 2, 2, 3, 3, 4, 4, 5, 5, 6, 6, 7, 7, 7, 7

Exit Survey (0%)

Date: Sat, Apr 4, 12:00 PM

A component of Life-Long Learning Graduate Attribute assessment is the School's Exit Survey. This Exit Survey provides valuable insight into student development and expectations as they enter the workforce. **Information provided to the School through the Exit Survey is confidential.**

Failure to complete the Exit Survey will result in an Incomplete Grade for the entire course.

Exam (20%)

Date: Fri, Apr 17, 8:30 AM

Learning Outcome: 6

Two hour duration. Will be completed on CourseLink. Students are asked to bring their laptop or tablet to the examination room. Students wishing to use SOE computers, need to let the instructor know by noon on Friday Feb. 14, 2020. Discussions with SAS will determine where those students write the final.

Students must pass the Final Exam to pass the course. **For those who fail the final exam, the course grade will be calculated as follows:**

1. Interim Report 10%
 2. Final Report 25%
 3. Poster 10%
 4. Reflection 5%
 5. Memo (2) 2%
 6. Memo (3) 3%
 7. Final Exam 45%
-

7 Course Statements

7.1 Course Grading Policies

Missed Assessments: If you are unable to meet an in-course requirement due to medical, psychological, or compassionate reasons, please email the course instructor. See the undergraduate calendar for information on regulations and procedures for Academic Consideration: <http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml>

Accommodation of Religious Obligations: If you are unable to meet an in-course requirement due to religious obligations, please email the course instructor at the start of the semester to make alternate arrangements. See the undergraduate calendar for information on regulations and procedures for Academic Accommodation of Religious Obligations: <http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-accomrelig.shtml>

Passing grade: In order to pass the course, students must obtain an overall grade of 50% or higher on the aggregate of all the course work outlined in Section 6 Assessment. Please note the alternate grading scheme outlined in Section 6 in the event that a student fails the exams.

Late Reports: There will be no extension of the deadlines for submissions, except for serious health or compassionate reasons, with the appropriate documentation. Just like the consulting world where projects are not awarded if the proposals are late, a grade of zero will be given for late submissions.

Certification: Students must write their PEO SMP (Student Membership Program) number on all submitted work. This signifies that the SOE Code of Ethics was adhered to. For group projects, students must also state that they contributed to the group effort in an equitable manner.

Logbook: Each student should keep a logbook detailing the activities performed that are related to the course. It should include record of all group and individual activities, lecture notes, meeting minutes, work distribution, design notes, calculations, planning, decisions, sketches and all relevant information. The logbook should be signed off by other members of

the group on a regular basis. The logbook will be reviewed by the instructor, course coordinator, faculty advisor and TA from time to time.

7.2 Course Specific Lab and Machine Shop Safety

Safety is critically important to the School and is the responsibility of all members of the School: faculty, staff and students. ENGG*41X0 does not have a laboratory component for the lecture portion for the course. However, for the project component, some student teams may be in the shop and or in the lab to build and test their prototype or final design. When in the shop and the lab, students must adhere to the applicable safety requirements and regulations. In addition, you are responsible for reporting all safety issues to the laboratory supervisor, GTA or faculty responsible.

7.3 Photo, Video, Media Consent

Photos and videos will be taken throughout the semester for the purpose of communicating to the public about the engineering program at UofG. These pictures and videos may include poster presentations and showcasing of prototypes on Design Day. The final memo will also be included in a compendium and on the university's website, which will be made accessible to the public.

Please follow the link to the university's website to download the consent form:

<https://news.uoguelph.ca/guides/brand-guide/imagery/copyright-and-consent/>

The completed consent form should be submitted individually to the Courselink dropbox.

8 School of Engineering Statements

8.1 Instructor's Role and Responsibility to Students

The instructor's role is to develop and deliver course material in ways that facilitate learning for a variety of students. Selected lecture notes will be made available to students on Courselink but these are not intended to be stand-alone course notes. Some written lecture notes will be presented only in class. During lectures, the instructor will expand and explain the content of notes and provide example problems that supplement posted notes. Scheduled classes will be the principal venue to provide information and feedback for tests and labs.

8.2 Students' Learning Responsibilities

Students are expected to take advantage of the learning opportunities provided during lectures and lab sessions. Students, especially those having difficulty with the course content, should also make use of other resources recommended by the instructor. Students who do (or may) fall behind due to illness, work, or extra-curricular activities are advised to keep the instructor informed. This will allow the instructor to recommend extra resources in a timely

manner and/or provide consideration if appropriate.

8.3 Lab Safety

Safety is critically important to the School and is the responsibility of all members of the School: faculty, staff and students. As a student in a lab course you are responsible for taking all reasonable safety precautions and following the lab safety rules specific to the lab you are working in. In addition, you are responsible for reporting all safety issues to the laboratory supervisor, GTA or faculty responsible.

9 University Statements

9.1 Email Communication

As per university regulations, all students are required to check their e-mail account regularly: e-mail is the official route of communication between the University and its students.

9.2 When You Cannot Meet a Course Requirement

When you find yourself unable to meet an in-course requirement because of illness or compassionate reasons please advise the course instructor (or designated person, such as a teaching assistant) in writing, with your name, id#, and e-mail contact. The grounds for Academic Consideration are detailed in the Undergraduate and Graduate Calendars.

Undergraduate Calendar - Academic Consideration and Appeals

<https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml>

Graduate Calendar - Grounds for Academic Consideration

<https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml>

Associate Diploma Calendar - Academic Consideration, Appeals and Petitions

<https://www.uoguelph.ca/registrar/calendars/diploma/current/index.shtml>

9.3 Drop Date

Students will have until the last day of classes to drop courses without academic penalty. The deadline to drop two-semester courses will be the last day of classes in the second semester. This applies to all students (undergraduate, graduate and diploma) except for Doctor of Veterinary Medicine and Associate Diploma in Veterinary Technology (conventional and alternative delivery) students. The regulations and procedures for course registration are available in their respective Academic Calendars.

Undergraduate Calendar - Dropping Courses

<https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-drop.shtml>

Graduate Calendar - Registration Changes

<https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/genreg-reg-regchg.shtml>

Associate Diploma Calendar - Dropping Courses

<https://www.uoguelph.ca/registrar/calendars/diploma/current/c08/c08-drop.shtml>

9.4 Copies of Out-of-class Assignments

Keep paper and/or other reliable back-up copies of all out-of-class assignments: you may be asked to resubmit work at any time.

9.5 Accessibility

The University promotes the full participation of students who experience disabilities in their academic programs. To that end, the provision of academic accommodation is a shared responsibility between the University and the student.

When accommodations are needed, the student is required to first register with Student Accessibility Services (SAS). Documentation to substantiate the existence of a disability is required; however, interim accommodations may be possible while that process is underway.

Accommodations are available for both permanent and temporary disabilities. It should be noted that common illnesses such as a cold or the flu do not constitute a disability.

Use of the SAS Exam Centre requires students to book their exams at least 7 days in advance and not later than the 40th Class Day.

For Guelph students, information can be found on the SAS website

<https://www.uoguelph.ca/sas>

For Ridgetown students, information can be found on the Ridgetown SAS website

<https://www.ridgetownc.com/services/accessibilityservices.cfm>

9.6 Academic Integrity

The University of Guelph is committed to upholding the highest standards of academic integrity, and it is the responsibility of all members of the University community—faculty, staff, and students—to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring. University of Guelph students have the responsibility of abiding by the University's policy on academic misconduct regardless of their location of study; faculty, staff, and students have the responsibility of supporting an environment that encourages academic integrity. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection.

Please note: Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member or faculty advisor.

Undergraduate Calendar - Academic Misconduct

<https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08->

amisconduct.shtml

Graduate Calendar - Academic Misconduct

<https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml>

9.7 Recording of Materials

Presentations that are made in relation to course work - including lectures - cannot be recorded or copied without the permission of the presenter, whether the instructor, a student, or guest lecturer. Material recorded with permission is restricted to use for that course unless further permission is granted.

9.8 Resources

The Academic Calendars are the source of information about the University of Guelph's procedures, policies, and regulations that apply to undergraduate, graduate, and diploma programs.

Academic Calendars

<https://www.uoguelph.ca/academics/calendars>
