Course Title	ChE180: Chemical Engineering Design Studio 1
Term and year of offering	Fall 2022
Class time	Tuesdays 10:30-11:30 RCH 301 Tuesdays 12:30-2:30 CPH1346 Thursdays 1:30-2:30 RCH 301
Instructor name	Prof. Marc Aucoin, PhD, PEng
Instructor contact	Office: E6-4012 Hours: Wednesdays from 12:00 to 1:00, or by appointment Email: maucoin@uwaterloo.ca Phone: 519-888-4567 x36084
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1 Course Details

1.1 Calendar Description

Engineering as a profession. An introduction to the fundamentals of data analysis, investigation, design, and communication in chemical engineering. Introduction to chemical product and process design. Needs analysis and problem identification. Literature search and brainstorming. Design requirements, constraints and criteria. Development and preliminary evaluation of alternative solutions using software tools. Process synthesis, block diagrams, process flow diagrams (PFD), and piping and instrumentation diagrams (P&ID). Introduction to computer-aided design (CAD). Safety and sustainability in design. Principles of green engineering. Occupational health and safety. Introduction to process safety and process hazard identification. Communication of technical information, written reports and oral presentations. Teamwork. Professional development, resume and interview skills, and e-portfolios.

1.2 Intended Learning Outcomes

At the end of the course, you should be able to:

- Brainstorm and develop ideas for engineering design.
- Use standard computational tools needed for performing engineering analysis, calculation, and communication.
- Analyze data using spreadsheets.
- Prepare reports using word-processing tools.

- Prepare and deliver oral presentations.
- Reading P&ID diagrams and create them using computer-assisted drawing tools.
- Design a process for a chemical commodity.
- Ability to work in different team environments.
- Recognize and apply safety to design and practice.
- Articulate your technical and professional knowledge, skills, and abilities.

1.3 Suggested Text(s)

Introduction to Professional Engineering in Canada, Fifth Canadian Edition, 5th Edition. By Andrews et al. (excerpts will be provided in class).

1.4 Suggested Reading and Viewing

Videos:

- Historical perspective about the evolution of Chemical Engineering: https://www.youtube.com/watch?v=bsvFojoqlmY
- Research Profile: Marc Aucoin https://www.youtube.com/watch?time_continue=2&v=SJLMVOTxb0E (note – the message is still valid even though this was recorded about 12 years ago) https://uwaterloo.ca/applied-virus-complex-biologics-bioprocessing-research-lab/

1.5 Scheduling

This class is intended for 42 total hours. This means that several of the scheduled sessions will not be used. Please refer to the detailed schedule included in this syllabus for more information. All classes are to be in person. The soap making activity will be scheduled outside of class hours to accommodate everyone in the Ideas Clinic Lab.

1.6 Canadian Engineering Accreditation Board (CEAB) Graduate Attributes

The student learning objectives for each lab refer to the CEAB Engineering Graduate Attributes defined by the Canadian Engineering Accreditation Board. In this course, the target is an introductory level for the following attributes. All the attribute/outcomes are listed below as a reference.

Outcome		Definition
1	A Knowledge Base for Engineering	Demonstrated competence in university level mathematics, natural sciences, engineering fundamentals, and specialized knowledge appropriate to the program.
2	Problem Analysis	An ability to use appropriate knowledge and skills to identify, formulate, analyze, and solve complex engineering problems to reach substantiated conclusions.
3	Investigation	An ability to conduct investigations of complex problems by methods that include appropriate experiments, analysis and

		interpretation of data, and synthesis of information to reach valid conclusions.
4	Design	An ability to design solutions for complex, open-ended engineering problems and to design systems, components or processes that meet specified needs with appropriate attention to health and safety risks, applicable standards, and economic, environmental, cultural, and societal considerations.
5	Use of Engineering Tools	An ability to create, select, apply, adapt, and extend appropriate techniques, resources, and modern engineering tools to a range of engineering activities, from simple to complex, with an understanding of the associated limitations.
6	Individual and Teamwork	An ability to work effectively as a member and leader in teams, preferably in a multi-disciplinary setting.
7	Communication Skills	An ability to communicate complex engineering concepts within the profession and with society at large. Such ability includes reading, writing, speaking, and listening, and the ability to comprehend and write effective reports and design documentation, and to give and effectively respond to clear instructions.
8	Professionalism	An understanding of the roles and responsibilities of the professional engineer in society, especially the primary role of protection of the public and the public interest.
9	Impact of Engineering on Society and the Environment	An ability to analyze social and environmental aspects of engineering activities. Such ability includes an understanding of the interactions that engineering has with the economic, social, health, safety, legal, and cultural aspects of society, the uncertainties in the prediction of such interactions, and the concepts of sustainable design and development and environmental stewardship.
10	Ethics and equity	An ability to apply professional ethics, accountability, and equity.
11	Economics and project management	An ability to appropriately incorporate economics and business practices including project, risk, and change management into the practice of engineering and to understand their limitations.
12	Life-long learning	An ability to identify and to address their own educational needs in a changing world in ways sufficient to maintain their competence and to allow them to contribute to the advancement of knowledge.

2 Topics and Schedule

The following table outlines a ***tentative* class schedule** (please note that this is the plan for the first in-person offering of this course in 3 years) for this semester:

		Tuesday		**Thursday**
September			8	Report Writing
	13	Report Writing (Cont.) Co-op fundamental presentation Personalized academic calendar	15	Personalized academic calendar (cont.)
	20	Specialized knowledge and reasonable care, engineering design, brainstorming, prototyping	22	Specialized knowledge and reasonable care, engineering design, brainstorming, prototyping (cont.)
	27	Prototype design analysis, safety, and workplace harassment Teamwork	29	Soap calculator and project proposal
October	4	Soap calculator and project proposal	6	Soap calculator and project proposal (cont)
	11	Reading Week	13	Reading Week
	18	Midterm Week	20	Midterm Week
	25	Making soap: IDEAS clinic	27	Making soap: IDEAS clinic
November	1	Making soap: IDEAS clinic	3	Making soap: IDEAS clinic
	8	Process & instrumentation diagrams: principles and terminology Principles of Green Chemistry	10	Engineering as a profession quiz
	15	WatPD Process and instrumentation diagrams: CAD tools; ***Soap to be submitted to instructor!!***	17	Process and instrumentation diagrams: CAD tools
	22	Symposium Check-In	24	
	29	Tentative Date for Soap Symposium		
December			1	Wrap-Up

Fair Contingencies for Emergency Remote Teaching.

We are facing unusual and challenging times. The course outline presents the instructor's intentions for course assessments, their weights, and due dates in Fall 2022. **As best as possible, we will keep to the specified assessments, weights, and dates**. To provide contingency for unforeseen circumstances, the instructor reserves the right to modify course topics and/or assessments and/or weight and/or deadlines with **due and fair notice to students**. In the event of such challenges, **the instructor will work with the Department/Faculty to find reasonable and fair solutions that respect rights and workloads of students, staff, and faculty**.

2.1 Important Dates

2.1.1 Core material

Monday September 19, 11:59 PM: Submit Assignment 1 (Personalized Academic Calendar (individual))
Monday September 26, 11:59 PM: Submit Assignment 2 (part a: Fluid in Motion video (group); part b: word document describing design (group): NOTE: part a and b can be submitted in the same Dropbox in Learn.
Monday October 3, 11:59 PM: Submit Assignment 3 (Workplace harassment quiz), Assignment 4 (Team contract (group)) and Assignment 5 (Safety: a document with screenshots of completed safety quizzes (individual))
Monday October 17, 11:59 PM: Submit Assignment 6 (Soap Calculator, individual)
Sunday October 23, 11:59 PM: Submit Assignment 7 (Soap Proposal, group)
Monday November 7, 11:59 PM: Submit Assignment 8 (Post Clinic Submission)
Thursday November 10, 11:59 PM: Submit Assignment 9 (Engineering as a profession quiz completed (on Learn, individual))
Monday November 21, 11:59 PM: Submit Assignment 10 (P&ID CAD)
Tuesday November 22 – Class Time: Symposium Check-In (Assignment 11)
Sunday November 27, 11:59 PM: Design Symposium Item Uploads (Assignment 12)
Tuesday November 29: Design symposium (also part of Assignment 12)
December 6, 11:59 PM: Submit Assignment 13 (Final Reflection Report)

2.1.2 CFE related tasks

Date	Associated student activities
Sept 9	– Students must schedule their upcoming mandatory résumé critique with TA by Fri, Sept 9 @ 11:59 pm (dates below) – Q&A on Piazza opens Sept 9 at 2 pm
Sept 12-16	– Mandatory résumé reviews for 4-stream students with WEEF TAs – Q&A on Piazza opens Sept 16 at 2 pm – Résumé quiz is due by Thurs, Sept 15 @ 11:59 pm
Sept 19-23	– Mandatory résumé reviews for 8-stream students with WEEF TAs – Interview Skills quiz due by Thurs, Sept 22 @ 11:59 pm – Q&A on Piazza opens Sept 23 at 2 pm
Oct 3-Oct 28	– CFE Check-in Survey due by Wed, Oct 5 @ 11:59 pm – CFE Knowledge quiz due by Fri, Oct 28 @ 11:59 pm

3 Evaluation

Component	Grade Percent
Assignment 1: Personalized Academic Calendar	5%
Assignment 2: Fluid in Motion	5%
Assignment 3: Workplace Harassment and your Rights Quiz	5%
Assignment 4: Team Contract	5%
Assignment 5: Safety	5%
Assignment 6: Soap Calculator	5%
Assignment 7: Soap Proposal	10%
Assignment 8: Engineering as a Profession Quiz	5%
Assignment 9: Post Clinic Submission	5%
Assignment 10: P&ID Diagram	5%
Assignment 11: Symposium Check-In	***10%***
Assignment 12: Soap Symposium	20%
Assignment 13: Post Symposium Report	5%
Coop Fundamentals for Engineering	10%
WatPD	CR/NCR
Practice Midterm (offered by First Year Office)	Can replace up to 3 lost marks.

4 Administrative Information

4.1 Late penalties, missed classes

Items that are not submitted on time will receive a deduction of 1/3 per day, meaning that a 3/3 report will get 2/3 after 1 day, 1/3 after 2 days, and finally 0/3. Attendance is not tracked, but highly encouraged. This class is about hands-on learning, with experienced TAs looking over your shoulder. You'll rarely get this level of intensive support again!

4.2 Academic integrity, grievance, discipline, appeals and note for students with disabilities:

- Academic integrity: 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 the Office of Academic Integrity for more information.]
- Note Policies, procedures and guidelines can be found at: https://uwaterloo.ca/secretariat/policies-procedures-guidelines
- Grievance: A student who believes that a decision affecting some aspect of his/her 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 department's administrative assistant who will provide further assistance.
- Discipline: A student is expected to know what constitutes academic integrity to avoid committing an academic offence, and to take responsibility for his/her actions. [Check the Office of Academic

Integrity for more information.] A student who is unsure whether an action constitutes an offence, or who needs help in learning how to avoid offences (e.g., plagiarism, cheating) or about "rules" for group work/collaboration should seek guidance from the course instructor, academic advisor, or the undergraduate associate dean. For information on categories of offences and types of penalties, students should refer to Policy 71, Student Discipline. For typical penalties, check Guidelines for the Assessment of Penalties.

- 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 he/she has a ground for an appeal should refer to Policy 72, Student Appeals.
- Note for students with disabilities: AccessAbility Services, https://uwaterloo.ca/accessability-services/ located in Needles Hall North, Room 1401 (Phone: 519-888-4567, ext. 45231, Email: access@uwaterloo.ca), collaborates with all academic departments to arrange appropriate accommodations for students with disabilities without compromising the academic integrity of the curriculum. If you require academic accommodations to lessen the impact of your disability, please register with AccessAbility Services ***at the beginning of each academic term***.

5 Addendum

Because of the introductory nature of this course, several additional modules are added to get you up to speed in all aspects of your degree. The following sections give a brief overview of these.

5.1 Co-op Fundamentals for Engineering (CFE) Module – Content and Associated Activities & Quizzes

The Faculty of Engineering wants you to be successful in the co-op process from day one. Partnering with our colleagues in the Centre for Career Action and the department of Co-operative Education, we have designed Co-op Fundamentals for Engineering (CFE), a suite of co-op supports just for Engineering students. The Centre for Career Action has developed virtual modules on LEARN that provide an overview of the strategies and tactics students often use to obtain a co-op job. A Career Advisor will join one of your classes in Week 1 and thereafter will be available on Piazza for live Q&A sessions to answer any CFE and co-op related questions. You will also get an opportunity to receive résumé feedback from a trained TA. Please note that there is a dedicated LEARN site hosting CFE content and resources.

Your active participation in CFE activities has the potential to make a real impact on your first co-op experience. Please note that your work in this module will also contribute to your final grade in this course. See the grading section.

5.2 Workplace Harassment and Your Rights Module

The University of Waterloo seeks to surround you with environments that are equitable, inclusive, and supportive. There is no room for workplace harassment in this vision. CFE includes content developed by

the Office of Equity, Diversity, Inclusion & Anti-racism on Workplace Harassment and Your Rights. It is geared toward preparing you to successfully manage conflict in the workplace and learn about the Waterloo-specific workplace resources available to resolve harassment issues. Please note that there is a mandatory quiz included in this module and its grade will contribute to your final grade in this course. See the grading section.

6 Useful Resources on Campus

6.1 The Writing Centre

The Writing Centre works across all faculties to help students clarify their ideas, develop their voices, and write in the style appropriate to their disciplines. Writing Centre staff offer one-on-one support in planning assignments and presentations, using and documenting research, organizing, and structuring papers, and revising for clarity and coherence. One can make multiple appointments throughout the term or drop in at the Library for quick questions or feedback. To book a 50-minute appointment and to see drop-in hours, visit https://uwaterloo.ca/writing-and-communication-centre/. Group appointments for team-based projects, presentations, and papers are also available. Please note that writing specialists guide one to see their work as readers would. They can teach revising skills and strategies but will not proof-read or edit specific documents. Please bring hard copies of assignment instructions and any notes or drafts to an appointment.

6.2 Resumes

This year the CFE team has continued to expand its selection of résumé resources for junior students. A set of annotated résumés are housed in the dedicated CFE LEARN site.