UNIVERSITY OF WATERLOO DEPARTMENT OF CHEMICAL ENGINEERING

ChE 100 CHEMICAL ENGINEERING CONCEPTS 1 FALL 2022

Lectures and tutorials (Week 1-5):

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Lectures and tutorials (Week7-13):

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Teaching assistants

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Course overview

- ChE 100 will be all in person.
- All course material is located in Waterloo-LEARN, https://learn.uwaterloo.ca/d2l/home
- The course will consist of lectures, tutorials, problem sets, a midterm and a final exam.
- *The first lecture will be on Wednesday, Sept 7, 2022 from 9.30-10.20am.
- **The tutorials will start the week of Sept 12, 2022 (according to your schedule).

Email correspondence

According to University policy all official correspondence with students must be done through uwaterloo.ca e-mail [see http://www.adm.uwaterloo.ca/infocist/emailuse.html]. E-mail received from other e-mail addresses (like gmail, hotmail, yahoo, etc.) will be ignored.

Office hours

Thursdays 3:30-4:20 PM (EDT) with Prof. Tam
Mondays 3:30-4:20 PM (EDT) with Prof. Moresoli
Outside of these office hours, Prof. Tam and Prof. Moresoli can be contacted by email.

Course Learning Outcomes

After completing this course, students will be able to (numbers refer to the graduate attributes defined by the Canadian Engineering Accreditation Board (CEAB), details in the table below):

- Translate and visualize complex written problem statements (1, 3).
- Recognize and analyze simplified chemical processes (1, 2).
- Use excel and alternative linearization tools for data representation and analysis (5).
- Define, apply and analyze temperature, pressure, concentration, flowrates in the context of chemical processes and products (1, 2).
- Define and apply material balance principles to chemical processes (1, 2).

CEAB Graduate Attributes

Outcome	Definition
1. A knowledge base for engineering	Demonstrated competence in university level mathematics, natural sciences, engineering fundamentals, and specialized engineering 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 in order 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 in order 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, 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 team work	An ability to work effectively as a member and as a 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 abilities include 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 abilities include 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 to sufficiently maintain their competence and contribute to the advancement of knowledge.

Textbook
We will be using extensively the textbook, Elementary Principles of Chemical Processes, R.M. Felder, R.W. Rousseau and L.G. Bullard, 4th Edition, J. Wiley & Sons, 2016. You can order a copy through the https://wstore.uwaterloo.ca/

Lectures

- Lectures: Monday, Wednesday, Friday (9.30-10.20 am, RCH301)
- Make-up lectures (Sept 15, Oct 6, Nov 10): Thursday (12:30–1:20 pm, RCH 301)
- The lectures will present and discuss key concepts of chemical processes and provide examples and applications of these concepts.
- The first 4 weeks will introduce chemical engineering problem analysis and process variables. The following 8 weeks will introduce a variety of process operations and the flow of materials (~8 weeks). These topics cover material in Chap. 1-4 of the textbook.

- Reading week: Oct 9-15 (no lectures/no tutorials)
- Midterm week: October 17-21 (no lectures/no tutorials)

Tutorials

The first tutorial will be held in the week of Monday September 12, 2022 (according to your schedule).

Tutorials are held weekly. You should attend the tutorial time assigned to you:

- TUT 101: Monday @ 2:30-3:50 pm (DWE 3518)
- TUT 102: Thursday @ 8:30-9:50 am (MC 4042)
- TUT 103: Thursday @ 2:30-3:50 pm (MC4042)

Tutorial attendance
If you are unable to attend a tutorial session (e.g. illness, co-op interviews), you should notify the tutorial instructor (via email) ***before*** the date of the tutorial to make alternate arrangements. Otherwise, the quiz will be considered incomplete, unless you can prove other extenuating circumstances (i.e., medical note, etc.).

Tutorial objectives and organization
The purpose of the tutorials is to provide a smaller class environment and guidance to practice solving problems and analysis of chemical processes and product manufacturing. Engineering problem solving techniques will also be discussed.

Each student has a 80 minutes tutorial each week, at a time and place indicated on the schedule. Please ensure that you come to your tutorial (Mon 2.30-3.50 pm, Thurs 8.30-9.50 am, 2.30-3.50 pm).
Each tutorial consists of 10-15 minutes devoted to discussion/illustration of lecture material and individual quiz (65-70 minutes) on the material of the lectures; Quizzes will be graded and returned the following week. Details on quiz marking will be discussed during the first tutorial.

Tutorial quiz resources and communication

- Tutorial quizzes are open book in the sense that you may consult your textbook, course notes, and materials posted in the course LEARN site. Use of any other resource (including file-sharing services such as chegg.com, coursehero.com, stackexchange.com , ...) is prohibited.
- During the tutorial quiz you may communicate directly or indirectly only with students sitting near you, the course instructor and the WEEF TA.
- While ***students may be working with classmates, students are expected to have developed their independent knowledge of the concepts.*** The students are encouraged to call upon the tutorial instructor/WEEF TA for assistance when encountering difficulties. **The instructor/WEEF TA will not solve the problems for the students**, but will help guide students in the right direction.

Tutorial quiz completion (9 best out of 10 quizzes) is a mandatory component of ChE 100.

- Failure of taking a quiz will result in:

* mark of zero on the quiz
* 1% off the final course grade per missed quiz

Tutorial quiz grading

- **Only handwritten quiz solution will be graded**
- The quiz will be graded and returned the following week. The marks are intended to provide feedback and assist students in assessing their understanding course material.

Grade	
5	Attempt to answer all parts of the quiz is clearly articulated and presented (readable)
1-4	Partial attempt to answer the quiz is presented, e.g.: • Minor logical error, • Poorly presented, • Hard to follow, • Missing/incorrect units, or improper use of significant figures.
0	Minimal attempt to answer the quiz is presented

Lecture Assignments

- Posted on LEARN every Monday and usually due Thursday at 4:30 pm (10 days from posting).
- Solutions should be handed in the drop box in E6 (5th floor, South-East corner).
- Solutions should have a **'stand-alone tag' with FULL NAME and STUDENT ID**.
- **First page of the solution should have ONLY your STUDENT ID (no name)**. Failure to comply to these requirements will result in a grade of 0 for the given assignment.
- Lecture assignments are compulsory; a minimum of 8 assignments must be submitted. The assignment grade will be based on the average grade of the 8 best assignment marks.

- Each question on an assignment will be graded:

5- solution is correct or very nearly correct
1-4- solution is partially correct (depending on the efforts)
0- solution is incorrect or nearly incorrect

Examinations

- **There will be a midterm exam and a final exam.**
- Exams are closed book. You will be provided with conversion factors.
- During the Exam, you may not communicate directly or indirectly with any person except the course instructor.

Examination	Topic	Date
Midterm exam	Unit Conversion, Significant figures, and process data analysis Pressure, Moles, Molecular weight, mole fraction, composition	Midterm exam period Thursday October 20 10:30 am-12:20 pm
Final Exam	Material balances no/with reactions and single and multiple units	Final exam period (time and date will be annonced later)

Note that if the average of the midterm and final exam is less than 50, the this average becomes the course grade, resulting in a fail course.

Course Assessment

- Midterm exam 25%
- Final exam 55%
- Assignments (average of 8 best assignments) 10%
- Quizzes (average of 9 best quizzes) 10%

Mid-term exam: Oct 20 (Thurs-10.30am-12.20pm) (RCH 103, RCH 301, DWE 3519)
Final exam: Date and venue to be confirmed

ChE 100 Fall 2022

Week by week overview (tentative schedule, subject to minor adjustment during the term)

*FRB: Elementary Principles of Chemical Processes. Felder, RM, Rousseau RW and Bullard LG. 4th edition, 2016

Week	Lectures	Tutorial	Test
Sept 7 (Wed)-9, 2022	1.1-1.2 Process data representation and analysis (*FRB, 2.7)	**Quiz 1** (not graded) Data analysis (practice quiz-to be completed at home	
Sept 12-16, 2022	1.0 Units conversion, Significant figures (*FRB, 2.1- 2.5)	**Quiz 2** Process data representation	
Sept 19-23, 2022	2.1-2.3 Process and variables: force, weight, pressure & flow measurements (*FRB, 3.2-3.5)	**Quiz 3** Pressure application	
Sept 26-30, 2022	2.4-2.5 Moles, molecular weight, mass and mole fraction, composition (*FRB, 3.1)	**Quiz 4** Product/Chemical composition	
Oct 3-7 2022	3.1-3.2 Materials balance, flowchart representation, Fundamental law of materials balance, batch and continuous process (*FRB, 4.0-4.2)	**Quiz 5** Process representation and material balance	
Oct 10-14, 2022	CANCELLED READING WEEK	CANCELLED READING WEEK	
Oct 17-21, 2022	CANCELLED MIDTERM WEEK	CANCELLED MIDTERM WEEK	**Midterm exam (closed book) Thurs Oct 20 (10:30am-12:20 pm)**
Oct 24-28, 2022	3.3 General material balances calculations, sustainable development and circular economy (*FRB, 4.3, additional resources)	**Quiz 5**: Material balance: no reaction	
Oct 31-Nov 4, 2022	3.4 Material balances – no reaction and multiple unit operations 3.5 Material balances with recycle (*FRB, 4.4, 4.5)	**Quiz 6**: Material balance: no reaction	
Nov 7-11, 2022	3.6 Material balances with reactions 3.6.1 Reaction terminology 3.6.2 Solving material balances with reactions (*FRB, 4.6, 4.7)	**Quiz 7**: Material balance: no reaction	
Nov 14-18, 2022	3.6.3 Material balances with multiple reactions (*FRB, 4.6d)	**Quiz 8**: Material balance: with reactions	
Nov21-25, 2022	3.6.4 Material balances with reactions, product separation, recycle 3.6.5 Material balances with reactions, product separation, recycle, purge (*FRB, 4.7f, 4.7g)	**Quiz 9**: Material balance: with reactions	
Nov 28-Dec 2, 2022	3.7 Material balances with combustion reactions 3.7.1 Combustion chemistry 3.7.2 Solving material balances for combustion (*FRB, 4.8)	Quiz 10 Material balance with combustion reactions	
Dec 5 (Mon), 2022	Review wrap up		
Final exam period			**Final exam Material balances**

Chemical Engineering Schedule (All courses)

	Monday	Tuesday	Wednesday	Thursday	Friday
8:30	**MATH 115** LEC 001 RCH 301	**CHE 120** LEC 001 RCH 301	**MATH 115** LEC 001 RCH 301	**CHE 100** TUT 102, MC 4042	**MATH 115** LEC 001 RCH 301
9:30	**CHE 100** LEC 001 RCH 301		**CHE 100** LEC 001 RCH 301		**CHE 100** LEC 001 RCH 301
10:30	**CHE 102** LEC 001 RCH 301	**CHE 180** LEC 001 RCH 301	**MATH 116** LEC 001 RCH 301	**MATH 115** LEC 001 RCH 301	**MATH 116** LEC 001 RCH 301
11:30					
12:30	**MATH 116** TUT 101, MC 4060 TUT 102, DWE 3518 TUT 103, MC 4042	**CHE 180** STU 101 CPH 1346	**CHE 102** LEC 001 RCH 301	**Make-up Lectures** MATH 115, RCH 301 MATH 116, RCH 301 CHE 100, RCH 301	**CHE 102** TUT 101, RCH 205 TUT 102, DWE 1502 TUT 103, RCH 206 TUT 104, QNC 1506
1:30			**CHE 120** LAB 101 E2 1792	**CHE 180** SEM 201 RCH 301	
2:30	**CHE 100** TUT 101, DWE 3518	**Make-up Lectures** CHE 120, RCH 301 CHE 180, RCH 301 CHE 102, RCH 301	**CHE 120** LAB 102 E2 1792	**CHE 100** TUT 103, MC 4042	**CHE 102** LEC 001 RCH 301
3:30		**MATH 116** LEC 001 RCH 301			**GENE 119** SEM 001 CPH 1346
4:30	**MATH 115** TUT 101 RCH 301				

CHE 100 - Christine Moresoli, Michael Tam
CHE 102 - Tizazu Mekonnen
CHE 120 - Pendar Mahmoudi
CHE 180 - Marc Aucoin
MATH 115 - Ryan Trelford
MATH 116 – Leo Jiminez

ACADEMIC INTEGRITY and STUDENT MISCONDUCT

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 *https://uwaterloo.ca/engineering/current-undergraduate-students/academic-support/academic-integrity* for more information.]

ACADEMIC and NON-ACADEMIC OFFENSES include but are not limited to:

- *Cheating* (meaning trying to gain unfair advantage without individual effort) on examinations, assignments, work term reports, or any other work used to judge student performance, including:
  - Copying from another student's work, or allowing another student to copy from your work;
  - Excessive collaboration or collusion;
  - Fabrication of data;
  - Consultation with any unauthorized person during an examination or test;
  - Possession, use of, or intent to use unauthorized aids (e.g., book, calculator, computer) during an examination or test;
  - Violation of examination regulations.

- *Plagiarism* is the act of presenting the ideas, words, or intellectual property of another as one's own. The use of other people's work must be properly acknowledged and referenced in all written and orally presented material (e.g., take-home examinations, essays, lab reports, presentations, design projects, statistical data, computer programs and research results). The properly acknowledged use of sources is an accepted and important part of scholarship. Use of such material without complete and unambiguous acknowledgement, however, is an offence.

- Submitting an essay, report, or assignment when a major portion has been previously submitted for another course without the express permission of the instructors involved.

- Obtaining by improper means examination papers, tests or similar materials; using or distributing such materials to others.

- Misuse of resources, including computer usage and e-mail.

- Impersonating another student or entering into an arrangement with another person to be impersonated (e.g., for the purposes of taking examinations or tests, or carrying out labs or other assignments).

- Disruptive or threatening behaviour (including intimidation, vandalism and disruptions in classes, laboratories, examinations, on-campus residences, housing, and common areas) which infringes on the rights of other members of the University community.

- False or misleading representation, oral or written, which may have an effect on registration or academic evaluations, including:
  - failure to disclose prior academic records required for admission decisions or other academic purposes;
  - obtaining medical or other certificates under false pretences;
  - altering documents or certificates, including health claims, tests, examinations; and
  - submitting false credentials for any purpose.

- Unethical Behaviour (e.g., harassment, discrimination).
  (Reference: http://www.adm.uwaterloo.ca/infosec/Policies/policy33.html)

- Violation of safety regulations (classrooms, labs, field trips, etc.).

- Contravention of statues, including: the Copyright Act, UW Cancopy License, and the Criminal Code of Canada (e.g., forgery, fraud).

- For further information, refer to Policy #71 on "Student Academic Discipline" in the Undergraduate Calendar, or on-line at:
  http://www.adm.uwaterloo.ca/infosec/Policies/policy71.html

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, www.adm.uwaterloo.ca/infosec/Policies/policy70.htm. 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 [check www.uwaterloo.ca/academicintegrity/] to avoid committing an academic offence, and to take responsibility for his/her actions. 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, www.adm.uwaterloo.ca/infosec/Policies/policy71.htm. For typical penalties check Guidelines for the Assessment of Penalties, www.adm.uwaterloo.ca/infosec/guidelines/penaltyguidelines.htm.

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) www.adm.uwaterloo.ca/infosec/Policies/policy72.htm.

Note for Students with Disabilities: The AccessAbility Services (https://uwaterloo.ca/accessability-services/) 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 contact the AccessAbility Services.

Counselling Services: Here to help, do not hesitate to contact. There are both Engineering and University counselling services.

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.