Department of Chemical Engineering

ChE 564 Food Process Engineering (Winter 2023)

INSTRUCTOR
Prof. Tiz Mekonnen tmekonnen@uwaterloo.ca Office: E6 5010

LECTURES
Monday 1:30 – 2:50 pm
Wednesday 1:30 – 2:50 pm

Office Hours
TBD

E-mail 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. Please allow one business day for a response to email. All e-mails must contain an appropriate subject line. The body of the e-mail must contain your name and student number. The e-mail must have text with complete sentences, correct spelling, and proper grammar. Overall, it should have a professional tone.

Resources

Website
The course website is on Waterloo LEARN. Course notes, projects, practice problems, and other course materials will be posted there.

Course Delivery
- This course will be provided exclusively in person in classroom E6-2024.

Notes:
- In the case of unexpected event related to the COVID pandemic, there could be a temporary **short-term switch to online** (For example, the instructor may be unable to come to campus one day due to the COVID screening, exposure concern and self-isolation). In such situations, the instructor will notify the class and the course will be delivered online (synchronous) using MS Teams temporarily.
- In the event of a further Provincial lockdown associated with the COVID pandemic, or an order by local Public Health associated with a COVID outbreak, the course will undergo a **longer-term switch to online**. MS Teams platform will be used for delivery.

Course material

Course material will be available through Waterloo LEARN for use in class.

Other appointments: please speak with me after class or contact me by email to arrange a meeting. I am available to assist you and would like everyone to succeed in this course. Please don't wait

until the end of the term to seek help!

COURSE LEARNING OUTCOMES

In this course you will be introduced to the basics of foods and food processing and you will apply chemical engineering principles for the analysis of food processes and food products. By the end of the course you should be able to (numbers refer to the graduate attributes defined by the Canadian Engineering Accreditation Board (CEAB) and presented in the table below):

1) Define and distinguish major nutrients, physicochemical properties and quality attributes of food products (1).

2) Define and apply microbiological and safety principles of food processes and products (1, 2, 3, 9).

3) Apply material and energy balances, reaction kinetics, heat and mass transfer principles for the analysis of major food processes (1, 2, 3, 4, 5).

4) Explain and communicate (oral and written), to a scientific audience, the engineering and safety of food processes and products (7, 9).

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.

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RESOURCES

Website

The course website is on Waterloo LEARN. Course notes, projects, practice problems, and other course materials will be posted there.

Course Notes

Course notes are available through Waterloo LEARN for use in class.
It is your responsibility to bring them with you to class.

Textbook

No textbook is required for this course, but you may find these books useful:

- P.J. Fellows. Food Processing Technology: Principles and Practice, 3rd Edition. Woodhead Publishing Ltd and CRC Press, 2009.
- R.P. Singh, D.R. Heldman. Introduction to Food Engineering, 5th Edition. Academic Press, 2012.
- A. Ibarz, G.V. Barbosa-Canovas. Introduction to Food Process Engineering. CRC Press, 2014.

COURSE ASSESSMENT*

Item	
Mid-term exam	30 %
Final exam	30 %
Assignment (s)	10 %
Term project	30 %
• Topic	CR/NC
• Preliminary literature review	CR/NC
• Project overview and critical component	CR/NC
• Presentation and Q&A	10
• Written report	20

Exam dates:

Mid-term – Feb 15th, 2023 (1:30 – 2:50 pm)

***Final exam – To be decided**

***FINAL EXAM**

The final exam will occur during the final exam period in April as assigned by the Registrar's Office. The final exam will cover all aspects of the course and will be comprised of both short answer questions and longer computational problems.
More information on the final exam will be provided later in the term.

TERM PROJECT

The objective is to conduct a critical review of an emerging topic in food process engineering.
The project will be completed in groups of **two**. **Details of the deliverables, submission and rubric will be presented separately.**

COURSE CONTENT

Unit 1. Introduction

1.1. Course introduction and background
1.2. Food compositions
1.3. Nutritional requirements
1.4. Food physicochemical and other properties

Unit 2. Food Safety

2.1 Introduction to food safety
2.2 Regulations and Labelling
2.3 Microbiological food safety
2.3 HACCP
2.4 Process and equipment design
2.5 Cleaning in Place

Unit 3. High temperature processes

3.1 Heat transfer in food
3.2 Thermal death kinetics
3.3 Blanching
3.4 Pasteurization
3.5 Sterilization
3.6 Batch operations
3.6 Continuous operations

Unit 4. Low temperature processes

4.1 Chilling
4.3 Freezing
4.4 Thawing

Unit 5. Drying Operations

5.1 Air and drum drying
5.2 Spray drying
5.3 Freeze drying

Unit 6. Selected Food Processing Operations

Faculty Regulations

Academic offenses, such as copying another student's report or submitting another student's assignment solution as your own, will not be tolerated. UW Policy #71, which gives definitions of the types and consequences of academic offenses, can be found at. www.adm.uwaterloo.ca/infosec/Policies/policy71.htm. If you have questions after reading Policy #71, please speak with your instructor.

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. [See www.uwaterloo.ca/academicintegrity/ for more information.]

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 for more information.

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 [see www.uwaterloo.ca/academicintegrity]. A student who is unsure whether an action constitutes an offence, or who needs help in learning how to avoid offences (such as plagiarism and/or 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 see 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) 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
AccessAbility Services, located in Needles Hall, Room 1132, 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 at the beginning of each academic term. www.uwaterloo.ca/disability-services/