



ENGG*4300 Food Processing Engineering Design

01

Winter 2023

Section(s): C01

School of Engineering

Credit Weight: 0.75

Version 1.00 - January 03, 2023

1 Course Details

1.1 Calendar Description

This course covers the design of various food processing operations and the physico-chemical and mechano-biological response of foods to such operations. Topics include: process evaluation; optimization of operations such as thermal and chemical processes; and rheological properties of various food forms.

Pre-Requisites: ENGG*3430 or FOOD*3170

1.2 Course Description

Topics in this course include overview of food process design, pasteurization and sterilization process design, drying process design (hot air dryer, freeze dryer, spray dryer), extrusion process design, baking process design, frying process design, separation process design, extraction process design, size reduction process design, mixing and agitation process design, refrigeration and freezer system design, food packaging and system design, novel processes design (high-pressure processing (HPP), microwave processing, pulsed electric field processing (PEF)), system design for food quality and safety assurance, hazard analysis and critical control point (HACCP) and food factory design. The students will put into practice what they learn in the classroom through a group design project that combines research study and mathematical modeling for various food processes design.

1.3 Timetable

Lectures

Wednesday and Friday: 1:00 pm - 2:20 pm (MCKN 521)

Laboratory

Wednesday 8:30 am - 10:20 am (Room - THRN 1104)

1.4 Final Exam

There is no final exam for this course

2 Instructional Support

2.1 Instructional Support Team

Instructor: Manickavasagan Annamalai Ph.D., P.Eng.
Email: mannamal@uoguelph.ca
Telephone: (519) 824-4120 Ext: 53499
Office: THRN 2401
Office Hours: **Non-lecture contact hours**

Wednesday: 2:30 pm to 3:30 pm

Friday: 2:30 pm to 3:30 pm

Lab Technician: Jacqueline Fountain
Email: fountain@uoguelph.ca
Telephone: 5198231268 ext. 57454
Office: THRN 1102
Office Hours: During lab time

2.2 Teaching Assistants

Teaching Assistant (GTA): Rahul Barbhuiya
Email: rbarbhui@uoguelph.ca
Office Hours: During lab time

3 Learning Resources

3.1 Required Resources

COURSE WEBSITE (WEBSITE) (Website)
<https://courselink.uoguelph.ca>

Course material, news, announcements, and grades will be regularly posted to the ENGG*4300 Courselink site. You are responsible for checking the site regularly.

3.2 Recommended Resources

Handbook of Food Process Design (Textbook)

2012. Edited by: Jasim Ahmed and Mohammad Shafiur Rahman. Wiley Blackwell , West Sussex, UK (1470 pages)

Handbook of Food Factory Design (Textbook)

2013. Edited By: Christopher G.J. Baker. Springer, New York, USA (499 pages)

Handbook of Food Processing Equipment (Second Edition) (Textbook)

2016. Edited by: George Saravacos and Athanasios E. Kostaropoulos. Springer, New York, USA (781 pages)

Unit Operations in Food Processing (Textbook)

1983. Earle, R. L. Pergamon Press, New York, USA (207 pages)

3.3 Additional Resources

Lecture Information (Notes)

All lecture notes will be posted on CourseLink.

Project Information (Other)

The project requirements and information will be discussed in class/lab, and posted on CourseLink.

3.4 Communication & Email Policy

Please use lectures and lab help sessions as your main opportunity to ask questions about the course. Major announcements will be posted to the course website. It is your responsibility to check the course website 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 its student.

4 Learning Outcomes

4.1 Course Learning Outcomes

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

1. Describe unit operations in food engineering and their implementation in food manufacturing operations.
2. Design individual or series of unit operations in food processing systems including instrumentation and control components.

3. Evaluate food processing designs and food processing equipment in the real world food manufacturing environment.
4. Designate and accept responsibilities in a team environment, manage time and resources and communicate results.

4.2 Engineers Canada - Graduate Attributes (2018)

Successfully completing this course will contribute to the following:

#	Outcome	Learning Outcome
1	Knowledge Base	1, 2, 3, 4
1.1	Recall, describe and apply fundamental mathematical principles and concepts	1, 2, 3, 4
1.2	Recall, describe and apply fundamental principles and concepts in natural science	1, 2, 3, 4
1.3	Recall, describe and apply fundamental engineering principles and concepts	1, 2, 3, 4
1.4	Recall, describe and apply program-specific engineering principles and concepts	1, 2, 3, 4
2	Problem Analysis	1, 2, 3, 4
2.1	Formulate a problem statement in engineering and non-engineering terminology	1, 3, 4
2.2	Identify, organize and justify appropriate information, including assumptions	3, 4
2.3	Construct a conceptual framework and select an appropriate solution approach	3, 4
2.4	Execute an engineering solution	1, 2, 3, 4
2.5	Critique and appraise solution approach and results	1, 3, 4
3	Investigation	2, 3, 4
3.1	Propose a working hypothesis	2, 3, 4
3.2	Design and apply an experimental plan/investigative approach (for example, to characterize, test or troubleshoot a system)	2, 3, 4

#	Outcome	Learning Outcome
3.3	Analyze and interpret experimental data	2, 3, 4
3.4	Assess validity of conclusions within limitations of data and methodologies	2, 3, 4
4	Design	1, 2, 3, 4
4.1	Describe design process used to develop design solution	2, 4
4.2	Construct design-specific problem statements including the definition of criteria and constraints	2, 4
4.3	Create a variety of engineering design solutions	1, 2, 3, 4
4.4	Evaluate alternative design solutions based on problem definition	2, 4
4.5	Develop and refine an engineering design solution, through techniques such as iteration, simulation and/or prototyping	2, 4
5	Use of Engineering Tools	1, 2, 3, 4
5.1	Select appropriate engineering tools from various alternatives	2, 3, 4
5.2	Demonstrate proficiency in the application of selected engineering tools	1, 2, 3, 4
5.3	Recognize limitations of selected engineering tools	2, 3, 4
6	Individual & Teamwork	3
6.2	Understand all members' roles and responsibilities within a team	3
7	Communication Skills	4
7.1	Identify key message(s) and intended audience in verbal or written communication as both sender and receiver	4
7.5	Demonstrate ability to process oral and written communication by following instructions, actively listening, incorporating feedback, and formulating meaningful questions	4
8	Professionalism	4
8.2	Effectively describe engineering law and its impact on professional engineering practice	4
9	Impact of Engineering on Society and the Environment	4
9.1	Analyze the safety, social, environmental, and legal aspects of engineering activity	4

#	Outcome	Learning Outcome
9.3	Anticipate the positive and negative impacts of introducing innovative technologies to solve engineering problems	4
10	Ethics & Equity	4
10.3	Demonstrate values consistent with good ethical practice, including equity, diversity, and inclusivity	4
11	Economics and Project Management	4
11.2	Identify risk and change management techniques, in the context of effective project management	4
12	Life Long Learning	4
12.3	Demonstrate capability for continuous knowledge and skill development in a changing world	4

4.3 Relationships with other Courses & Labs

Previous Courses:

- **FOOD*3170:** Integration of the various unit operations into a functioning food process.
- **ENGG*3430:** Application of the conservation of mass and energy laws in food process design.
- **ENGG*3830:** Application of mass and energy balances in food manufacturing environment.

5 Teaching and Learning Activities

The following is the general breakdown of the topics that will be covered on any given week. There may be variations depending on students' interest.

5.1 Lecture

Week 1

Topics:	Introduction to food processing and food industries.
Learning Outcome:	1
Week 2	
Topics:	Drying process design (hot air dryer, freeze dryer, spray dryer).
Learning Outcome:	2, 3
Week 3	
Topics:	Pasteurization and sterilization process design.
Learning Outcome:	2, 3
Week 4	
Topics:	Extrusion process design.
Learning Outcome:	2, 3
Week 5	
Topics:	Baking process design.
	Frying process design.
Learning Outcome:	2, 3
Week 6	
Topics:	Separation process design.
	Extraction process design.
	Size reduction process design.
	Mixing and agitation process design.
Learning Outcome:	2, 3
Week 7	

Topics: Refrigeration and freezer system design.

Food packaging system design.

Learning Outcome: 2, 3

Week 8

Topics: Novel processes design:

-High-pressure processing (HPP)

-Microwave processing

-Pulsed electric field processing (PEF))

Learning Outcome: 2, 3

Week 9

Topics: System design for food quality and safety assurance, and hazard analysis and critical control point (HACCP).

Food factory design.

Learning Outcome: 2, 3

Week 10

Topics: **Guest Lecture:**

Food industry 1

Food industry 2

Learning Outcome: 3, 4

Week 11

Topics: **Guest Lecture:**

Food industry 3

Food industry 4

Learning Outcome: 3, 4

Week 12

Topics:

Guest Lecture:

1. Ontario Ministry of Agriculture, Food, and Rural Affairs (OMAFRA)
2. Agriculture and Agri-Food Canada (AAFC)
3. Canadian Food Inspection Agency (CFIA)

Learning Outcome: 3, 4

5.2 Lab

Week 1

Topics: Teammate selection and project overview

Learning Outcome: 4

Week 2

Topics: Design project: Problem identification and work distribution

Learning Outcome: 2, 3, 4

Week 3

Topics: Design project: Proposal

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

Week 4

Topics: Design project: Proposal

Learning Outcome: 2, 3, 4

Week 5

Topics: **Design project: Proposal presentation**

Learning Outcome: 4

Week 6

Topics: Design project: Design and fabrication (if required)

Learning Outcome: 2, 3, 4

Week 7

Topics: Design project: Design and fabrication (if required)

Learning Outcome: 2, 3, 4

Week 8

Topics: Design project: Experiments and data collection (if required)

Learning Outcome: 2, 3, 4

Week 9

Topics: Design project: Experiments and data collection (if required)

Learning Outcome: 2, 3, 4

Week 10

Topics: Design project: Data analysis and report writing

Learning Outcome: 2, 3, 4

Week 11

Topics: Design project: Data analysis and report writing

Learning Outcome: 2, 3, 4

Week 12

Topics: **Design project: Final Presentation**

Learning Outcome: 4

5.3 Other Important Dates

09 January 2023, Monday: First day of class.

20 February 2023, Monday: Winter Break begins--NO CLASSES SCHEDULED THIS WEEK.

27 February 2023, Monday: Classes resume.

10 April 2023 Monday: Last day of class.

6 Assessments

6.1 Assessment Details

Test 1 (20%)

Learning Outcome: 1, 2, 3
Date: March 01 (Wednesday)

Test 2 (20%)
Learning Outcome: 1, 2, 3
Date: March 31 (Friday)

Design Project: Proposal (10%)
Learning Outcome: 2, 4
Date: Feb 08 (Wednesday)

Design Project : Proposal Presentation (10%)
Learning Outcome: 2, 4
Date: Feb 08 (Wednesday)

Design Project: Final Report (30%)
Learning Outcome: 2, 3, 4
Date: Apr 05 (Wednesday)

Design Project: Final Presentation (10%)
Learning Outcome: 2, 3, 4
Date: Apr 05 (Wednesday)

6.2 Note

Partner and Project Selection Process

Projects will be completed in teams of 3 to 4 students

6.3 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 within two weeks of 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, you must obtain a grade of 50% or higher on the exam portion of the course in order for the remaining portions of the course to count towards the final grade.

Lab Work: You must attend and complete all laboratories. If you miss a laboratory due to grounds for granting academic consideration or religious accommodation, arrangements must be made with the instructor to complete a makeup lab.

Late Lab Reports: Not applicable.

7 School of Engineering Statements

7.1 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.

7.2 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.

7.3 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.

8 University Statements

8.1 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.

8.2 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>

8.3 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>

8.4 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.

8.5 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 make a booking at least 14 days in advance, and no later than November 1 (fall), March 1 (winter) or July 1 (summer). Similarly, new or changed accommodations for online quizzes, tests and exams must be approved at least a week ahead of time.

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>

8.6 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>

8.7 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.

8.8 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>

8.9 Disclaimer

Please note that the ongoing COVID-19 pandemic may necessitate a revision of the format of course offerings, changes in classroom protocols, and academic schedules. Any such changes will be announced via CourseLink and/or class email.

This includes on-campus scheduling during the semester, mid-terms and final examination schedules. All University-wide decisions will be posted on the COVID-19 website (<https://news.uoguelph.ca/2019-novel-coronavirus-information/>) and circulated by email.

8.10 Illness

Medical notes will not normally be required for singular instances of academic consideration, although students may be required to provide supporting documentation for multiple missed assessments or when involving a large part of a course (e.g.. final exam or major assignment).

8.11 Covid-19 Safety Protocols

For information on current safety protocols, follow these links:

- <https://news.uoguelph.ca/return-to-campus/how-u-of-g-is-preparing-for-your-safe-return/>
- <https://news.uoguelph.ca/return-to-campus/spaces/#ClassroomSpaces>

Please note, these guidelines may be updated as required in response to evolving University, Public Health or government directives.
