ENGG*4300 Food Processing Engineering Design

Winter 2019
Section(s): C01

School of Engineering
Credit Weight: 0.75
Version 1.00 - January 05, 2019

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1 Course Details

1.1 Calendar Description

This course covers the formulation of mathematical models to describe food processing operations and the response of foods to such operations. Topics include: process evaluation; development and computer-aided design of operations such as thermal processes; and properties of various food forms.

Pre-Requisite(s): ENGG*3260, ENGG*3830

1.2 Course Description

This course covers the design of various food processing operations, including fluid flow, spray-drying and high shear extrusion. This course will also cover engineering and physico-chemical aspects of microencapsulation technologes for making foods with targeted delivery.

1.3 Timetable

Lectures:
Monday and Wednesday 08:30am - 09:50am CRSC 101

Tutorials/Demo Laboratory:
Thursday 02:30pm - 04:20pm THRN 1104 or Food Science Pilot Plant 1
(TBA on CourseLink or in class)

1.4 Final Exam

Thursday, April 18, 2019 08:30am - 10:30am, Room TBA on Webadvisor

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2 Instructional Support

2.1 Instructional Support Team

Instructor:	Mario Martinez Martinez Ph. D.
Email:	mariom@uoguelph.ca
Telephone:	5198244120 ext. 58677
Office:	RICH 3501
Office Hours:	By appointment.
Lab Technician:	Nick Vanstone
Email:	vanstonn@uoguelph.ca
Telephone:	5198231268 ext. 57454
Office:	THRN 1102
Office Hours:	By appointment.

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3 Learning Resources

3.1 Required Resource(s)

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

Course materials, news, announcements, and grades will be regularly posted to the ENGG*3830 Courselink site. You are responsible for checking the site regularly.

UNIT OPERATIONS IN FOOD PROCESSING. (TEXTBOOK) (Textbook)
http://www.nzifst.org.nz/unitoperations

Earle, R. 1983. Unit Operations in Food Processing. Web Edition.

3.2 Recommended Resource(s)

EXTRUSION PROCESSING TECHNOLOGY (Textbook)
Bouvier & Campanella, 2014. 1st Edition. John Wiley & Sons, Ltd, The Atrium, Southern Gate, Chichester, West Sussex, PO19 8SQ, UK

UNIT OPERATIONS OF CHEMICAL ENGINEERING (TEXTBOOK) (Textbook)
McCabe, W.L., Smith, J.C. and Harriott, P. 2005. 7th Edition. McGraw-Hill, Inc. New York.

3.3 Additional Resource(s)

LECTURE INFORMATION (Notes)
All the lecture notes will be posted on the web page at least one day prior to the lecture. You are expected to have access to these for each class.

ASSIGNMENTS (Other)
Download the assignments according to instructions given in class. No solutions will be posted but will be discussed in class as required.

LAB INFORMATION (Lab Manual)
All the lab session information will be 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.

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4 Learning Outcomes

4.1 Course Learning Outcomes

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

1. Understand food engineering unit operations and their mass balances.
2. Identify rheological indicators to design unit operations involving the transformation of newtonian and non-newtonian fluid foods.
3. Understand hydrothermal processing techniques to manufacture foods with targeted delivery and functionality.
4. Explain and design high shear extrusion technology as a bio-recycling tool of high value edible food waste.

4.2 Engineers Canada - Graduate Attributes (2018)

Successfully completing this course will contribute to the following:

#	Outcome	Learning Outcome(s)
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	1, 2, 3, 4

#	Outcome	Learning Outcome(s)
	natural science	
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
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

#	Outcome	Learning Outcome(s)
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
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.
- **ENGG*3830:** Aplication of mass and energy balances.

Same Semester Courses:

- **ENGG*3260:** Foundations of thermodynamics.

Follow-on Courses:

- **ENGG*6090:** Material Science and Nutrient Delivery in Food Engineering.

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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

Topic(s):	Introduction to engineering unit operations and food processing.
Learning Outcome(s):	1,2,3,4

Week 2

Topic(s):	Mass balances in food processing.
Learning Outcome(s):	1,2

Week 3

Topic(s):	Mass balances in Food Processing.
Learning Outcome(s):	1,2

Week 4

Topic(s): Fluid mechanics of non-Newtonian food materials.

Learning Outcome(s): 1,2

Week 5

Topic(s): Fluid mechanics of non-Newtonian food materials.

Learning Outcome(s): 1,2

Week 6

Topic(s): Fluid mechanics of non-Newtonian food materials.

Learning Outcome(s): 1,2

Week 7

Topic(s): High shear extrusion.

Learning Outcome(s): 1,2,4

Week 8

Topic(s): Project presentation.

Learning Outcome(s): 1,2,3,4

Week 9

Topic(s): High shear extrusion.

Learning Outcome(s): 1,4

Week 10

Topic(s): High shear extrusion.

Learning Outcome(s): 1,4

Week 11

Topic(s): Drying of food materials.

Learning Outcome(s): 1,3

Week 12

Topic(s): Spray-drying as a microencapsulation tool in food processing.

Learning Outcome(s): 1,3

Week 12

Topic(s): Final exam.

Learning Outcome(s): 1,2,3,4

5.2 Lab

Week 4

Topic(s): Rheological and thermo-rheological inditators in food processing.

Learning Outcome(s): 2,3,4

Week 9

Topic(s): High shear extrusion as bio-recycling technology of high value food waste.

Learning Outcome(s): 1,2,3,4

Week 11

Topic(s): Encapsulation of macro and micro-nutrients using spray-drying.

Learning Outcome(s): 1,3

5.3 Other Important Dates

07 January 2019, Thursday: First day of class.
18 February 2019, Monday: Winter Break begins--NO CLASSES SCHEDULED THIS WEEK.
25 February, 2019, Monday: Classes resume.
08 March 2019, Friday: 40th class day, last day to drop classes.
05 April 2019, Friday: Last day of class.

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6 Assessments

6.1 Marking Schemes & Distributions

Name	Scheme A (%)
Assignment 1	10
Lab report 1	10

Name	Scheme A (%)
Lab report 2	10
Lab report 3	10
Project	30
Final exam	30
Total	100

6.2 Assessment Details

Assignments (0%)

Learning Outcome(s): 1,3

10% - Assignment 1 (due on February 13). The Assignment will be graded before March 8, 2019.

Lab reports (0%)

Learning Outcome(s): 2,3,4

10% - Lab 1 report (due 1 week after completion of lab session 1). Lab 1 report will be graded before March 8, 2019.

10% - Lab 2 report (due 1 week after completion of lab session 2). Lab 2 report will be graded before March 31, 2019.

10% - Lab 3 report (due 1 week after completion of lab session 3). Lab 3 report will be graded before March 31, 2019.

Project (0%)

Learning Outcome(s): 3,4

15% - written report (due on March 3, 2019)

15% - oral presentation in class or tutorial after submission of written report (week 8). Either paper or electronic copy are to be submitted. The project will be graded before March 8, 2019.

Final exam (0%)

Learning Outcome(s): 1,2,3,4

30% - Final exam (April 18, 2019)

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 35% 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.

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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.

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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

8.3 Drop Date

Courses that are one semester long must be dropped by the end of the fortieth class day; two-semester courses must be dropped by the last day of the add period in the second semester. The regulations and procedures for course registration are available in the Undergraduate and Graduate 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

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 book their exams at least 7 days in advance and not later than the 40th Class Day.

More information can be found on the SAS website
https://www.uoguelph.ca/sas

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