



ENGG*3830 Bio-Process Engineering

01

Fall 2022

Section(s): C01

School of Engineering

Credit Weight: 0.50

Version 1.00 - September 02, 2022

1 Course Details

1.1 Calendar Description

Application of engineering principles to the processing of biological products in the biological and food industry. Analysis and design of unit processes such as sedimentation, centrifugation, filtration, milling and mixing involving rheology and non-Newtonian fluid dynamics of biological materials. Analysis of heat and mass balances for drying evaporation, distillation and extraction.

Pre-Requisites: ENGG*2230, ENGG*2660

Co-Requisites: ENGG*3260

1.2 Course Description

The aim of this course is to familiarize the students with different unit operations used in biological engineering, bioprocess engineering and food engineering. The students will learn to use different engineering techniques and system analysis tools to analyze, appraise and design these unit operations involving heat and mass transfer, mixing and separation technologies.

1.3 Timetable

Lectures: MACN 202

Monday 1600hr - 1720hr

Wednesday 1600hr - 1720hr

Tutorials/Demo Laboratory: MCKN 307 (or THRN1104 Bio-Eng Lab)

Monday 1230hr - 1320hr

1.4 Final Exam

Saturday, Dec 10, 2022 1430hr - 1630hr

Room TBA on Webadvisor

2 Instructional Support

2.1 Instructional Support Team

Instructor: Ping Wu P.Eng.
Email: pingwu@uoguelph.ca
Telephone: 519-824-4120 ext 58451
Office: THRN 2361
Office Hours: By appointment

Lab Technician: Jacqui Fountain
Email: fountain@uoguelph.ca
Telephone: +1 519 824 4120 x56676
Office: THRN 1102

2.2 Teaching Assistants

Sindhu - ssindhu@uoguelph.ca

3 Learning Resources

3.1 Required Resources

Course 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)

<https://nzifst.org.nz/resources/unitoperations/index.htm>

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

3.2 Recommended Resources

Transport Processes and Separation Process Principles (Textbook)

Geankoplis, C.; A. Hersel; D. Lepek. 2018. 5th Edition. Pearson Education Inc. New York.

Unit Operations of Chemical Engineering (Textbook)

McCabe, W.L., Smith, J.C. and Harriott, P. 2005. 7th Edition. McGraw-Hill, Inc. New York.

Experimental Methods in Food Engineering (Textbook)

Rizvi, S.S.H. and Mittal, G.S. 1992. Van Nostrand and Reinhold, New York.

Introduction to Food Engineering (Textbook)

Singh, R.P. and Heldman, D.R. 2013. 5th Edition. Academic Press. Massachusetts.

Food Process Engineering (Textbook)

Heldman, D.R., and Singh, R.P. 1981. 2nd Edition. AVI Publishing Company, Inc. Connecticut.

3.3 Additional Resources**Lecture Information (Notes)**

All lecture notes will be posted on courselink.

Lab Information (Lab Manual)

The handouts for all the lab sessions will be given out at the lab.

Practice Assignments (Other)

Assignments will be given out on various topics. It is not required for students to submit the assignments for marking. However, students are strongly encouraged to complete them. Solutions of all the assignments will be made available on the course web page.

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. Analyze unit operations for biological processes using the techniques of engineering and system analysis
2. Appraise and quantify processes used for the recovery of biological materials in unit operations
3. Explain and design unit operations involving simultaneous heat and mass transfer
4. Understand unit operations involving mechanical separations of biological systems

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
5	Use of Engineering Tools	1, 2, 3, 4
5.1	Select appropriate engineering tools from various alternatives	1, 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	1, 2, 3, 4
6	Individual & Teamwork	2, 3, 4
6.1	Describe principles of team dynamics and leadership	2, 3, 4
6.2	Understand all members' roles and responsibilities within a team	2, 3, 4
6.3	Execute and adapt individual role to promote team success through, for example, timeliness, respect, positive attitude	2, 3, 4
6.4	Apply strategies to mitigate and/or resolve conflicts	2, 3, 4
6.5	Demonstrate leadership through, for example, influencing team vision and process, promoting a positive team culture, and inspiring team members to excel	2, 3, 4

4.3 Relationships with other Courses & Labs

Previous Courses:

- **ENGG*2230:** Application of the conservation of mass and energy laws
- **ENGG*2660:** Using a "systems" approach for problem investigation and analysis

Same Semester Courses:

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

Follow-on Courses:

- **ENGG*4300:** Foundations of food processing design
- **ENGG*4380:** Foundations of bioreactor design
- **ENGG*4110:** Foundations of bioprocessing for related 41X project

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 Engineering Unit Operations

Mass and Energy Balance

Learning Outcome: 1, 2, 3, 4

Week 2

Topics: Mass and Energy Balance

Food Rheology

Learning Outcome: 1, 2, 3

Week 3

Topics: Heat Transfer

Learning Outcome: 1, 2, 3

Week 4

Topics:	Heat Transfer
Learning Outcome:	1, 2, 3
Week 5	
Topics:	Evaporator
Learning Outcome:	1, 3
Week 6	
Topics:	Thermal Processing
Learning Outcome:	1, 3
Week 7	
Topics:	Pychrometry
	Drying
Learning Outcome:	1, 3
Week 8	
Topics:	Particulate Solids
Learning Outcome:	4
Week 9	
Topics:	Mechanical Separation
Learning Outcome:	4
Week 10	
Topics:	Mechanical Separation
Learning Outcome:	1, 3
Week 11	
Topics:	Extraction/Leaching
Learning Outcome:	1, 4
Week 12	

Topics: Extraction/Leaching and Distillation

Additional topics if time permits

Learning Outcome: 1, 2, 3, 4

5.2 Lab

Topics: Assessment of Newtonian and non-Newtonian fluids behaviour

Learning Outcome: 1, 2

Topics: Drying of liquid dispersions (spray-drying)

Learning Outcome: 2, 2, 3, 3

5.3 Tutorial/Demo Lab Schedule

Tutorials will take place in MCKN 307.

Demo Lab will take place in THRN 1104.

Exact schedules will be announced on CourseLink or in class.

5.4 Other Important Dates

08 September 2022, Thursday: First day of class

10 October 2022, Monday: Thanksgiving Day

11 October 2022, Tuesday: Fall Study Break Day

01 Dec 2022, Thursday: Classes rescheduled from Tuesday, October 11

02 Dec 2022, Friday: Classes rescheduled from Monday, October 10. Classes conclude

10 Dec 2022, Saturday: Final Exam (1430hr to 1630hr)

6 Assessments

6.1 Marking Schemes & Distributions

Name	Scheme A (%)
Case Studies	40
Project	20
Final Exam	40
Total	100

6.2 Assessment Details

Case Studies (40%)

Date: Tutorial or Lab

Learning Outcome: 1, 2, 3, 4

Best 6 out of 8 case studies if all they have been attempted. Otherwise, the grade will be based on the average of all 8 case studies.

The schedule will be announced in class and posted on Courselink

Project (20%)

Learning Outcome: 1, 2, 3, 4

5% - In Class Presentation

15% - Final report

The presentation schedule and report due date will be announced in class and posted on Courselink.

Final Exam (40%)

Date: Sat, Dec 10, 2:30 PM - 4:30 PM, Room TBA on Webadvisor

Learning Outcome: 1, 2, 3, 4

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: Students must obtain an overall grade of 50% or higher on the aggregate of

all the course work outlined in Section 6 Assessment.

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 Assignments/Reports: Late assignments or reports will not be accepted.

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.
