ENGG*3830 Bio-Process Engineering

01

Fall 2023
Section(s): C01

School of Engineering
Credit Weight: 0.50
Version 2.00 - September 07, 2023

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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: CRSC 101

Tuesday 1130hr - 1250hr
Thursday 1130hr - 1250hr

Tutorials/Demo Laboratory: MCKN 119A (or THRN1104 for demo lab)
Thursday 1530hr - 1620hr

1.4 Final Exam

Wednesday, Dec 6, 2023 0830hr - 1030hr

Room TBA on Webadvisor

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2 Instructional Support

2.1 Instructional Support Team

Instructor:	Guneet Kaur PhD
Email:	gkaur41@uoguelph.ca
Telephone:	519-824-4120 ext 54719
Office:	RICH 1503
Office Hours:	By appointment
Lab Technician:	Jacqui Fountain
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Office:	THRN 1102

2.2 Teaching Assistants

Malvika

Email: mmalvika@uoguelph.ca

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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.

Bioprocess Engineering: Basic Concepts (Textbook)

Bioprocess Engineering: Basic Concepts. Michael Shuler, Fikret Kargi, Matthew DeLisa. Pearson Publishing. 3rd Edition

Bioprocess Engineering Principles. Pauline M. Doran. Elsevier. 2nd Edition

3.2 Additional Resources

Lecture information (Notes)

Lecture Information: All the lecture notes will be posted on Courselink prior to the lecture. During the lecture, additional notes and examples will be provided. It is expected that you will have a copy of the posted lecture notes for each class.

Lab Information (Notes)

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

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

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	1, 2, 3, 4

#	Outcome	Learning Outcome
	concepts	
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, 2, 3, 4
2.2	Identify, organize and justify appropriate information, including assumptions	1, 2, 3, 4
2.3	Construct a conceptual framework and select an appropriate solution approach	1, 2, 3, 4
2.4	Execute an engineering solution	1, 2, 3, 4
2.5	Critique and appraise solution approach and results	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

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

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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

Topics: Introduction to Engineering Unit Operations

Learning Outcome: 1, 2, 3, 4

Week 2

Topics: Fluid Flow and Mixing

Learning Outcome: 1, 4

Week 3

Topics: Mass Transfer

Learning Outcome: 1, 2, 4

Week 4

Topics: Heat Transfer

Learning Outcome: 1, 2, 4

Week 5

Topics: Cell Growth and Product Formation Dynamics

Learning Outcome: 1, 2, 3, 4

Week 6

Topics: Cell Growth and Product Formation Dynamics

Learning Outcome: 1, 2, 3, 4

Week 7

Topics: Mechanical Separation

Guest Lecture from Industry Professional

Learning Outcome: 1, 2, 4

Week 8

Topics: Separation: Extraction and Adsorption

Guest Lecture from Industry Professional

Learning Outcome: 1, 2, 4

Week 9

Topics: Evaporation and Drying

Learning Outcome: 1, 2, 4

Week 10

Topics: Evaporation and Drying

Learning Outcome: 1, 2, 4

Week 11

Topics: Membrane Separation and Distillation

Learning Outcome: 1, 2, 4

Week 12

Topics: Membrane Separation and Distillation

Problem Discussion

Learning Outcome: 1, 2, 4

5.2 Lab

Topics:	Assessment of Newtonian and non-Newtonian fluids behaviour
Learning Outcome:	1, 4
Topics:	Drying of liquid dispersions (spray-drying)
Learning Outcome:	1, 2, 4

5.3 Tutorial/Demo Lab Schedule

Tutorials will take place in MCKN 119A.

Demo Lab will take place in THRN 1104.

Exact schedules will be announced on CourseLink or in class.

5.4 Other Important Dates

07 September 2023, Thursday: First day of class

10 October 2023, Tuesday: Fall Study Break Day

30 November 2023, Thursday: Classes rescheduled from Tuesday, 10 October

01 Dec 2023, Friday: Classes conclude and last day to drop this course

06 Dec 2023, Wednesday: Final Exam (0830hr to 1030hr)

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6 Assessments

6.1 Assessment Details

Tutorial and Lab Report (20%)
Date: Tuitorial or Lab
Learning Outcome: 1, 2, 3, 4
Best 8 out of 10 submissions if all have been attempted. Otherwise, the grade will be based on 8 submissions.

The schedule will be announced in class and posted on Courselink.

Midterm I (20%)

Date: Week 5
Learning Outcome: 1, 2, 3, 4

Midterm II (20%)
Date: Week 9
Learning Outcome: 1, 2, 3, 4

Final Exam (40%)
Date: Wed, Dec 6, 8:30 AM - 10:30 AM, Room TBA on Webadvisor
Learning Outcome: 1, 2, 3, 4

6.2 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.

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.

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.

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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.

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 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).