

Course Outline

Instructor

- Dr. Chyngyz Erkinbaev (he/him)
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Student Hours

- Appointment by e-mail

Teaching Assistant

- N/A

Location

- **Lecture, EITC E2-310**
- Tues & Thurs 8:30 AM-9:45 AM

Lab/Tutorial, EITC E2-223
Mon 2:30 PM- 5:15 PM

Prerequisites:

- None

Course Website:

<http://umanitoba.ca/umlearn>

BIOE 4440 Bioprocessing and Biorefining

Winter 2026

Course Objectives

This course allows students with a background in either biological sciences or engineering to gain an understanding of food and bioprocess engineering processes. Topics include unit food and bioprocessing unit operations, production of biofuels, bioreactor systems, and downstream processing for product recovery.

Course Content

This course deals with operations that aim at designing proper conditions for processing of biomaterials for production of bioproducts of desired quality of the end product. The principles of this course are built based on chemistry, physics, transport phenomena, thermodynamics, reaction kinetics, fermentation, and industrial unit operations. This course will assist students in understanding the principles involved in the designing aspect of handling and processing parameters of biomaterials.

LECTURES: Three hours of lectures per week in one term.

Week 1: Introduction

Week 2: Bioprocessing for 1st and 2nd generation of biofuels

Week 3: Unit operations

Week 3: Fluid flow in food and bioprocessing (slurry transport)

Week 4: Heat transfer, thermal processing

Week 5: Thermal processing

Week 6: Drying of biomass (fixed, spouted and fluidized bed drying)

Week 7: **No classes (reading week)**

Week 8: Evaporation of fluid food concentration

Week 9: Mixing equipment design and operation

Week 10: Filtration process and equipment

Week 11: Membrane filtration, predicting flux in ultrafiltration

Week 12: Bioreactor design

Week 13: Project presentations

Tutorials:

Tutorials will include numerical experiments and determination of process-design parameters.

Assignments will be posted on the UM Learn website:

<https://universityofmanitoba.desire2learn.com/d2l/login> assigned to the course.

(Jan. 12) **No classes**

(Jan. 19) Introduction and lab organization

(Jan. 26) **A1: Bioethanol Production Process**

(Feb.2) Tutorial for A1

(Feb. 9) **A2: Design of slurry transport systems**

(Feb. 16) **No classes (reading week)**

(Feb. 23) Tutorial for A2

(Mar.2)	A3: Design parameters for drying
(Mar. 9)	Tutorial for A3
(Mar. 16)	A4: Design parameters for multi-effect evaporators/filtration
(Mar. 23)	Tutorial for A4
(Mar. 30)	Industry visit, TBD

Textbook

The textbook for the course is “*BioProcessing*”, by Drs. Stefan Cenkowski and David B. Levin. This book was prepared and edited by Dr. Cenkowski and Dr. Levin in collaboration with several of their graduate students in 2021. An electronic version (.pdf) of the book will be provided to each student registered in the course.

Evaluation

The basis of the final grade is agreed upon with the students at the beginning of the term. The usual weighting is:

- 15%** on midterm test
- 20%** on design assignments
- 40%** major design project (presentation: 10% and written report: 30%)
- 25%** on written final examination

Late submission of assignments or laboratory reports would result in loss of 10% marks for each working day.

Accreditation Details

- Mathematics: 10%
- Natural Science: 40%
- Complementary Studies: 0%
- Engineering Science: 25%
- Engineering Design: 25%

Graduate Attributes

KB: A knowledge base for engineering
 PA: Problem analysis
 IN: Investigation
 DE: Design
 ET: Use of engineering tools
 IT: Individual and team work
 CS: Communication skills
 PR: Professionalism
 IE: Impact of engineering on society/environment
 EE: Ethics and equity
 EP: Economics and project management
 LL: Life-long learning

Competency Levels

- 1 - Knowledge (Able to recall information)
- 2 - Comprehension (Ability to rephrase information)
- 3 - Application (Ability to apply knowledge in a new situation)
- 4 - Analysis (Able to break problem into its components and establish relationships.)
- 5 - Synthesis (Able to combine separate elements into a whole)
- 6 - Evaluation (Able to judge the worth of something)

Grading Scale

Note: These boundaries represent a guide for the instructor and class alike. Provided that no individual student is disadvantaged, the instructor may vary any of these boundaries to ensure consistency of grading from year-to-year.

Letter	Mark
A+	92–100
A	85–92
B+	85–78
B	78–72
C+	72–66
C	66–60
D	60–50
F	< 50

Learning Outcomes

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

No.	Learning Outcome	Transferable Skill
1	Determine design parameters for: mixing solids/liquids, gases, fluids, powders, pastas, and agitation processes	A knowledge base for engineering
2	Parameters for drying of biological solids, multi-effect evaporators, filtration and ultrafiltration	A knowledge base for engineering
3	Prepare a conceptual design of a grain-based ethanol production plant	Teamwork; design
4	Collaborate with group members in a team setting to manage an engineering design project	Design, project management
5	Apply laws and theories to practical solutions	Problem analysis
6	Communicate orally and in writing a design solution	Communication skills

Expected Competency Levels

Outcome	KB	PA	IN	DE	ET	IT	CS	PR	IE	EE	EP	LL
1	3											
2	3											
3				3		3						
4				3		4						
5		4										
6							4					

CEAB Graduate Attributes Assessed

- KB.3 – Determined the engineering problems associated with bioprocessing.
 DE.3 – Develops possible solutions to an open-ended design problem, leading to an appropriate recommendation.
 IT.3 – Participates in group activities and decision-making.
 PA.4 – Provide solution for conceptual design of processing conditions.
 CS. 4 – Demonstrate communication and writing skills.

Important Dates

• **Early Withdrawal Deadline**
January 19, 2026

• **Louis Riel Day**
February 16, 2026
No classes or examinations

• **Winter Term Break**
February 16-20, 2026
No classes or examinations

• **Voluntary Withdrawal Deadline**
March 19, 2026

• **Last Day of Classes**
April 9, 2026

• **Midterm Examination Dates**
TBD

Evaluation

Component	Value (%)	Assessor	Method of Feedback*	Learning Outcomes Evaluated	I/T**
Final Exam	25	CE	S	1	I
Design assignments	20	CE	F, S	1,2,3,4	I
Major design project (presentation 10% and written report 30%)	40	CE	F, S	1, 2, 3, 4, 5, 6	I/T
Midterm test	15	CE	S	1,2,3,4	T

* Method of Feedback: **F** - Formative (written comments and/or oral discussion), **S** - summative (numerical grade)

** I/T: **I** – Individual effort, **T** – Team effort

Academic Integrity

Students are expected to conduct themselves in accordance with the highest ethical standards of the Profession of Engineering and evince academic integrity in all their pursuits and activities at the university. As such, in accordance with the *General Academic Regulations on Academic Integrity*, students are reminded that plagiarism or any other form of cheating in examinations, term tests, assignments, projects, or laboratory reports is subject to serious academic penalty (e.g. suspension or expulsion from the faculty or university). A student found guilty of contributing to cheating by another student is also subject to serious academic penalty.

Requirements/Regulations

- No programmable devices or systems (such as calculators, PDAs, iPods, iPads, cell phones, smart watches, wireless communication, or data storage devices) are allowed in examinations unless approved by the course instructor.
- All email communication must conform to the Communicating with Students university policy.

[Communicating with Students](#)

- Attending lectures and laboratories is essential for the successful completion of this course.
- Self-declaration forms may be completed for missed tests, exams, or assignments during short-term absences (≤ 72 hours) for extenuating circumstances. Students don't need to share personal information about their situation beyond declaring the nature of the extenuating circumstance on the self-declaration form.

[Self-Declaration Form for Brief or Temporary Absence](#)

- This form cannot be used for planned absences like vacations. It is also not to be used for longer-term absences, or ongoing circumstances (e.g., Authorized Withdrawals, Leaves of Absence, or other accommodations), which will still require additional documentation.

[Self-Declaration Policy for Brief or Temporary Absences](#)

- It is the responsibility of each student to contact the instructor in a timely manner if he or she is uncertain about his or her standing in the course and about his or her potential for receiving a failing grade. Students should familiarize themselves with the University's *General Academic Regulations*, as well as Section 3 of the Faculty of Engineering *Academic Regulations* dealing with incomplete term work, deferred examinations, attendance, and withdrawal.

[General Academic Regulations](#)

[Engineering Academic Regulations](#)

- Students should be aware that they have access to an extensive range of resources and support organizations. These include Academic Resources, Counselling, Advocacy and Accessibility Offices as well as documentation of key University policies e.g. Academic Integrity, Respectful Behaviour, Examinations and related matters.

[Supplemental Resources](#)

Retention of Student Work

Students are advised that copies of their work submitted in completing course requirements (i.e. assignments, laboratory reports, project reports, test papers, examination papers, etc.) may be retained by the instructor and/or the department for the purpose of student assessment and grading, and to support the ongoing accreditation of each Engineering program. This material shall be handled in accordance with the University's *Intellectual Property Policy* and the protection of privacy provisions of *The Freedom of Information and Protection of Privacy Act (Manitoba)*. Students who do not wish to have their work retained must inform the Head of Department, in writing, at their earliest opportunity.

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