Course Outline

Instruction Team
- Dr. Chyngyz Erkinbaev (he/him)
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Student Hours
- Wed 2:00 – 3:00 PM (by appointment)

Teaching Assistant
- None

Location
- **Lecture E2-351**
  Mon 11:30 AM - 12:20 PM
  Wed 11:30 AM - 12:20 PM
  Fri 11:30 AM- 12:20 PM

Contact Hours
- 3 credit hours
- Lectures:
  3 hours x 12 weeks = 36 hours

Prerequisites:
- None

Course Website:
http://umanitoba.ca/umlearn

BIOE 7300 Food Process Engineering

Winter 2023

Course Objectives

This course allows students with a background in either biological sciences or engineering to gain an understanding of food engineering processes. Topics include unit operations in food engineering, fluid flow, heat and mass transfer, thermal and non-thermal food processing, canning, drying, filtration, evaporation, fermentation, food packaging, advanced food processing technologies, quality and safety control methods.

Course Content

This course deals with main unit operations and processing conditions that aim to analyze, design, and optimize various food processing operations. The course has three major blocks of food engineering: thermal, non-thermal processing, and novel processing methods. The principles of this course are built based on chemistry, physics, transport phenomena, thermodynamics, and computer modelling. The course will assist students in understanding the principles involved in food processing and help in the designing aspect of handling of various food matrices in providing healthy, safe and nutritious foods. The following topics will be covered in lectures and tutorials.

LECTURES:

(Jan. 9) Course introduction

(Jan. 11) Unit operations

(Jan. 13) Fluid flow in food processing

(Jan.16) Heat transfer in food matrices (convection, conduction, radiation)

(Jan. 18) Heat transfer (food thermal properties, heat exchangers)

(Jan. 20) Thermal food preservation (blanching, pasteurization, sterilization)

(Jan. 23) Thermal food preservation (canning, thermal rate, D, Z-value)

(Jan. 25) Aseptic, UHT, ohmic and pulse electric treatment

(Jan. 27) Assignment tutorial for A1 and A2

(Jan. 30) Micronization, radio and microwave heating

(Feb. 1) Drying process

(Feb. 3) Drying process 2, Evaporation 1

(Feb. 6) Evaporation 2

(Feb. 8) Freezing, freeze drying

(Feb. 10) Solid separation methods 1

(Feb. 13) Solid separation methods 2

(Feb. 15) Mixing

(Feb. 17) Size reduction 1

(Feb. 20) Size reduction 2

(Feb. 20) no classes (Luis Riel Day)

(Feb 22) no classes (reading week)

(Feb. 24) no classes (reading week)

(Feb. 27) Assignment Tutorial for A3 and A4

(Mar. 1) Extraction

(Mar. 3) Supercritical extraction (Guest Lecture 1)

(Mar. 6) Food quality and shelf-life, hurdles

(Mar. 8) Water activity

(Mar. 10) Midterm Exam

(Mar. 13) Fermentation

(Mar. 15) Filtration

(Mar. 17) Filtration (membrane filtration, reverse osmosis)

(Mar. 20) Advanced extrusion (Guest Lecture 2)

(Mar. 22) Industry visit TBD

(Mar. 24) Assignment Tutorial for A5

(Mar. 27) Smart food packaging/ modified atmosphere

(Mar. 29) Advanced food quality control methods

(Mar. 31) Advanced food quality control methods / Guest Lecture 3)

(Apr. 3) Group Presentation 1

(Apr. 5) Group Presentation 2

(Apr. 7) No lecture (Good Friday)

(Apr. 10) Group project feedback

(Apr. 12) Course discussion

Tutorials/Assignments:

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. 20) A1: Fluid Flow/Heat Transfer

(Feb. 3) A2: Canning/UHT/Drying

(Feb. 17) A3: Side reduction/mixing

(Mar. 10) A4: Filtration/mixing/evaporation

Textbook

There are several textbooks availabe on food processing. Students will be provided lecture series developed by Dr. Erkinbaev.

Evaluation

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

25% midterm test
20% assignments
20% major project (presentation: 50% and written report: 50%)
35% on written final examination

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

Accreditation Details

- Mathematics: 20%
- Natural Science: 30%
- 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	Understand the concept of fluid flow, heat and mass transfer in food processing. Determine design parameters for selected food processing operations such as drying, mixing, fermentation, evaporation, freezing.	A knowledge base for engineering, Use of Engineering Tools
2	To be familiar with novel food processing and advanced food quality control methods.	Investigation, Problem analysis
3	Able to hypothesize, identify the research gaps, analyze and propose solution and prepare a conceptual design of processing food operations.	Problem analysis, 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	4				5							
2		4	4									
3		5		4		3						
4				4							4	
5		5										
6							4					

CEAB Graduate Attributes Assessed

KB. 4 – Determined the engineering problems associated with food engineering.

PA.4&5– Solving real life problems using knowledge

IN.4 – Investigation of novel, advanced, green technologies and methods in food processing.

DE.4 – Develops possible solutions to an open-ended design problem, leading to an appropriate recommendation.

ET.5– Use of engineering tools, tables, charts to determine the physico-chemical properties of complex food matrices.

I T.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.

EP.4– Management of the group projects in a team, written report and oral presentation.

Important Dates

- **Early Withdrawal Deadline**
  January 20, 2023
- **Louis Riel Day**
  February 20, 2023
  No classes or examinations
- **Winter Term Break**
  February 21 -24, 2023
  No classes or examinations
- **Good Friday**
  April 7, 2023
  No classes or examinations
- **Voluntary Withdrawal Deadline**
  March 22, 2023
- **Last Day of Classes**
  April 14, 2023
- **Examination Dates**
  April 14 - 28, 2023

Evaluation

Component	Value (%)	Assessor	Method of Feedback*	Learning Outcomes Evaluated	I/T**
Midterm Exam	25	CE	S	1,2,4	I
Assignments	20	CE	F, S	2,3,4,5	I
Major design project (presentation 50% and written report 50%)	20	CE	F, S	2, 3, 4, 5, 6	I/T
Final Exam	35	CE	S	1,2,3,4	I

* 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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