University of Manitoba | Price Faculty of Engineering
Department of Biosystems Engineering

Course Outline

BIOE 3110 Heat Transfer for Biosystems

Fall 2024

Instruction Team

- Dr. Jason Morrison, P.Eng.
  E1–356 EITC
  Jason.Morrison@umanitoba.ca
- Mr. Derek Inglis
  Derek.Inglis@umanitoba.ca

Student Hours

- Individual assistance is available by appointment

Teaching Assistants

Hamideh Faridi
faridis@myumanitoba.ca

Location

A01 220 Animal Science
MWF 9:30 - 10:20 am
B01 E1-105 EITC
T 8:30-9:45 am
B02 138 Agric. Bldg
R 8:30-9:45 am

Contact Hours

- 4 credit hours
- Lectures:
  3 hours x 12.3 weeks = 37 hours
- Tutorials/Labs
  2 hours x 13 weeks = 26 hours

Prerequisites:

- ENG 1460
- BIOE 2790
- MECH 2150

Course Website:

http://umanitoba.ca/umlearn

Traditional Territories Acknowledgement

The University of Manitoba campuses are located on the original lands of Anishinaabeg, Ininiwak, Anisininewuk, Dakota Oyate and Dene, and on the National Homeland of the Red River Métis.

We respect the Treaties that were made on these territories, we acknowledge the harms and mistakes of the past, and we dedicate ourselves to move forward in partnership with Indigenous communities in a spirit of reconciliation and collaboration.

Course Description

This course introduces the principles of heat transfer using examples involving biological systems. The laboratory component of the course involves demonstrating and validating heat transfer theory.

Course Objectives

This course is intended to introduce students to:

1. Model and analyze heat and mass transfer problems.
2. Use numerical computation, estimation from graphs, and mathematical models (equations) to obtain information to solve problems.
3. Document technical computations to ensure that assumption, solution technique, and calculations can be validated.
4. Investigate the impact of materials' physical properties on heat and mass transfer (e.g., conductivity, thermal diffusivity, convection coefficient, and emissivity).

Course Content

1. Introduction
2. Steady-state heat conduction
3. Transient heat transfer
4. Forced convective heat transfer
5. Free convection
6. Radiative heat transfer
7. Solar radiation
8. Psychometrics and mass diffusion
9. Heat exchangers

Course Delivery

Lectures provide the bulk of in-class learning, while tutorial time enables students to work on Assignments with assistance from the Instruction Team. Two labs will provide context and demonstration to validate the theory.

Messages regarding the course will be given in person and through the course website at www.umanitoba.ca/umlearn.

Required Texts, Readings and Materials

Bergman T.; Lavine A.; Incropera F.; and D. DeWitt. *Fundamentals of heat and mass transfer*, 8th ed. (2019), John Wiley & Sons, Inc., Toronto.

The instructors will supply any additional materials through the course website www.umanitoba.ca/umlearn

Accreditation Details

Accreditation Units

- Mathematics: 0%
- Natural Science: 0%
- Complementary Studies: 0%
- Engineering Science: 100%
- Engineering Design: 0%

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

I - Introduced
D – Intermediate (Developing)
A - Advanced

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	85–91
B+	78–84
B	72–77
C+	66–71
C	60–65
D	50-59
F	< 50

Learning Outcomes

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

No.	Learning Outcome
1	Model and solve heat transfer problems as electrical analogue circuitry,
2	Understand the correspondence between electrical and heat-based systems,
3	Apply steady-state assumptions to determine the solutions,
4	Apply geometric simplifications to generate and solve models of systems heat transfer,
5	Identify assumptions of typical heat transfer modelling,
6	Identify mechanisms of heat and mass transfer under a given situation,
7	Identify and compute thermophysical material properties, and
8	Compute estimations of heat loss from structures

CEAB Graduate Attributes Assessed

This course will assess the following CEAB graduate attribute indicators shown below:

Indicator (Level)	Indicator Description	Assessment Point
KB.3 (D)	Recalls and defines, and/or comprehends and applies information, first principles and concepts in fundamental engineering science.	Assigns 1-8 Midterm I Midterm II Final Exam
PA.1 (D)	Identifies and defines complex engineering problems	Assigns as appropriate
PA.3 (D)	Analyzes and solves complex engineering problems	Assigns 1-8 Midterm I Midterm II Final Exam

Important Dates

Assign 1 due
Mon Sept. 16 4:00pm

Assign 2 due
Mon Sept. 23 4:00pm

National Day for Truth and Reconciliation
Mon. Sept. 30, 2024
No classes or examinations

Lab 1
Tues Oct. 1 8:30am (B01)
Tues Oct. 3 8:30am (B02)

Assign 3 due
Wed Oct. 2 4:00pm

Midterm #1
Tuesday, Oct. 8 (8:30 am)

Thanksgiving
Mon. Oct. 14, 2024
No classes or examinations

Assign 4 due
Mon Oct 21 4:00pm

Assign 5 due
Mon Oct 28 4:00pm

Lab 2
Oct 29 8:30am (B01)
Oct 31 8:30am (B02)

Midterm #2
Tuesday Nov 5 (8:30 am)

Remembrance Day
Mon. Nov. 11, 2024
No classes or examinations

Fall Term Break
Nov. 12-15, 2024
No classes or examinations

- **Voluntary Withdrawal Deadline**
  November 21, 2023

Assign 6
Mon Nov 25, 4:00

Assign 7
Mon Dec 3, 4:00

Assign 8
Mon Dec 9, 4:00

Last Day of Classes
Mon. Dec. 9, 2024

Evaluation

Component	Value (%)	Assessor	Method of Feedback*	Learning Outcomes Evaluated	I/T**
Assignments	25	HF	S	1-8	I
Midterm I	15	JM	S, F	1-3	I
Midterm II	20	JM	S, F	3-6	I
Final Exam	35	JM	S	1-8	I
Participation	5	JM DI	S		I

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

** I/T: **I** – Individual effort, **T** – A team effort

Description of Evaluation Components

Assignments: Eight assignments are due on the dates specified on the left. They are equally weighted, and time will be given in the previous tutorial to work on each one.

Midterm Exams: These are tentatively scheduled for the 8:30-9:50 Tuesday B01 Tutorial on Oct 8 and Nov 5.

Final Exam: will be scheduled by the registrar's office.

Participation: This will be assessed through questions to students or attendance in lectures, tutorials and the two Lab sessions (see dates on the left).

Late Submission Policy: Deadlines are a reality in engineering practice. We expect assignments to be completed on time. Assignments submitted late on the due date will be docked 10%. Anything submitted more than 8 hours late will be given zero.

Assignments or midterms missed due to illness or legitimate reasons will have that portion of their grade moved to the final exam.

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

Deferred Final Examinations

Students who miss the regularly scheduled writing of a final examination for valid medical or compassionate reasons will only be allowed to write a deferred exam if the Associate Dean (Undergraduate) approves the request. All requests for a deferred examination *must* be made within 48 hours of the missed exam and follow the procedure described on the Faculty website without exception. Course Instructors *do not have the discretion* to grant deferred final examinations.

Deferred Exam Policy (student experience website)

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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 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.

Requirements/Regulations

- Communication devices will not be permitted in Midterm and Final examinations unless specific allowance is granted by the instructor.
- Please copy the Instruction Team in all emails (Instructors and Teaching Assistants). All email communication must conform to the Communicating with Students university policy.

Communicating with Students

- As the Instruction Team, we will do our best to respond to all emails **within 48 hours during working hours** (8:30 AM – 5:30 PM Monday thru Friday). Ex. A Friday night email may not be responded to until the following Tuesday.
- Self-declaration forms may be completed for missed tests, exams, or assignments during short-term absences (≤72 hours) for extenuating circumstances. 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 Form for Brief or Temporary Absence

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*.

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*

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