



Course Outline

Instruction Team

- Dr. Jason Morrison, P.Eng.
E1-356 EITC
Jason.Morrison@umanitoba.ca

Student Hours

- Individual assistance is available by appointment

Teaching Assistants

- Amin Mohseni Ghalehgazi
mohseni1@myumanitoba.ca

Location

A01 301 Biological Sciences
MWF 11:30 - 12:20 am

B01 300 Human Ecology
Thurs 2:30-4:45 pm

Contact Hours

- 4 credit hours
- Lectures:
3 hours x 12.3 weeks = 37 hours
- Tutorials/Labs
2.25 hours x 12 weeks = 28 hours

Prerequisites:

- BIOL 1400
- BIOL 1410
- BIOE 3320

Course Website:

<http://umanitoba.ca/umlearn>

BIOE 4640 Bioengineering Applications in Medicine

Winter 2025

Course Description

To provide the fundamental knowledge and skills required by a bioengineer to begin working in a medically related field and be capable of the necessary day-to-day collaborations with professionals in medicine and engineering.

Course Content

1. Introduction to engineering in medicine, clinical engineering and basic regulations for medical devices
2. Design, principles, and properties of biomedical sensors and biosensors
3. Biocompatibility, mechanics, wear and biological effects of biomaterials
4. Principles of and design in radiology, x-ray, CT and MRI imaging modalities

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.

Recommended Reading

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

Enderle J, Blanchard S, Bronzino J. ed. *Introduction to Biomedical Engineering* 3rd ed., Academic Press, 2012.

Anon. Ed. *Encyclopedia of Biomaterials and Biomedical Engineering*. Marcel Dekker, 2006

Bronzino, J. D. Ed. *Tissue Engineering and Artificial Organs*, CRC Press, 2006.

David, Y., W. W. von Maltzahn, M. R. Neuman, and J. D. Bronzino, Eds.. *Clinical Engineering*, CRC Press, 2003.

Mudry, K. M., R. Plonsey, and J. D. Bronzino, Eds.. *Biomedical Imaging*, CRC Press, 2003.

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.

Accreditation Details

Accreditation Units

- Mathematics: 0%
- Natural Science: 0%
- Complementary Studies: 0%
- Engineering Science: 50%
- Engineering Design: 50%

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	Gain and use the fundamental knowledge an engineer requires to work in a medical field.
2	Analyze x-ray, CT and MRI technology to determine the constraints of working with these modalities.
3	Learn regulatory mechanisms relevant to designing new medical devices.
4	Design and evaluate biomedical equipment.
5	Summarize the results of the design process in a formal report.
6	Apply learned material to novel situations of equipment design.

CEAB Graduate Attributes Assessed

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

Indicator (Level)	Indicator Description	Assessment Point
KB.4 (D)	Recalls, defines, comprehends and applies information and concepts in specialized engineering science	Midterm I Midterm II Final Exam
KB.4 (A)	Recalls, defines, comprehends and applies information and concepts in specialized engineering science	Assignment I
DE.3 (A)	Develops possible solutions to an open-ended design problem, leading to an appropriate recommendation	Assignment I, II & III
ET 2 (A)	Evaluates and selects or creates appropriate tools for a given scenario	Assignment II & III

Evaluation

Midterms missed for legitimate reasons will have that portion of the grade moved to the final exam.

Component	Value (%)	Assessor	Method of Feedback*	Learning Outcomes Evaluated	I/T* *
Final Exam	30	JM	S	1, 2, 3	I
Midterm	20	JM	S	1, 2, 3	I
Assignment I	15	AM	S, F	4, 5, 6	T
Assignment II	15	AM	S, F	4, 5, 6	T
Assignment III	20	AM/JM	S, F	4, 5, 6	T

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

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

Important Dates

- **Early Withdrawal Deadline**
January 17, 2025

- **Assignment 1 Part A**
Monday, January 17, 2025

- **Assignment 1 Part B**
February 3, 2025

- **Louis Riel Day**
February 17, 2025
No classes or examinations

- **Winter Term Break**
February 18-21, 2025
No classes or examinations

- **Midterm**
February 27, 2025

- **Assignment 2**
March 14, 2025

- **Voluntary Withdrawal Deadline**
March 19, 2025

- **Assignment 3 Present & due**
April 3, 2025 5:30 PM

- **Last Day of Classes**
April 9, 2025

Description of Evaluation Components

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 \(student experience website\)](#)

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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