



Course Outline

Instructor

- Prof. Zahra Moussavi, P.Eng.
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Office Hours

- By appointment

Teaching Assistant

- Maria Uehara
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Contact Hours

- 4 credit hours
- Lectures:
3 hours x 13 weeks = 39 hours
- Laboratories:
3 hours x 5 weeks = 15 hours

Prerequisites:

- ECE 2160 Electronics 2E
- ECE 3780 Signal Processing 1

Course Website:

<https://umanitoba.ca/umlearn>

Traditional Territories Acknowledgement

The University of Manitoba campuses and the Department of Electrical and Computer Engineering are located on the original lands of the Anishinaabeg, Cree, Oji-Cree, Dakota, and Dene peoples, and on the homeland of the Métis Nation.

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.

ECE 4610 – Biomedical Instrumentation and Signal Processing

Fall 2021

IMPORTANT NOTICE – Mandatory Requirement to Report

This course will be conducted using remote instruction. Students who are accessing the course from outside of Canada or the USA **must notify the instructor** and indicate in which country they are located. Access to software may be restricted from some countries and failure to comply with these restrictions may result in criminal prosecution.

Course Objectives

The goal is to introduce biological systems and apply engineering principles (electrical and mechanical) to the solution of the biomedical problems. The emphasis of this course will be both practical and theoretical. You will design systems to acquire biomedical signals in the laboratory and use this data throughout the course.

Course Content

The following topics will be covered:

- Special problems and requirements for recording and analyzing biological signals, i.e. ECG, EMG, from human subjects.
- The design of instrumentation amplifiers for analog signal conditioning.
- Examination of possible health hazards associated with measurement of biological signals.
- Study of relevant physiology and anatomy of the physiological systems.
- Analysis of biological signals

Textbook

Lecture Notes for ECE 4610, Z. Moussavi, 2021. (Available in the UofM Bookstore.)

Other Resources

Lecture notes, which will be available on the course web page and will provide the necessary physiology and anatomy, as well as signal analysis background.

Requirements and Regulations

- Attendance at lectures and laboratories is essential for successful completion of this course. Students must satisfy each evaluation component in the course to receive a final grade.
- 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 also 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.
- No programmable devices or systems (such as calculators, PDAs, iPods, iPads, cell phones, wireless communication or data storage devices) are allowed in examinations unless approved by the course instructor.
- 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](#)

Important Dates

- **Term Test**
None.
- **Voluntary Withdrawal Deadline**
November 23rd, 2021
- **National Day for Truth and Reconciliation**
September 30th, 2021
No classes or examinations
- **Thanksgiving Day**
October 11th, 2021
No classes or examinations
- **Remembrance Day**
November 11th, 2021
No classes or examinations
- **Fall Term Break**
November 8th–12th, 2021
No classes or examinations

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

- 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)

Learning Outcomes

1. To be able to build a signal conditioning device for most biological signals.
2. To be able to debug and analyze instrumentation amplifiers.
3. To be able to record and analyze Electromyographic (EMG-muscles') signals.
4. To be able to record and analyze Electroencephalogram (ECG) signals (heart vital signal).
5. To be able to record and analyze heart, respiratory and swallowing sounds.

Expected Competency Levels

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

Evaluation

The final course grade will be determined from a student's performance in quizzes, lab experiments and assignments, a project, and a final examination. Attendance at lectures is essential to successful completion of this course. To receive a passing grade the student must finish all the components of the course.

Component	Value (%)	Method of Feedback	Learning Outcomes Evaluated
Assignments & Laboratories	20	S	1, 2, 3, 4
Quizzes	25	F, S	1, 2, 3, 4, 5
Project	15	F, S	1, 2, 3, 4, 5
Final Examination	40	S	1, 2, 3, 4, 5

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

CEAB Graduate Attributes Assessed

- DE.3 – Develops/implements possible solutions to an open-ended design problem, leading to an appropriate recommendation.
- EE.2 – Appreciates, articulates and/or resolves issues and dilemmas related to ethics and equity.

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.

Copyright Notice

All materials provided in this course are copyright and are provided under the fair dealing provision of the Canadian Copyright Act. This material may not be redistributed in any manner without the express written permission of the relevant copyright holder.

Grading Scale

Letter	Mark
A+	95–100
A	85–94
B+	80–84
B	70–79
C+	65–69
C	55–64
D	45–54
F	< 45

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.

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.