



## Course Outline

### Instructor

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

- By appointment

### Teaching Assistant

- Jeffrey Winkler  
umwinklj@myumanitoba.ca

### 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>

## Important Dates

- **Term Test**  
None
- **Voluntary Withdrawal Deadline**  
November 23<sup>rd</sup>, 2020
- **Thanksgiving Day**  
October 12<sup>th</sup>, 2020  
No classes or examinations
- **Remembrance Day**  
November 11<sup>th</sup>, 2020  
No classes or examinations
- **Fall Term Break**  
November 9<sup>th</sup>–13<sup>th</sup>, 2020  
No classes or examinations

## ECE 4610 – Biomedical Instrumentation and Signal Processing

Fall 2020

### 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

*Medical Instrumentation*, J. Webster, 4<sup>th</sup> Edition, Wiley, 2009.

*Fundamental Respiratory Sound Analysis*, Z. Moussavi, Morgan & Claypool Publisher series, 2006.

### 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 Information](#)

## 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)

### 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.

## 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 Oral 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.

## 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.