ECE 4610 – Biomedical Instrumentation and Signal Processing

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

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.

---

Instructor
Prof. Zahra Moussavi, P.Eng.
(204) 474–7023
Zahra.Moussavi@umanitoba.ca

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 18th, 2019
• Thanksgiving Day
  October 14th, 2019
  No classes or examinations
• Remembrance Day
  November 11th, 2019
  No classes or examinations
• Fall Term Break
  November 12th–15th, 2019
  No classes or examinations

---

Supplemental Information
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

<table>
<thead>
<tr>
<th>Outcome</th>
<th>KB</th>
<th>PA</th>
<th>IN</th>
<th>DE</th>
<th>ET</th>
<th>IT</th>
<th>CS</th>
<th>PR</th>
<th>IE</th>
<th>EE</th>
<th>EP</th>
<th>LL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>3</td>
<td>3</td>
<td>4</td>
<td>6</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>6</td>
<td>6</td>
<td>3</td>
<td>3</td>
<td>4</td>
<td>6</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>6</td>
<td>6</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>6</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>6</td>
<td>6</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>6</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>6</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>6</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

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.

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.

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.