



Course Outline

Instructor

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

- By appointment

Teaching Assistant

- Farahnaz Hajipour
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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 3780 Signal Processing 1

Course Website:

<http://umanitoba.ca/umlearn>

Important Dates

- **Term Test**
TBD
- **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

ECE 4850 T05 – Basics of Biological Signal Analysis

Fall 2019

Course Objectives

Students will become comfortable with utilizing basic signal processing techniques for analyzing biological signals such as EMG, ECG, EEG or respiratory sounds.

Course Content

- Classification/Representation of Signals
- Fourier Series Representation of Periodic Signals, Frequency Spectrum
- Aperiodic Signals - Fourier Transform
- Discrete Fourier Transform
- Autocorrelation - Energy/Power Density Spectrum
- Impulse Function/ Impulse Response/ Convolution/ LTI system/ Transfer Function
- Random Signals, Random events, Bayes theorem; probability
- Intro to Random Process: EMG signal/EEG/ECG and sounds signal
- Power Spectral Density of a Random Process
- Basics of Wavelet Analysis (if time permits)

Reference (optional)

Biomedical Signal Processing and Signal Modeling, Eugene N. Bruce, Wiley, 2001

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.

Accreditation Details

Accreditation Units

- Mathematics: 0%
- Natural Science: 0%
- Complementary Studies: 0%
- Engineering Science: 55%
- Engineering Design: 45%

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 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 choose proper pre-processing methods for a biological signal.
2. To be able to choose proper signal processing methods for a biological signal.
3. To be able to analyze a biological signal and interpret the results
4. To be able to analyze stochastic signals.

Expected Competency Levels

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

Evaluation

The final course grade is determined by the student's performance on assignments, in laboratories, and on tests and examinations.

Students must complete all laboratories in order to be eligible to receive a passing grade.

Component	Value (%)	Method of Feedback	Learning Outcomes Evaluated
Project	20	F, S	1, 2, 3, 4
Term Test	30	F, S	1, 2, 3, 4
Final Examination	50	S	1, 2, 3, 4

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

CEAB Graduate Attributes Assessed

ET.2 – Evaluates and selects appropriate tools for a given scenario.

EE.2 – Appreciates, articulates and/or resolves issues and dilemmas related to ethics and equity.

Requirements/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, smart watches, 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](#)