University of Manitoba

Price Faculty of Engineering
Department of Electrical and Computer Engineering

Course Outline

Instructor
- Prof. Sherif Sherif, P.Eng.
  E3–557 EITC
  (204) 474–6893
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Office Hours
- After class or by appointment

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**
  Monday, March 8th, 2021
  6:00PM – 8:00PM

- **Voluntary Withdrawal Deadline**
  March 31st, 2021

- **Louis Riel Day**
  February 15th, 2021
  No classes or examinations

- **Spring Break**
  February 16th – 19th, 2021
  No classes or examinations

- **Good Friday**
  April 2nd, 2021
  No classes or examinations

ECE 4860 (T02) – Biomedical Signal Processing
Winter 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

Introduce Statistical Detection and Estimation Theory and Time-Frequency Signal Representations. Apply these approaches to process different biomedical signals. Labs will be used to give students hands-on experience in programming many of the techniques covered in the theoretical parts of the course.

Course Content

The following topics will be covered:

- Review of discrete-time signals and systems.
- Introduction to Detection and Estimation Theory.
- Estimation of signals in noise.
- Orthogonal representation of signals.
- Time-frequency representations of signals.
- Application of above concepts to biomedical signals.

Textbook

Detection and Estimation Methods for Biomedical Signals, Metin Akay, Academic Press.

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.

Learning Outcomes

1. Understand the basics of Detection and Estimation Theory.
2. Model and estimate signals in noise.
3. Analyze and synthesize signals using time-frequency techniques.
4. Process and extract information from different biomedical signals.

Expected Competency Levels

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

Accreditation Details

Accreditation Units
- Mathematics: 25%
- Natural Science: 0%
- Complementary Studies: 0%
- Engineering Science: 75%
- Engineering Design: 0%

Attributes
A1: A knowledge base for engineering
A2: Problem analysis
A3: Investigation
A4: Design
A5: Use of engineering tools
A6: Individual and team work
A7: Communication skills
A8: Professionalism
A9: Impact of engineering on society/environment
A10: Ethics and equity
A11: Economics and project management
A12: 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.

Evaluation

The final course grade is determined by the student's performance in laboratories, quizzes, term test, and on the examination. Students must complete all the laboratories in order to be eligible to receive a passing grade.

Component	Value (%)	Method of Feedback	Learning Outcomes Evaluated
Assignments	5	S	1, 2, 3, 5
Quizzes	10	S	1, 2, 3, 5
Laboratories	15	F, S	2, 3, 4, 5
Term Test	20	S	1, 2, 3
Final Examination	50	S	1, 2, 3, 5

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

CEAB Graduate Attributes Assessed

PA.4 – Evaluates a solution to a complex engineering problem.

ET.3 – Adapts or creates tools to meet specific analysis or design needs.

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 passing 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*

Copyright Notice

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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.