Course Outline

ECE 3780 – Signal Processing 1

Fall 2024

Instructors
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Office Hours
- By appointment

Teaching Assistant
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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 2262 Electric Circuits
- MATH 3132 Engineering Mathematical Analysis 3

Traditional Territories Acknowledgement

The University of Manitoba campuses are located on the original lands of the Anishinaabeg, Ininiwak, Anisininewuk, Dakota Oyate and Dene, and on the National Homeland of the Red River Métis.

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.

Course Objectives

Introduction to signals and systems; spectral analysis (Fourier Series) of continuous-time periodic signals; spectral analysis of aperiodic signals (Fourier Transform); the impulse response and convolution operation; frequency analysis of linear time-invariant systems; A/D conversion; sampling. Lab periods 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:

- Introduction to signals and systems.
- Time-domain analysis of continuous/discrete-time systems linear shift-invariant systems.
- Spectral analysis of continuous-time signals: Fourier series and Fourier transform.
- Spectral analysis of discrete-time signals: Discrete Fourier Transform.

Textbook

Linear Systems and Signals, B.P. Lathi and R. Green, 3rd edition, Oxford University Press, 2018.

Learning Outcomes

1. Identify, distinguish and explain signals such as the unit step, impulse, and exponential that will be covered during the course as well as the basic definitions and properties of systems.
2. Analyze time-domain continuous and discrete - time systems and calculate the output response from linear systems.
3. Analyze and synthesize signals by Fourier series and Fourier transform.
4. Explain and solve problems related to applications such as filtering and communication systems.
5. Understand the basics of signal sampling and reconstruction.

Expected Competency Levels

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

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.

Important Dates

- **Term Test**
  October 22nd, 2024
  6:00PM – 9:00PM
- **Voluntary Withdrawal Deadline**
  November 19th, 2024
- **National Day for Truth and Reconciliation**
  September 30th, 2024
  No classes or examinations
- **Thanksgiving Day**
  October 14th, 2024
  No classes or examinations
- **Remembrance Day**
  November 11th, 2024
  No classes or examinations
- **Fall Term Break**
  November 12th –15th, 2024
  No classes or examinations

Accreditation Details

Accreditation Units

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

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

I - Introduced (Introductory)
D - Developed (Intermediate)
A - Applied (Advanced)

Evaluation

The final course grade will be determined from a student's performance in laboratories, tests and on the final examination. All laboratories must be completed in order to receive a passing grade in this course.

Component	Value (%)	Method of Feedback	Learning Outcomes Evaluated
Assignments	20	F, S	1, 2, 3, 4
Laboratories	20	F, S	1, 2, 3, 4
Term Test	20	F, S	1, 2, 3
Final Examination	40	S	3, 4

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

CEAB Graduate Attributes Assessed

IN.1 – Gathers information (literature review, measurements, experiments, laboratory exercises) and analyzes data.

IT.1 – Participates equitably in group activities and decision-making in leadership and followership (support) roles.

Student Absences

Attendance in lectures, tutorials, and laboratories is mandatory. For short-term absences due to illness or other extenuating circumstances of 120 hours (5 days) or less, students are required to complete a *Self-Declaration Form for Brief or Temporary Absence* available on the University website.🔗 This form must be submitted to the course instructor within 48 hours of the absence. (No additional documentation is required.)
Note that students are responsible to complete any missed work and must consult with the instructor to make appropriate arrangements.
For absences longer than 120 hours, students must contact the instructor and ECE Undergraduate Advisor, Tammy Holowachuk (Tammy.Holowachuk@umanitoba.ca) for further instructions.

Deferred Final Examinations

Students who miss the regular scheduled writing of a final examination, for valid medical or compassionate reasons, may be given the opportunity to write a deferred examination, subject to approval by the Associate Dean (Undergraduate). All requests for a deferred examination must be made within 48 hours of the missed examination, and must follow the procedure described on the Faculty website, without exception. Course instructors do not have the discretion to grant deferred final examinations.
(https://umanitoba.ca/engineering/student-experience#engineering-student-policies)

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.

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.

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