Course Outline

Instructor

- Prof. Gabriel Thomas, P.Eng.
  E3–555 EITC
  (204) 474–6758
  Gabriel.Thomas@umanitoba.ca
- Prof. Miroslaw Pawlak, P.Eng.
  E1–528 EITC
  (204) 474–8881
  Miroslaw.Pawlak@umanitoba.ca

Office Hours

- By appointment

Teaching Assistant

- Tharuki De Silva
  desilva1@myumanitoba.ca
- Logan Froese
  froesel3@myumanitoba.ca
- Niloosha Esmaeilzadeh Khorasani
  esmaeil1@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 2262 Electric Circuits
- MATH 3132 Engineering Mathematical Analysis 3

Course Website:

http://ece.eng.umanitoba.ca/undergraduate/ECE3780

Important Dates

- **Voluntary Withdrawal Deadline**
  November 23rd, 2020
- **Thanksgiving Day**
  October 12th, 2020
  No classes or examinations
- **Remembrance Day**
  November 11th, 2020
  No classes or examinations
- **Fall Term Break**
  November 9th –13th, 2020
  No classes or examinations

ECE 3780 – Signal Processing 1

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

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.

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.

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: 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

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. 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	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
5	5	5	4	2	4	3	2					3

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	40	F, S	1, 2, 3, 4
Laboratories	20	F, S	1, 2, 3, 4
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.2 – Contributes equitably to completion of group work.

Copyright Notice

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.