Course Outline

Instructor

- Prof. Pradeepa Yahampath, P.Eng.
  E1-536 EITC
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Office Hours
- By appointment

Teaching Assistant
- Logan Froese
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- Maryam Shojaei
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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
- STAT 2220 Contemporary Statistics for Engineers

Course Website:
https://umanitoba.ca/umlearn

Important Dates

- **Term Test**
  Wednesday, March 3rd, 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 4260 – Communication Systems

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

The course is indented to provide an introduction to modern analog and digital communication systems. The main topics covered include the fundamentals of analog and digital modulation, modeling random signals, noise in communication systems, and elements of digital receivers. Laboratory component involves simulation of both analog and digital communication systems using Matlab/Simulink.

Course Content

The following topics will be covered:

- Introduction to communication systems; analog vs. digital transmission; concepts of transmitter power and bandwidth; limitations of communication channels; performance measures such as SNR and BER
- Analog modulation techniques (AM, FM, and PM)
- Digital modulation techniques (ASK, PSK, QAM, and FSK)
- Review of probability theory with applications to communication systems
- Introduction to random processes; modeling of random signals and noise; correlation function, power spectrum, and linear filtering of random signals
- Digital receivers for Gaussian channels; elementary binary detection theory for polar and orthogonal signalling.

Other Resources

Fundamentals of Communication Systems, J.G. Proakis and M. Salehi, 2nd edition, Pearson-Prentice Hall, 2013.

Modern Digital and Analog Communication Systems, B. P. Lathi and Z. Ding, Oxford University Press, 4th edition, 2009.

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 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, 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: 0%
- Natural Science: 0%
- Complementary Studies: 0%
- Engineering Science: 100%
- 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. Describe the role of important elements of a modern communication system.
2. Analyze analog and digital modulation techniques by using signal processing tools.
3. Solve simple problems involving random signals, noise, and linear systems by using basic tools of probability and random processes.
4. Analyze the effects of channel noise on simple communication systems.
5. Identify (and justify the suitability of) a modulation technique for a given application scenario.

Expected Competency Levels

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

Evaluation

The final course grade is determined by the student's performance on assignments, in laboratories, and on examinations. 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	15	F, S	1, 2, 3, 4, 5
Laboratories	15	F, S	1, 2, 3, 4, 5
Term Test	20	F, S	1, 2
Final Examination	50	S	1, 2, 3, 4, 5

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

CEAB Graduate Attributes Assessed

KB.3 – Recalls and defines, and/or comprehends and applies information, first principles, and concept in fundamental engineering science.

IN.3 – Interprets results and reaches appropriate conclusions.

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.

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