



## Course Outline

### Instructor

- Pradeepa Yahampath, P.Eng.  
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### Office Hours

- By appointment

### Teaching Assistant

- Logan Froese  
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- TBD

### 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>

## Traditional Territories Acknowledgement

The University of Manitoba campuses and the Department of Electrical and Computer Engineering are located on the original lands of the Anishinaabeg, Cree, Oji-Cree, Dakota, and Dene peoples, and on the homeland of the Métis Nation.

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.

## ECE 4260 – Communication Systems

Winter 2022

### IMPORTANT NOTICE

Lectures and laboratories in this course will initially be conducted via remote instruction but will return to *in-person instruction* the week of February 28<sup>th</sup> 2022. All students are required to be present for in-person instruction at that time. Furthermore, University policy requires all students to be fully vaccinated against COVID-19 in order to attend campus and participate in this course.

### 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 Resources](#)

## Important Dates

- **Term Test**  
Monday, March 21<sup>st</sup>, 2022  
6:00PM – 8:00PM
- **Voluntary Withdrawal Deadline**  
April 25<sup>th</sup>, 2022
- **Louis Riel Day**  
February 21<sup>st</sup>, 2022  
No classes or examinations
- **Spring Break**  
February 22<sup>nd</sup>– 25<sup>th</sup>, 2022  
No classes or examinations
- **Good Friday**  
April 15<sup>th</sup>, 2022  
No classes or examinations

## 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)

## 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	25	F, S	1, 2
Final Examination	45	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.

## 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.

## Copyright Notice

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