ECE 4260 – Communication Systems  

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

The course is intended 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


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.
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

<table>
<thead>
<tr>
<th>Outcome</th>
<th>KB</th>
<th>PA</th>
<th>IN</th>
<th>DE</th>
<th>ET</th>
<th>IT</th>
<th>CS</th>
<th>PR</th>
<th>IE</th>
<th>EE</th>
<th>EP</th>
<th>LL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>3</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>3</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>2</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Component</th>
<th>Value (%)</th>
<th>Method of Feedback</th>
<th>Learning Outcomes Evaluated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assignments</td>
<td>15</td>
<td>F, S</td>
<td>1, 2, 3, 4, 5</td>
</tr>
<tr>
<td>Laboratories</td>
<td>15</td>
<td>F, S</td>
<td>1, 2, 3, 4, 5</td>
</tr>
<tr>
<td>Term Test</td>
<td>20</td>
<td>F, S</td>
<td>1, 2</td>
</tr>
<tr>
<td>Final Examination</td>
<td>50</td>
<td>S</td>
<td>1, 2, 3, 4, 5</td>
</tr>
</tbody>
</table>

* 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.
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.