



# ENGG\*3210 Communication Systems

Winter 2019

Section(s): C01

School of Engineering

Credit Weight: 0.50

Version 1.00 - January 05, 2019

---

## 1 Course Details

### 1.1 Calendar Description

This course is an introduction to the fundamentals of data communication and computer networking. The data communication basics will cover signal transmission and signal encoding techniques such as: multiplexing techniques, signaling, encoding and decoding, error detection and recovery, sliding window techniques. Computer networking basics will cover: communication network components and topologies, multiple access design issues and performance analysis, switching, routing, services and applications, and security. The course will also cover the mathematical tools (Fourier transform, etc.) used in signal analysis.

**Pre-Requisite(s):** MATH\*2130, STAT\*2120

### 1.2 Course Description

This course aims at providing the students with the necessary tools to understand, analyze and design the fundamental components of the communication processes, which includes: data format, modulation, communication media, error control, routing, multiplexing and multiple access techniques.

### 1.3 Timetable

#### Lectures:

Monday 01:00PM – 02:20PM, MCKN, Room 236

Wednesday 01:00PM – 02:20PM, MCKN, Room 236

#### Laboratory:

Monday 08:30AM - 10:20AM RICH 1532

## 1.4 Final Exam

Monday April 22nd 08:30AM – 10:30AM, Room TBA on Webadvisor

---

## 2 Instructional Support

### 2.1 Instructional Support Team

**Instructor:** Mohamad Abou El Nasr Ph.D  
**Email:** maboueln@uoguelph.ca  
**Office:** THRN 1513  
**Office Hours:** TBA or by appointment

### 2.2 Teaching Assistant(s)

**Teaching Assistant:** Evan Fallis  
**Email:** efallis@uoguelph.ca

### 2.3 Lab Technician

**Technician:** Kevin Dong  
**Office:** RICH 2506, ext. 56455  
**Email:** [kdong@uoguelph.ca](mailto:kdong@uoguelph.ca)

---

## 3 Learning Resources

### 3.1 Required Resource(s)

#### Course Website (Website)

<https://courselink.uoguelph.ca/>

Course material, news, announcements, and grades will be regularly posted to the ENGG\*3210 Courselink site. You are responsible for checking the site regularly.

#### Lecture notes and slides (Notes)

#### Data Communications and Networking (Textbook)

Behrouz A. Forouzan, 5/e, Copyright year: 2013.

### 3.2 Recommended Resource(s)

#### Modern Digital and Analog Communication Systems (Textbook)

Oxford Series in Electrical and Computer Engineering, B. P. Lathi, Zhi Ding

**Digital Communications: Fundamentals and Applications (Textbook)**

Bernard Sklar, 2nd Edition, 2001

**Data and Computer Communications (Textbook)**

Pearson Prentice hall, William Stallings

**3.3 Additional Resource(s)****Lecture Information (Notes)**

All the lecture notes are posted on the web page (Lecture #1 - #24)

**Lab Information (Lab Manual)**

The handouts for all the lab sessions are within the lab section. All types of resources regarding tutorials, links to web pages can be found in this section.

**Assignments (Other)**

Download the assignments according to the schedule given in this handout.

**Exams (Other)**

Sample problems and questions will be posted prior to midterm and final on the course link.

**Miscellaneous Information (Other)**

Other information related to ENGG\*3210 are also posted on the web page.

**3.4 Relationships with other Courses & Labs****Previous Courses:****ENGG\*2400:** Analytical solution techniques in time and transform domains, numerical solution and simulations, Laplace solution and frequency response.**MATH\*2130:** Solution of a single nonlinear equation, interpolation, numerical differentiation and integration.**STAT\*2120:** probability, conditional probability and independence; Bayes' theorem; probability distributions; probability densities.**Follow-on Courses:****ENGG\*4650:** wireless communications, routing protocols, network layer, prototyping.**4 Learning Outcomes****4.1 Course Learning Outcomes**

By the end of this course, you should be able to:

1. Utilize the basic mathematical concepts to describe and analyse various signals and systems.
2. Describe analog and digital modulated signals in both time and frequency domains.
3. Understand and analyse the main communication protocols and layers.
4. Understand the requirements and designs for single and multiple users' communication systems.
5. Describe basic structure of communication networks.
6. Understand the basic concepts of error control coding.
7. Understand the principles of multiplexing, FDM, and TDM and design multiplexed communications systems
8. Understand the principles of wired and wireless networks.
9. Design the baseband section of a communication system to satisfy certain constraints.
10. Analyse and evaluate the performance of a communication system.

## 4.2 Engineers Canada - Graduate Attributes (2018)

Successfully completing this course will contribute to the following:

#	Outcome	Learning Outcome(s)
1	Knowledge Base	1, 2, 3, 4, 5, 6, 7, 8
1.1	Recall, describe and apply fundamental mathematical principles and concepts	1, 2, 6
1.3	Recall, describe and apply fundamental engineering principles and concepts	1, 2, 3, 4, 5, 6, 7, 8
2	Problem Analysis	3, 4, 5, 6, 8
2.2	Identify, organize and justify appropriate information, including assumptions	3, 4, 5, 6
2.3	Construct a conceptual framework and select an appropriate solution approach	4, 6, 8
3	Investigation	3
3.2	Design and apply an experimental plan/investigative approach (for example, to characterize, test or troubleshoot a system)	3
4	Design	4, 6, 7, 9
4.2	Construct design-specific problem statements including the definition of	4, 9

#	Outcome	Learning Outcome(s)
	criteria and constraints	
4.3	Create a variety of engineering design solutions	6, 7
4.4	Evaluate alternative design solutions based on problem definition	6, 7, 9
4.5	Develop and refine an engineering design solution, through techniques such as iteration, simulation and/or prototyping	9
5	Use of Engineering Tools	10
5.1	Select appropriate engineering tools from various alternatives	10
5.3	Recognize limitations of selected engineering tools	10

## 5 Teaching and Learning Activities

### 5.1 Lecture

<b>Topic(s):</b>	Introduction
<b>Reference(s):</b>	Ch 1
<b>Topic(s):</b>	Network Models
<b>Reference(s):</b>	Ch 2
<b>Learning Outcome(s):</b>	3,5,8
<b>Topic(s):</b>	Introduction to Physical Layer
<b>Reference(s):</b>	Ch 3
<b>Learning Outcome(s):</b>	1,2,4,7,9
<b>Topic(s):</b>	Digital Transmission
<b>Reference(s):</b>	Ch 4
<b>Learning Outcome(s):</b>	2,5,7,9
<b>Topic(s):</b>	Analog Transmission
<b>Reference(s):</b>	Ch 5
<b>Learning Outcome(s):</b>	1,2,7,8
<b>Topic(s):</b>	Bandwidth Utilization
<b>Reference(s):</b>	Ch 6
<b>Learning Outcome(s):</b>	7,8
<b>Topic(s):</b>	Switching
<b>Reference(s):</b>	Ch 8
<b>Learning Outcome(s):</b>	5,7,9
<b>Topic(s):</b>	Transmission Media
<b>Reference(s):</b>	Ch 7

<b>Learning Outcome(s):</b>	4,6,10
<b>Topic(s):</b>	Introduction to Data-Link Layer
<b>Reference(s):</b>	Ch 9
<b>Learning Outcome(s):</b>	3,6,8,10
<b>Topic(s):</b>	Error Detection and Correction
<b>Reference(s):</b>	Ch 10
<b>Learning Outcome(s):</b>	1,6,10
<b>Topic(s):</b>	Data Link Control
<b>Reference(s):</b>	Ch 11
<b>Learning Outcome(s):</b>	3,5,6,10
<b>Topic(s):</b>	Media Access Control (MAC)
<b>Reference(s):</b>	Ch 12
<b>Learning Outcome(s):</b>	3,8,10
<b>Topic(s):</b>	Wired and Wireless LANs
<b>Reference(s):</b>	Ch 13, 15, 16
<b>Learning Outcome(s):</b>	5,8,9,10

## 5.2 Seminar

<b>Topic(s):</b>	Tutorial
<b>Reference(s):</b>	CourseLink

## 5.3 Lab

### Week 1

<b>Topic(s):</b>	Laboratory 0
	Safety and group formation
<b>Reference(s):</b>	Lab manual

### Week 2

<b>Topic(s):</b>	Lab 1- Introduction to Simulink
<b>Reference(s):</b>	Lab manual
<b>Learning Outcome(s):</b>	1,2
	3 marks

### Week 3

**Topic(s):** Lab 2- BER in AWGN Channels

**Reference(s):** Lab manual

**Learning Outcome(s):** 3,5,6,8

3 Marks

#### **Week 4**

**Topic(s):** Lab 3- Amplitude Shift Keying

**Reference(s):** Lab manual

**Learning Outcome(s):** 4,5,6,9,10

3 Marks

#### **Week 5**

**Topic(s):** Lab 4- Higher order MPSK

**Reference(s):** Lab manual

**Learning Outcome(s):** 4,5,6,9,10

3 Marks

**Topic(s):** Tutorial

**Topic(s):** Winter break, no lab

#### **Week 8**

**Topic(s):** Lab 5- Pulse Code Modulation

**Reference(s):** Lab manual

**Learning Outcome(s):** 2,3,5,9,10

3 Marks

#### **Week 9**

**Topic(s):** Lab 6- BER performance of Comm Sys with Error Correction

**Reference(s):** Lab manual

**Learning Outcome(s):** 5,6,9,10

3 Marks

#### **Week 10**

**Topic(s):** Lab 7- Direct Sequence Spread Spectrum

**Reference(s):** Lab manual

**Learning Outcome(s):** 4,9,10

3 Marks

#### **Week 11**

<b>Topic(s):</b>	Lab 8- Hamming Codes
<b>Learning Outcome(s):</b>	5,6,10
<b>Topic(s):</b>	Tutorial

---

## 6 Assessments

### 6.1 Marking Schemes & Distributions

If you miss the midterm due to grounds for granting academic consideration or religious accommodation, you can reschedule the midterm at most within a week following the midterm. If a reschedule within the one week limit is not possible the weight of the missed midterm will be added to the final exam.

**You must get  $\geq 50\%$  on the written exam part (midterm + final),** in order for the laboratory and assignment write-up portion of the course to count towards the final grade.

Labs - - 20%  
 Assignments - 10%  
 Midterm - 30%  
 Final - 40%

Name	Scheme A (%)	Scheme B (%)
Assignments	10	10
Labs	20	20
Midterm	30	0
Final	40	70
Total	100	100

### 6.2 Assessment Details

#### Labs (20%)

**Date:** Monday 8:30AM - 10:20AM, RICH 1532

**Learning Outcome(s):** 1,2,3,4,5,6,9,10

There are **eight mandatory** labs of two hours each. You will work in groups of two.

In each lab, you will typically have to build a system. Once this is done, show it to your TA for grading, out of 3:

**Judgment of TA**

**Grade**



Did not attend or try	0
Tried, but failed to get much working	1
Most, but not all working	2
Everything worked	3

You need to submit a written report graded out of 2

<b>Judgment of TA</b>	<b>Grade</b>
-----------------------	--------------

Report not submitted	0
----------------------	---

A report that is lacking in structure and not answering and addressing all questions.	1
---	---

A complete report addressing and answering all the questions.	2
---	---

**Note 1:** Although the lab portion of the course is worth **20% ((8Labs x 5pts) /2)**, both the midterm and the final exam will contain questions directly related to skills learned in the lab.

**Note 2:** In order to get marked, you have to participate in the lab and submit a lab report (report deadline: a week after each lab.)

\*Tutorial/ Laboratory order will be adjusted throughout the course as needed.

**Assignment #1 (2.5%)**

**Date:** Week 3

**Assignment #2 (2.5%)**

**Date:** Week 6

**Assignment #3 (2.5%)**

**Date:** Week 9

**Assignment #4 (2.5%)**

**Date:** Week 11

**Midterm exam (30%)**

**Date:** Wed, Feb 27, 1:00 PM - , 2:20 PM, MCKN, Room 236

**Learning Outcome(s):** 1,2,10

**You must get  $\geq 50\%$  on the written exam part (midterm + final), in order for the**

laboratory and assignment write-up portion of the course to count towards the final grade

### **Final Exam (40%)**

**Date:** Mon, Apr 22, 8:30 AM - , 10:30 AM, Room TBA on Webadvisor

**Learning Outcome(s):** 1,2,3,4,5,6,7,8,9,10

**You must get  $\geq 50\%$  on the written exam part (midterm + final),** in order for the laboratory and assignment write-up portion of the course to count towards the final grade.

## 6.3 Other Important dates

Monday, January 7, 2019: First day of class

Monday, February 18 – Friday, February 22 2019: Winter Break

Wednesday, February 27, 2019: Midterm in class

Friday, March 08, 2019: drop date – 40th class

Wednesday, April 3 2019: last day of class

## 7 Course Statements

### 7.1 Course Grading Policies

**Missed Assessments:** If you are unable to meet an in-course requirement due to medical, psychological, or compassionate reasons, please email the course instructor. See the undergraduate calendar for information on regulations and procedures for Academic Consideration:

<http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml>

**Accommodation of Religious Obligations:** If you are unable to meet an in-course requirement due to religious obligations, please email the course instructor within two weeks of the start of the semester to make alternate arrangements. See the undergraduate calendar for information on regulations and procedures for Academic Accommodation of Religious Obligations:

<http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-accomrelig.shtml>

**Passing grade:** In order to pass the course, you must pass both the laboratory and exam course portions. Students must obtain a grade of 50% or higher on the exam portion of the course in order for the laboratory write-up portion of the course to count towards the final grade.

**Missed midterm tests:** If you miss a test due to grounds for granting academic consideration or religious accommodation, the weight of the missed test will be added to the final exam. There will be no makeup midterm tests.

**Lab Work:** You must attend and complete all laboratories. If you miss a laboratory due to grounds for granting academic consideration or religious accommodation, arrangements must be made with the teaching assistant to complete a makeup lab.

**Late Lab Reports:** Late submissions of lab reports will not be accepted

---

## 8 School of Engineering Statements

### 8.1 Instructor's Role and Responsibility to Students

The instructor's role is to develop and deliver course material in ways that facilitate learning for a variety of students. Selected lecture notes will be made available to students on Courselink but these are not intended to be stand-alone course notes. Some written lecture notes will be presented only in class. During lectures, the instructor will expand and explain the content of notes and provide example problems that supplement posted notes. Scheduled classes will be the principal venue to provide information and feedback for tests and labs.

### 8.2 Students' Learning Responsibilities

Students are expected to take advantage of the learning opportunities provided during lectures and lab sessions. Students, especially those having difficulty with the course content, should also make use of other resources recommended by the instructor. Students who do (or may) fall behind due to illness, work, or extra-curricular activities are advised to keep the instructor informed. This will allow the instructor to recommend extra resources in a timely manner and/or provide consideration if appropriate.

### 8.3 Lab Safety

Safety is critically important to the School and is the responsibility of all members of the School: faculty, staff and students. As a student in a lab course you are responsible for taking all reasonable safety precautions and following the lab safety rules specific to the lab you are working in. In addition, you are responsible for reporting all safety issues to the laboratory supervisor, GTA or faculty responsible.

---

## 9 University Statements

### 9.1 Email Communication

As per university regulations, all students are required to check their e-mail account regularly: e-mail is the official route of communication between the University and its students.

### 9.2 When You Cannot Meet a Course Requirement

When you find yourself unable to meet an in-course requirement because of illness or compassionate reasons please advise the course instructor (or designated person, such as a teaching assistant) in writing, with your name, id#, and e-mail contact. The grounds for

Academic Consideration are detailed in the Undergraduate and Graduate Calendars.

Undergraduate Calendar - Academic Consideration and Appeals

<https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml>

Graduate Calendar - Grounds for Academic Consideration

<https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml>

### **9.3 Drop Date**

Courses that are one semester long must be dropped by the end of the fortieth class day; two-semester courses must be dropped by the last day of the add period in the second semester. The regulations and procedures for course registration are available in the Undergraduate and Graduate Calendars.

Undergraduate Calendar - Dropping Courses

<https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-drop.shtml>

Graduate Calendar - Registration Changes

<https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/genreg-reg-regchg.shtml>

### **9.4 Copies of Out-of-class Assignments**

Keep paper and/or other reliable back-up copies of all out-of-class assignments: you may be asked to resubmit work at any time.

### **9.5 Accessibility**

The University promotes the full participation of students who experience disabilities in their academic programs. To that end, the provision of academic accommodation is a shared responsibility between the University and the student.

When accommodations are needed, the student is required to first register with Student Accessibility Services (SAS). Documentation to substantiate the existence of a disability is required; however, interim accommodations may be possible while that process is underway.

Accommodations are available for both permanent and temporary disabilities. It should be noted that common illnesses such as a cold or the flu do not constitute a disability.

Use of the SAS Exam Centre requires students to book their exams at least 7 days in advance and not later than the 40th Class Day.

More information can be found on the SAS website

<https://www.uoguelph.ca/sas>

### **9.6 Academic Integrity**

The University of Guelph is committed to upholding the highest standards of academic

integrity, and it is the responsibility of all members of the University community-faculty, staff, and students-to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring. University of Guelph students have the responsibility of abiding by the University's policy on academic misconduct regardless of their location of study; faculty, staff, and students have the responsibility of supporting an environment that encourages academic integrity. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection.

Please note: Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member or faculty advisor.

Undergraduate Calendar - Academic Misconduct

<https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-amisconduct.shtml>

Graduate Calendar - Academic Misconduct

<https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml>

## 9.7 Recording of Materials

Presentations that are made in relation to course work - including lectures - cannot be recorded or copied without the permission of the presenter, whether the instructor, a student, or guest lecturer. Material recorded with permission is restricted to use for that course unless further permission is granted.

## 9.8 Resources

The Academic Calendars are the source of information about the University of Guelph's procedures, policies, and regulations that apply to undergraduate, graduate, and diploma programs.

Academic Calendars

<https://www.uoguelph.ca/academics/calendars>

---