



ENGG*3210 Communication Systems

01

Winter 2023

Section(s): C01

School of Engineering

Credit Weight: 0.50

Version 1.00 - December 22, 2022

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-Requisites: 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 and coding, communication media, error control, multiplexing and multiple access techniques.

1.3 Timetable

Lectures:

Monday 1:00PM – 2:20PM, MCLN 107

Wednesday 1:00PM – 2:20PM, MCLN 107

Laboratory and Tutorials:

Wednesday 3:30PM - 5:20PM RICH, Room 1532

Wednesday 10:30AM - 12:20PM RICH, Room 1532

1.4 Final Exam

Monday April 22, 8:30AM – 10:30AM, Room TBD

2 Instructional Support

2.1 Instructional Support Team

Instructor: Lei Lei Ph.D
Email: leil@uoguelph.ca
Office: THRN 2407
Office Hours: By appointment via email

2.2 Teaching Assistants

Teaching Assistant (GTA): Bello Yahuza
Email: ybello@uoguelph.ca

2.3 Lab Technician

Technician: Kevin Dong
Office: RICH 2506, ext. 56455
Email: kdong@uoguelph.ca

3 Learning Resources

3.1 Required Resources

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, 6/e, Copyright year: 2022.

3.2 Recommended Resources

Modern Digital and Analog Communication Systems (Textbook)

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

Communication Networks: Fundamental Concepts and Key Architectures (Textbook)

McGraw Hill, Alberto Leon-Garcia, Indra Widjaja

Data and Computer Communications (Textbook)

Pearson Prentice hall, William Stallings

3.3 Additional Resources

Lecture Information (Notes)

All the lecture notes are posted on the web page

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.

Exams (Other)

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
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, 7
1.3	Recall, describe and apply fundamental engineering principles and concepts	1, 2, 3, 4, 5, 6, 7, 8
2	Problem Analysis	2, 3, 4, 5, 6, 8
2.2	Identify, organize and justify appropriate information, including assumptions	2, 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

#	Outcome	Learning Outcome
4	Design	4, 6, 7, 9, 10
4.2	Construct design-specific problem statements including the definition of criteria and constraints	4, 9
4.3	Create a variety of engineering design solutions	6, 7, 10
4.4	Evaluate alternative design solutions based on problem definition	6, 7, 9, 10
4.5	Develop and refine an engineering design solution, through techniques such as iteration, simulation and/or prototyping	9
5	Use of Engineering Tools	7, 9, 10
5.1	Select appropriate engineering tools from various alternatives	10
5.2	Demonstrate proficiency in the application of selected engineering tools	7, 9
5.3	Recognize limitations of selected engineering tools	10

5 Teaching and Learning Activities

5.1 Lecture

Topics:	Introduction
References:	Ch 1
Learning Outcome:	1
Topics:	Network Models
References:	Ch 2
Learning Outcome:	3, 5, 8
Topics:	Introduction to Physical Layer
References:	Ch 3
Learning Outcome:	1, 2, 4, 7, 9
Topics:	Digital Transmission
References:	Ch 4
Learning Outcome:	2, 5, 7, 9
Topics:	Analog Transmission
References:	Ch 5
Learning Outcome:	1, 2, 7, 8
Topics:	Bandwidth Utilization
References:	Ch 6
Learning Outcome:	7, 8

Topics:	Switching
References:	Ch 8
Learning Outcome:	5, 7, 9
Topics:	Transmission Media
References:	Ch 7
Learning Outcome:	4, 6, 10
Topics:	Introduction to Data-Link Layer
References:	Ch 9
Learning Outcome:	3, 6, 8, 10
Topics:	Error Detection and Correction
References:	Ch 10
Learning Outcome:	1, 6, 10
Topics:	Data Link Control
References:	Ch 11
Learning Outcome:	3, 5, 6, 10

5.2 Seminar

Week 6

Topics:	Tutorial 1
References:	Tutorial Document

Week 12

Topics:	Tutorial 2
References:	Tutorial Document

5.3 Lab

Week 1

Topics:	Laboratory 0
	Safety and group formation
References:	Lab manual

Week 2

Topics:	Lab 1- Introduction to Simulink
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References: Lab manual
Learning Outcome: 1, 2

Week 3

Topics: Lab 2- BER in AWGN Channels

References: Lab manual
Learning Outcome: 3, 5, 6, 8

Week 5

Topics: Lab 3- Pulse Code Modulation

References: Lab manual
Learning Outcome: 4, 5, 6, 9, 10

Week 7

Topics: Lab 4- Amplitude Shift Keying

References: Lab manual
Learning Outcome: 4, 5, 6, 9, 10

Week 9

Topics: Lab 5- BER performance of Comm Sys with Error Correction

References: Lab manual
Learning Outcome: 5, 6, 9, 10

Week 10

Topics: Lab 6- Hamming Codes

References: Lab manual

Learning Outcome: 5, 6, 10

6 Assessments

6.1 Marking Schemes & Distributions

You must get $\geq 50\%$ on the mid-term and final exams part, in order for the laboratory portion of the course to count towards the final grade. There are 6 assignments, which will not be graded. Completing the assignments are highly encouraged in order to practice for the mid-term and final exams.

Labs - 30%

Mid-term 20%

Final - 50%
 Assignments - 0%

Name	Scheme A (%)
Labs	30
Mid-term	20
Final	50
Assignments	0
Total	100

6.2 Assessment Details

Labs (30%)

Date: Wednesday 10:30AM-12:20PM; Wednesday 3:30PM - 5:20PM, RICH 1532

Learning Outcome: 1, 2, 3, 4, 5, 6, 9, 10

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

In each lab, you will typically have to build a system. Once this is done, show it to your TA for grading, out of 9:

Judgment of TA	Grade
Did not attend or try	0
Tried, but failed to get much working	3
Most, but not all working	6
Everything worked	9

You need to submit a written report graded out of 6.

Judgment of TA	Grade
Report not submitted	0
A report that is lacking in structure and not answering and addressing all questions.	3
A complete report addressing and answering all	6

the questions.

Note 1: The lab portion of the course is worth **30% ((6Labs x 15pts) /3)**.

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.)

*Laboratory schedule will be adjusted throughout the course as needed. Please check the CourseLink website regularly for the latest information.

Midterm exam (20%)

Date: Mon, Feb 27, 1:00 PM - 2:20 PM, MCLN 107

You must get $\geq 50\%$ on the mid-term and final exams part, in order for the laboratory portion of the course to count towards the final grade.

Final Exam (50%)

Date: Fri, Apr 22, 8:30 AM - 10:30 AM, Room TBD

Learning Outcome: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

You must get $\geq 50\%$ on the mid-term and final exams part, in order for the laboratory portion of the course to count towards the final grade.

6.3 Other Important dates

Monday, January 9, 2023: First day of class

Monday, February 20 – Friday, February 24 2023: Winter Break

Friday, April 10, 2023: drop date

Wednesday, April 5 2023: 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.

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>

Associate Diploma Calendar - Academic Consideration, Appeals and Petitions

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

9.3 Drop Date

Students will have until the last day of classes to drop courses without academic penalty. The deadline to drop two-semester courses will be the last day of classes in the second semester. This applies to all students (undergraduate, graduate and diploma) except for Doctor of Veterinary Medicine and Associate Diploma in Veterinary Technology (conventional and alternative delivery) students. The regulations and procedures for course registration are available in their respective Academic 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>

Associate Diploma Calendar - Dropping Courses

<https://www.uoguelph.ca/registrar/calendars/diploma/current/c08/c08-drop.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 make a booking at least 14 days in advance, and no later than November 1 (fall), March 1 (winter) or July 1 (summer). Similarly, new or changed accommodations for online quizzes, tests and exams must be approved at least a week ahead of time.

For Guelph students, information can be found on the SAS website
<https://www.uoguelph.ca/sas>

For Ridgetown students, information can be found on the Ridgetown SAS website
<https://www.ridgetownc.com/services/accessibilityservices.cfm>

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>

9.9 Disclaimer

Please note that the ongoing COVID-19 pandemic may necessitate a revision of the format of course offerings, changes in classroom protocols, and academic schedules. Any such changes will be announced via CourseLink and/or class email.

This includes on-campus scheduling during the semester, mid-terms and final examination schedules. All University-wide decisions will be posted on the COVID-19 website (<https://news.uoguelph.ca/2019-novel-coronavirus-information/>) and circulated by email.

9.10 Illness

Medical notes will not normally be required for singular instances of academic consideration, although students may be required to provide supporting documentation for multiple missed assessments or when involving a large part of a course (e.g.. final exam or major assignment).

9.11 Covid-19 Safety Protocols

For information on current safety protocols, follow these links:

- <https://news.uoguelph.ca/return-to-campus/how-u-of-g-is-preparing-for-your-safe-return/>
- <https://news.uoguelph.ca/return-to-campus/spaces/#ClassroomSpaces>

Please note, these guidelines may be updated as required in response to evolving University, Public Health or government directives.
