Toronto Metropolitan University

Department of Electrical, Computer, & Biomedical Engineering
Faculty of Engineering & Architectural Science

Course Outline (F2023)

ELE745: Digital Communication Systems

Instructor(s)	Dr. Lian Zhao [Coordinator] Office: ENG434 Phone: (416) 979-5000 x 556101 Email: l5zhao@torontomu.ca Office Hours: Wednesdays, 12:30-1:30 pm
Calendar Description	This course provides a comprehensive introduction to basic principles and techniques of digital communication. Lecture topics include: Analog to digital conversion, PCM, baseband transmission, power spectrum density analysis, intersymbol interference, matched filters, noise analysis, digital modulation, coherent and non-coherent detections. Laboratory work is based on simulations in Matlab.
Prerequisites	ELE 635
Antirequisites	None
Corerequisites	None
Compulsory Text(s):	1. B.P. Lathi and Z. Ding, Modern Digital and Analog Communication Systems, Oxford Press, 5th edition, 2018 (early editions would be fine). 2. B. Sklar, Digital Communications: Fundamentals and Applications, Prentice Hall, 2000.
Reference Text(s):	1. J. G. Proakis, Digital Communications, 4 th edition, McGrwa Hill, 2001. 2. S. Haykin, Communication Systems, 4 th edition, Wiley, 2001.
Learning Objectives (Indicators)	At the end of this course, the successful student will be able to: 1. Use communication engineering knowledge to understand and design digital communication systems; understand and evaluate the performance of digital communication systems under various conditions. (**1d**) 2. Develop mathematical models to predict the behavior of digital communication systems and compare with read world/simulated data and propose improvements. (**2b**) 3. Use communication engineering knowledge to understand and design digital communication systems. (**4a**) 4. Understand the impact to the environment of advanced technology; and the impact from human behaviour changes from the evolution of the technologies. (**9a**) 5. Understand the development history of modern communication; Self-learning for selected advanced communication techniques through course project to cultivate life-long learning perception and skills. (**12b**) **NOTE:** *Numbers in parentheses refer to the graduate attributes required by the Canadian Engineering Accreditation Board (CEAB).*

	Course Organization	3.0 hours of lecture per week for 13 weeks 2.0 hours of lab per week for 12 weeks 0.0 hours of tutorial per week for 12 weeks
	Teaching Assistants	TBA

	Course Evaluation	

Theory	
Midterm Exam	25 %
Final Exam	45 %
Literature Study Report	6 %
Laboratory	
4 Laboratory 6% each	24 %
TOTAL:	100 %

Note: In order for a student to pass a course, a minimum overall course mark of 50% must be obtained. In addition, for courses that have both **"Theory and Laboratory"** components, the student must pass the Laboratory and Theory portions separately by achieving a minimum of 50% in the combined Laboratory components and 50% in the combined Theory components. Please refer to the **"Course Evaluation"** section above for details on the Theory and Laboratory components (if applicable).

	Examinations	Midterm exam date: October 23 (8th week), two hours in-person exam (10:00-12:00), problem solving. Final exam, three hours in-person exam, problem solving.
	Other Evaluation Information	There will be some assignment problems for each chapter. The assignment will not be collected. However, students are expected to solve all assignment problems. Information about these assignments will be posted on the course homepage. Literature Study Report: 6%. More details will be posted
	Other Information	None

Course Content

Week	Hours	Chapters / Section	Topic, description
1-2	5		Introduction and background knowledge review System block diagram, advantages of digital communications, Fourier series for periodic signals. (Chapters 1 - 3)

2-4	6		Sampling Theory in Digital Communications Introduction to communication systems and digital information, review of Fourier transforms and linear systems, sampling, interpolation limits in digital transmission, Nyquist bandwidth, etc. (Chapter 5)
5-6	7		Baseband Transmission Line coding, signalling analysis, inter symbol interference (ISI), pulse shaping equalization etc. (Chapter 6)
8-10	9		Probability, Optimal Detection Probability, optimal detection of binary signals, optimal transceiver, bit error rate analysis. (Chapters 7-9)
11-12	6		Digital Modulation Signal space, signal space analysis of digital passband modulation, PSK/ASK/APK/QAM/FSK BER analysis, coherent and noncoherent detections and transceivers. (Lecture Notes)

Laboratory(L)/Tutorials(T)/Activity(A) Schedule

No lab information set for course.

University Policies

Students are reminded that they are required to adhere to all relevant university policies found in their online course shell in D2L and/or on the Senate website

Important Resources Available at Toronto Metropolitan University

- The Library provides research workshops and individual assistance. If the University is open, there is a Research Help desk on the second floor of the library, or students can use the Library's virtual research help service to speak with a librarian.
- Student Life and Learning Support offers group-based and individual help with writing, math, study skills, and transition support, as well as resources and checklists to support students as online learners.

- You can submit an [Academic Consideration Request](#) when an extenuating circumstance has occurred that has significantly impacted your ability to fulfill an academic requirement. You may always visit the [Senate website](#) and select the blue radio button on the top right hand side entitled: Academic Consideration Request (ACR) to submit this request.

  For Extenuating Circumstances, Policy 167: Academic Consideration allows for a once per semester ACR request without supporting documentation if the absence is less than 3 days in duration and is not for a final exam/final assessment. Absences more than 3 days in duration and those that involve a final exam/final assessment, require documentation. Students must notify their instructor once a request for academic consideration is submitted. See Senate [Policy 167: Academic Consideration.](#)

- If taking a remote course, familiarize yourself with the tools you will need to use for remote learning. The [Remote Learning Guide](#) for students includes guides to completing quizzes or exams in D2L Brightspace, with or without [Respondus LockDown Browser and Monitor, using D2L Brightspace,](#) joining online meetings or lectures, and collaborating with the Google Suite.
- Information on Copyright for [Faculty](#) and [students](#).

Accessibility

- Similar to an [accessibility statement,](#) use this section to describe your commitment to making this course accessible to students with disabilities. Improving the accessibility of your course helps minimize the need for accommodation.
- Outline any technologies used in this course and any known accessibility features or barriers (if applicable).
- Describe how a student should contact you if they discover an accessibility barrier with any course materials or technologies.

Academic Accommodation Support

Academic Accommodation Support (AAS) is the university's disability services office. AAS works directly with incoming and returning students looking for help with their academic accommodations. AAS works with any student who requires academic accommodation regardless of program or course load.

- Learn more about [Academic Accommodation Support](#).
- Learn [how to register with AAS](#).

Academic Accommodations (for students with disabilities) and Academic Consideration (for students faced with extenuating circumstances that can include short-term health issues) are governed by two different university policies. Learn more about [Academic Accommodations versus Academic Consideration and how to access each](#).

Wellbeing Support

At Toronto Metropolitan University, we recognize that things can come up throughout the term that may interfere with a student's ability to succeed in their coursework. These circumstances are outside of one's control and can have a serious impact on physical and mental well-being. Seeking help can be a challenge, especially in those times of crisis.

If you are experiencing a mental health crisis, please call 911 and go to the nearest hospital emergency room. You can also access these outside resources at anytime:

- **Distress Line:** 24/7 line for if you are in crisis, feeling suicidal or in need of emotional support (phone: 416-408-4357)
- **Good2Talk:** 24/7-hour line for postsecondary students (phone: 1-866-925-5454)
- **Keep.meSAFE:** 24/7 access to confidential support through counsellors via [My SSP app](#) or 1-844-451-9700

If non-crisis support is needed, you can access these campus resources:

- **Centre for Student Development and Counselling:** 416-979-5195 or email csdc@torontomu.ca
- **Consent Comes First - Office of Sexual Violence Support and Education:** 416-919-5000 ext 3596 or email osvse@torontomu.ca
- **Medical Centre:** call (416) 979-5070 to book an appointment

We encourage all Toronto Metropolitan University community members to access available resources to ensure support is reachable. You can find more resources available through the [Toronto Metropolitan University Mental Health and Wellbeing](#) website.