

Course Outline (W2026)

ELE815: Wireless Communications

Instructor(s)	Dr. Alagan Anpalagan [Coordinator] Office: ENG447 Phone: (416) 979-5000 x 556079 Email: alagan@torontomu.ca Office Hours: By appointment
Calendar Description	This course provides a comprehensive introduction to basic principles and techniques in cellular mobile communications. The topics include: communication overview and frequency reuse, the cellular concept, radio propagation environments, techniques of modulation and equalization, multiple access wireless systems: TDMA/FDMA systems, CDMA systems, etc.
Prerequisites	ELE 745
Antirequisites	None
Corerequisites	None
Compulsory Text(s):	1. T.S. Rappaport, Wireless Communications: Principles and Practice, 4th Edition, Prentice Hall, 2009.
Reference Text(s):	
Learning Objectives (Indicators)	<p>At the end of this course, the successful student will be able to:</p> <ol style="list-style-type: none"> 1. Uses engineering knowledge to solve real world open-ended engineering problems. Use appropriate channel and traffic models to evaluate the impact of wireless service quality and capacity. (1c) 2. Uses judgement in solving problems with uncertainty and imprecise information (2a) 3. Generate solutions for complex design problems via proper choice of system parameters, analyse the results and make recommendations. Overall wireless system knowledge and the role of various sub components will be used in obtaining solutions. (4b) 4. Designs and develops software tools to perform the tasks required by the project. Identifies the limitations and enhancements of the tools with respect to the project needs. (5a) 5. Gathers, synthesises and analyses the literature on the development of wireless systems; Prepares plan for project with deliverables. (12a) <p>NOTE: Numbers in parentheses refer to the graduate attributes required by the Canadian Engineering Accreditation Board (CEAB).</p>
Course Organization	3.0 hours of lecture per week for 13 weeks 1.0 hours of lab per week for 12 weeks 0.0 hours of tutorial per week for 12 weeks

Teaching Assistants	TBA														
Course Evaluation	<table border="1"> <thead> <tr> <th colspan="2">Theory</th> </tr> </thead> <tbody> <tr> <td>Midterm Test</td> <td>25 %</td> </tr> <tr> <td>Final Exam</td> <td>45 %</td> </tr> <tr> <th colspan="2">Laboratory</th> </tr> <tr> <td>Project Report</td> <td>20 %</td> </tr> <tr> <td>Project Presentation/Demo</td> <td>10 %</td> </tr> <tr> <td>TOTAL:</td> <td>100 %</td> </tr> </tbody> </table> <p>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).</p>	Theory		Midterm Test	25 %	Final Exam	45 %	Laboratory		Project Report	20 %	Project Presentation/Demo	10 %	TOTAL:	100 %
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Examinations	<p>Midterm test two hours during the lecture, closed book with one 8x11 double sided aid sheet will be allowed.</p> <p>Final exam, during exam period, three hours, closed book with two 8x11 double sided aid sheets allowed (covers weeks 1-13).</p>														
Other Evaluation Information	<p>Students will practice on Matlab/Simulink exercises. Lab exercises will not be marked. However, the project includes simulation and analysis of wireless system components and the labs will be useful for the project.</p> <p>Project marks are distributed as: Proposal (5%), Presentation/Demo (10%), Report (15%). Each group will submit one proposal and one report, and do one presentation. More information is available as part of the course notes and it will be discussed.</p> <p>Students may use Generative AI (e.g. ChatGPT, Grammarly, Perplexity, DeepL Translator) for ideation and brainstorming but not for research or for writing anything that will be submitted for credit. Failure to stay within these limits will be considered a breach of Policy 60.</p>														
Teaching Methods	Lectures, Labs/Projects, Simulation, Literature study, Presentation														
Other Information	None														

Course Content

Week	Hours	Chapters / Section	Topic, description
1	3		Introduction and Fundamental Concepts (Chapter 1 Sections 1.2-1.5)
2-3	4		Wireless Communication Systems (Chapters 2 and 11 Sections 2.1-2.3 11.1 11.3 and 11.4)
3-5	8		Mobile Radio Channels (Chapters 4 and 5 Sections 4.1-4.12 5.1-5.6)
6-7	6		Cellular Concepts and Network Capacity (Chapter 3 Sections 3.1-3.7)
8-9	6		Multiple Access Techniques (Chapter 9 Sections 9.1-9.5 and 9.7)
10-11	6		Modulation for Radio Systems (Chapter 6 Sections 6.1-6.4 6.8 and 6.11)
12	3		Wireless Networks and Emerging Wireless Technologies (Chapters 2 and 10 Sections 2.4 2.5 10.1-10.5)

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

Week	L/T/A	Description
1-2	ENG	Introduction Matlab/Simulink for system level simulation
3	ENG	BER of fading channel with BPSK modulation with single path

4	ENG	BER of fading channel with BPSK modulation with six multi-paths
5	ENG	Power allocation in downlink wireless communications
6-7	ENG	Simulation work for the course project
8	ENG	Cellular network capacity evaluation
9	ENG	Multicarrier-system (OFDM) simulation
10-12	ENG	Simulation work for the course project

University Policies & Important Information

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](#)

Refer to the [Departmental FAQ page](#) for further information on common questions.

Important Resources Available at Toronto Metropolitan University

- [The University Libraries](#) provide research [workshops](#) and individual consultation appointments. There is a drop-in Research Help desk on the second floor of the library, and students can use the [Library's virtual research help service](#) to speak with a librarian, or [book an appointment](#) to meet in person or online.
- [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, always require documentation. Students must notify their faculty/contract lecturer once a request for academic consideration is submitted. See Senate [Policy 167: Academic Consideration](#).

Longer absences are not addressed through Policy 167 and should be discussed with your Chair/Director/Program to be advised on next steps.

- [FAQs Academic Considerations and Appeals](#)
- Information on Copyright for [Faculty/Contract Lecturers](#) and [students](#).

Lab Safety (if applicable)

Students are to strictly adhere and follow:

- a. The Lab Safety information/guidelines posted in the respective labs,
- b. provided in their respective lab handouts, and
- c. instructions provided by the Teaching Assistants/Course instructors/Technical Staff.

During the lab sessions, to avoid tripping hazards, the area around the lab stations should not be surrounded by bags, backpacks etc, students should place their bags, backpacks etc against the walls of the labs and/or away from their lab stations in such a way that it avoids tripping hazards.

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](#).
- Learn about [Policy 159: Academic Accommodation of Students with Disabilities](#)

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.