University of Manitoba | Price Faculty of Engineering
Department of Electrical and Computer Engineering

Course Outline

Instructor

- Prof. Amine Mezghani
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Office Hours
- By appointment

Contact Hours
- 4 credit hours
- Lectures:
  3 hours x 13 weeks = 39 hours
- Laboratories:
  3 hours x 5 weeks = 15 hours

Prerequisites:
- ECE 3700 Telecommunication Network Engineering
- ECE 3780 Signal Processing 1

Course Website:
https://umanitoba.ca/umlearn

Traditional Territories Acknowledgement

The University of Manitoba campuses and the Department of Electrical and Computer Engineering are located on the original lands of the Anishinaabeg, Cree, Oji-Cree, Dakota, and Dene peoples, and on the homeland of the Métis Nation.

We respect the Treaties that were made on these territories, we acknowledge the harms and mistakes of the past, and we dedicate ourselves to move forward in partnership with Indigenous communities in a spirit of reconciliation and collaboration.

ECE 4540 – Wireless Networks

Fall 2022

Course Objectives

The objective of this course is to give an introduction to the fundamentals of the wireless communications systems, the wireless network architectures, protocols, and applications. Topics of study include an overview of wireless communications and mobile computing systems, signal propagation characteristics of wireless channels, wireless channel modelling, frequency reuse/cellular/microcellular concepts, modulation techniques for wireless systems, diversity techniques, and multiple access techniques.

Course Content

The following topics will be covered:

- Overview of Wireless Communications and Networks
- Wireless Channel Modelling
- Modulation, Coding, Diversity Techniques
- Cellular Concept
- Multiple Access Techniques

Textbook

Introduction to Wireless Digital Communications: A Signal Processing Perspective, R.W. Heath Jr., Pearson, 2017.

Other Resources

Wireless Communications, A. Goldsmith, Cambridge University Press, 2005.

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.

Supplemental Resources

Important Dates

- **Term Test**
  November 2th, 2022
  6:00PM – 8:00PM
- **Voluntary Withdrawal Deadline**
  November 22nd, 2022
- **National Day for Truth and Reconciliation**
  September 30th, 2022
  No classes or examinations
- **Thanksgiving Day**
  October 10th, 2022
  No classes or examinations
- **Remembrance Day**
  November 11th, 2022
  No classes or examinations
- **Fall Term Break**
  November 7th–10th, 2022
  No classes or examinations

Accreditation Details

Accreditation Units

- Mathematics: 0%
- Natural Science: 0%
- Complementary Studies: 0%
- Engineering Science: 70%
- Engineering Design: 30%

Graduate Attributes

KB: A knowledge base for engineering
PA: Problem analysis
IN: Investigation
DE: Design
ET: Use of engineering tools
IT: Individual and team work
CS: Communication skills
PR: Professionalism
IE: Impact of engineering on society/ environment
EE: Ethics and equity
EP: Economics and project management
LL: Life-long learning

Competency Levels

1 - Knowledge (Able to recall information)
2 - Comprehension (Ability to rephrase information)
3 - Application (Ability to apply knowledge in a new situation)
4 - Analysis (Able to break problem into its components and establish relationships.)
5 - Synthesis (Able to combine separate elements into a whole)
6 - Evaluation (Able to judge the worth of something)

Learning Outcomes

1. Understanding wireless channel modeling.
2. Understanding different digital modulation, channel coding, and diversity techniques for wireless communications.
3. Learning design and analysis of cellular wireless systems.
4. Learning and understanding multiple access techniques for wireless networks.
5. Understanding basic queuing theory for network performance analysis.

Expected Competency Levels

Outcome	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12
1	3	2	2	3	4		2		2			3
2	3	2	2	3	3		3		2			3
3	4	3	3	4	3		3		3			3
4	4	3	3	4	3		3		2			3
5	4	3	3									3

Evaluation

The final course grade is determined by the student's performance in laboratories, and on examinations. Students must complete all the laboratories in order to be eligible to receive a passing grade.

Component	Value (%)	Method of Feedback	Learning Outcomes Evaluated
Assignments	15	F, S	1, 2, 3, 4, 5
Laboratories	20	F, S	1, 2, 3, 4
Term Test	25	S	1, 2, 3
Final Examination	40	S	1, 2, 3, 4, 5

∗ Method of Feedback: **F** - Formative (written comments and/or oral discussion), **S** - summative (numerical grade)

Student Absences

Attendance in lectures and laboratories is mandatory. For short-term absences due to illness or other extenuating circumstances of 72 hours or less, students are required to complete a *Self-Declaration Form for Brief or Temporary Absence* available on the University website. 🔗 This form must be submitted to the course instructor within 48 hours of the absence. (No additional documentation is required.)
Note that students are responsible to complete any missed work and must consult with the instructor to make appropriate arrangements.
For absences longer than 72 hours, students must contact the instructor and ECE Undergraduate Advisor, Tammy Holowachuk (Tammy.Holowachuk@umanitoba.ca) for further instructions.

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.

Copyright Notice

Grading Scale

Letter	Mark
A+	95–100
A	85–94
B+	80–84
B	70–79
C+	65–69
C	55–64
D	45–54
F	< 45

Note: These boundaries represent a guide for the instructor and class alike. Provided that no individual student is disadvantaged, the instructor may vary any of these boundaries to ensure consistency of grading from year-to-year.

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.