Course Information

Instructor: Professor Mohamed El-Tanany
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email: tanany@sce.carleton.ca
Office hours: 1:30-3:00 pm., Wed and Fri

Course Description & Objectives
Mobile radio channel characterization: Signal strength prediction techniques and statistical coverage; fading; delay spread; interference models and outage probabilities. Digital modulation and transmission systems performance. Signal processing techniques: diversity and beam-forming, adaptive equalization and coding. Applications to TDMA and CDMA cellular systems.

Prerequisites
SYSC 5504 or ELG5375 or equivalent background in communication theory and stochastic Processes

Text Book

Recommended References
3) The course notes are available on culearn

Grading
Term Paper 20%
Midterm examination 15%
in-class quizzes (mini-exams) :15 %
Final Examination 60%

Date for Midterm Test
Mid-term test: Thursday, November 2nd in-class, 80 minutes.

Quizzes: there will be approximately 3 quizzes , in-class, through out the term. Each quizz will be allocated 30 min, and will count for 5% of credit

Midterm Tests Policy The Midterm Tests are to be written at the scheduled class time. A missed midterm will be recorded as a zero. If a midterm is missed for circumstances
beyond your control, you should submit appropriate documentation within 5 business
days for consideration.

**Final Examination Policy**
The final exam is for evaluation purposes only and will not be returned to the students
nor will Students be allowed to see their final exam once submitted.

**Attendance:** You are expected to attend the majority of all lectures

**Academic Integrity**
"Carleton University is a community of scholars dedicated to teaching, learning and research. Sound scholarship rests on a commitment to a code of academic integrity that stresses principles of honesty, trust, respect, fairness and responsibility. The University demands integrity of scholarship from all of its members including students. The quality and integrity of academic work is paramount in achieving student success. The University states unequivocally that it demands academic integrity from all its members. Academic dishonesty, in whatever form is ultimately destructive to the values of the University. Furthermore, it is unfair and discouraging to those students who pursue their studies honestly. The integrity of university academic life and the degrees conferred by the university is dependent upon the honesty and soundness of scholarship. Conduct by any person that adversely affects this process is a serious matter. Students who violate the principles of academic integrity through dishonest practices undermine the value of the Carleton degree. Dishonesty in scholarly activity cannot be tolerated. Any student who violates the standards of academic integrity will be subject to appropriate sanctions. Students should be aware of their obligations with regards to Academic Integrity (refer to the Academic Integrity Policy for additional details).

**Course material copyright**
Classroom teaching and learning activities, including lectures, discussions, presentations, etc., by both instructors and students, are copy protected and remain the intellectual property of their respective author(s). All course materials, including PowerPoint presentations, outlines, labs, case studies, assignments, exams and other materials, are also protected by copyright and remain the intellectual property of their respective author(s). Students registered in the course may take notes and make copies of course materials for their own educational use only. Students are not allowed to make electronic recordings (voice and / or video) or take photographs in the class room without the express written consent of the course instructor. The Students are not permitted to reproduce or distribute lecture notes and course materials publicly for commercial or non-commercial purposes without express written consent from the copyright holder(s)."

**Academic Accommodation**
You may need special arrangements to meet your academic obligations during the term. For an accommodation request the processes are as follows:

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1 From the Academic Integrity Policy (found) at


2 From [http://carleton.ca/equity/accommodation/](http://carleton.ca/equity/accommodation/)
Family obligation: write to me with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details see the Student Guide

Religious obligation: write to me with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details see the Student Guide

**Academic Accommodations for Students with Disabilities:** The Paul Menton Centre for Students with Disabilities (PMC) provides services to students with Learning Disabilities (LD), psychiatric/mental health disabilities, Attention Deficit Hyperactivity Disorder (ADHD), Autism Spectrum Disorders (ASD), chronic medical conditions, and impairments in mobility, hearing, and vision. If you have a disability requiring academic accommodations in this course, please contact PMC at 613-520-6608 or pmc@carleton.ca for a formal evaluation. If you are already registered with the PMC, contact your PMC coordinator to send me your Letter of Accommodation at the beginning of the term, and no later than two weeks before the first in-class scheduled test or exam requiring accommodation (*if applicable*). After requesting accommodation from PMC, meet with me to ensure accommodation arrangements are made. Please consult the PMC website (www.carleton.ca/pmc) for the deadline to request accommodations for the formally-scheduled exam (*if applicable*). “
Topics to be covered

Introduction: (1 week)
Overview of wireless systems
Wireless access and core networks
Elements of wireless transmission
Course overview
General description of the wireless channel
Definitions and terminology

Narrow band Radio Propagation: (2 weeks)
Narrow band wireless channel.
Multipath propagation model.
Fast fading and slow shadowing & Doppler effect
The un-correlated scattering model
Indoor, urban, suburban and open propagation environments with emphasis on Pathloss
Statistical coverage of outage

Broadband Radio propagation: (2 week)
Broadband wireless channel.
Coherence bandwidth
Power-delay channel profile
Coherence time
The wireless scattering function
Tapped delay line model of wireless channel

Narrow band Modem Design: (2 weeks)
Basic 2-dimensional modulation methods
QPSK and its variations
Basic transceiver design
Factors that affect the design of wireless transceiver
End-to-end link budget

Signal Improvement techniques: (2 weeks)
Diversity techniques
Space diversity in narrow band channel
Frequency diversity
Time diversity
Error correcting codes
Interleaving
Channel equalization techniques

Multiple Access techniques: (3 weeks)
The basis of cellular designs
Frequency division Multiple Access (FDMA)
Time Division Multiple Access (TDMA)
Code Division Multiple Access (CDMA)
System capacity calculations
Co-channel and adjacent channel interference
The management of radio spectrum
Description of some commercial wireless networks.