Instructor

Professor Mohamed El-Tanany
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Office Hours

Office hours: 1:30-3:00 pm., Tue and Thu

Course 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

Textbook and References

Textbook


Recommended References

3)The course notes are available on culearn
Evaluation and Marking Scheme

Grading

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

Exams

Date for Midterm Test
Mid-term test: Thursday, November 1st 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 3 business days for consideration.

Final Exam

The final examination is for evaluation purposes only and will not be returned to students. You will be able to make arrangements with the instructor or with the department office to see your marked final examination after the final grades have been made available.

General Regulations

- **Copyright on Course Materials**: The materials created for this course (including course outline, slides, posted notes, labs, project, assignments, quizzes, exams and solutions) are intended for personal use and may not be reproduced or redistributed or posted on any web site without prior written permission from the author(s).
- **Deferred Term Work**: Students who claim illness, injury or other extraordinary circumstances beyond their control as a reason for missed term work are held responsible for immediately informing the instructor concerned and for making alternate arrangements with the instructor and in all cases this must occur no later than three (3.0) working days after the term work was due. Consult the section 9.3 of the Graduate Calendar for more information
- **Academic Integrity**: Students should be aware of their obligations with regards to academic integrity. Please review the information about academic integrity at: https://carleton.ca/registrar/academic-integrity/ This site also contains a link to the complete Academic Integrity Policy that was approved by the University's Senate.
- **Academic Accommodations**: Requests for Academic Accommodation You may need special arrangements to meet your academic obligations during the term. For an accommodation request, the processes are as follows:
  - Pregnancy obligation
Please contact your instructor 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, visit the Equity Services website: carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf

- Religious obligation
  Please contact your instructor 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, visit the Equity Services website: carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf

- Academic Accommodations for Students with Disabilities
  If you have a documented disability requiring academic accommodations in this course, please contact the Paul Menton Centre for Students with Disabilities (PMC) at 613-520-6608 or pmc@carleton.ca for a formal evaluation or contact your PMC coordinator to send your instructor your Letter of Accommodation at the beginning of the term. You must also contact the PMC 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 your instructor as soon as possible to ensure accommodation arrangements are made. carleton.ca/pmc

- Survivors of Sexual Violence
  As a community, Carleton University is committed to maintaining a positive learning, working and living environment where sexual violence will not be tolerated, and is survivors are supported through academic accommodations as per Carleton’s Sexual Violence Policy. For more information about the services available at the university and to obtain information about sexual violence and/or support, visit: carleton.ca/sexual-violence-support

- Accommodation for Student Activities
  Carleton University recognizes the substantial benefits, both to the individual student and for the university, that result from a student participating in activities beyond the classroom experience. Reasonable accommodation must be provided to students who compete or perform at the national or international level. Please contact your instructor 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. https://carleton.ca/senate/wp-content/uploads/Accommodation-for-Student-Activities-1.pdf

**Additional Information**

**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.