ECE 414
Wireless Communications, Spring 2017

Instructor:	Professor G. Gong
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	http://comsecuwaterloo.ca/~ggong
	Office hours: TBD or by appointment

Lecture schedule

Time:	0930-1020TWTh
Room:	TBD

Webpage: UW-LEARN

Course description: This course introduces introduces fundamental principles and practice in wireless communications. The topics include channel characterization of wireless channels, bandpass transmission over the wireless channel, receiver techniques for fading channels, multiple-access techniques, mobility and resource management of wireless systems, and some special topics.

Objectives: A primary objective of this course is that the student should gain wide-ranging knowledge of many aspects of wireless communications.

Pre-requisite: Undergraduate probability as well as signals and systems and digital communications. It is nice to have some background in DSP as well, but not necessary.

Course Outline

1. Overview of wireless communications

2. Characterization of the wireless channel: fading characteristics (slow and fast), multipath delay spread and coherence bandwidth, Doppler spread and coherence time, frequency-selective fading and frequency-nonselective fading, and propagation loss models.

3. Bandpass transmission over the wireless channel: digital modulation techniques, power spectral densities of shift-keyed signals, probability of error in additive white Gaussian noise (AWGN), and Orthogonal Frequency Division Multiplexing (OFDM).

4. Receiver techniques for fading dispersive channels: diversity (receive diversity and and transmit diversity), equalization.

5. Multiple-access techniques: Frequency-division multiple access (FDMA), Time-division multiple access (TDMA), Code-division multiple access (CDMA); spectral efficiency; random access.

6. Fundamentals of cellular communications: frequency reuse, cell concept, interference, and call blocking, mobility and resource management of wireless systems.

7. Special topics (if the time permitted): coding for wireless channels, and space-time mudulation and coding.

Textbook and References

- **Textbook:** A. Goldsmith, *Wireless Communications*, Cambridge University Press, 2005 (reprinted 2007,2009).

- **Suggested reference books**

  a) J. W. Mark and W. Zhuang, *Wireless Communications and Networking*, Prentice Hall, 2003. (Currently, it is out of print, but you can make copies at the bookstore.)

  b) T.S. Rappaport, *Wireless Communications: Principles and Practice*, Prentice Hall, 2003.

  c) A. F. Molisch, *Wireless Communications*, Wiley, 2010.

  d) D. Tse and P. Viswanath, Fundamentals of Wireless Communications, Cambridge Univ. Press, 2005: http://www.eecs.berkeley.edu/ dtse/book.html.

Teaching Assistant: TBD.

Tutorials: The tutorials will be conducted by TA for questions and answers on material covered in lectures and homework assignments, and problem solving skills.

Course Evaluation

- Problem sets will be handed out. You should attempt them all. It is requested to submit one set of problems for 10% of the grade. Solutions will be posted on the course website.

- There will be one simulation project for 15% of the grade.

- There will be one midterm exam (date TBD) that will count for 25% of the grade.

- There will be one final exam (date TBD) that will count for 50% of the grade.