

# Course Overview – ECE 4784/6784, Wireless Communications

## Spring, 2014– Prof. Wilson

**Course Description:** This is a survey course in the theory and technology of modern wireless communication systems, exemplified in cellular telephony, paging, microwave distribution systems, wireless networks, and even garage openers. Primary emphasis will be upon system capacity calculations for cellular systems; propagation calculations; digital system performance; and important standards, including cellular, wireless LAN and so-called personal area networks.

**Text:** *Modern Wireless Communications*, S. Haykin and M. Moher, Pearson/Prentice-Hall.

**Auxiliary Texts:** *Principles of Mobile Communications*, G. Stuber, Kluwer  
*Wireless Communications*, T. Rappaport, Prentice-Hall, 2nd Ed  
*Wireless Communications*, A. Goldsmith, Cambridge  
(on reserve in Sci-Engr Library)

**Assumed background:** understanding of signals and systems calculus in continuous and discrete-time; basic notions of probability and random processes. This material is typical of that found in APMA 3110 (Probability), ECE 3750 (Signals and Systems), and ECE 4710 (Communications). Skill with math packages such as Matlab or MathCad will be eventually needed. If you are unsure of your background, please contact me.

### Syllabus:

1. Overview of wireless technology; some history
2. Block diagram representation of system elements; multiple access methods; frequency and time duplexing
3. Wave propagation and antenna basics; link budgeting and wireless propagation models; multipath channel descriptions
4. Cellular concept, traffic engineering, and system capacity calculations
5. Modulation and detection, (primarily digital); performance in Gaussian noise and on multipath channels (this will be somewhat descriptive, as opposed to having a lot of depth)
6. Spread spectrum technology, especially CDMA

7. Channel equalization for dispersive channels; the OFDM alternative
8. MIMO technology using antenna arrays
9. Wireless system standards overview (perhaps done through group presentations) Topics include cellular telephony standards (AMPS, IS-95, GSM), PCS standards; paging standards; wireless networking (802.11, Bluetooth, Zigbee, etc); WiMax; LTE; infrared technology; body area networks.
10. guest speakers on an occasional basis; occasional demonstrations; one field trip to a cell site is planned.

**Instructor's Note:**

Wireless technology is a highly-interdisciplinary field, leveraging material from a broad range of topics, and touching on most aspects of the electrical engineering discipline. Consequently, the coverage will be broad, at the expense of great depth. If you find some of the treatment shallow, consult with me for further reading or discussion.

**Dual Numbering:**

Graduate students (and maybe some undergraduates) that register under ECE 6784 should expect additional requirements. As a minimum this will typically mean one extra, more challenging, problem per set. I may also hold a couple of extra class meetings for some special topics aimed at graduate students. Grading will be separate for the two groups.

**Assessment:**

Homework, about seven sets – 35%

Mid-term exam – 25%

Final exam – 30%

Final Project – 10%