New Jersey Institute of Technology
ECE 644 Wireless Communications
Fall 2014

This course is focused on the technical challenges and solutions to physical and link layer design of wireless communication systems. Course topics include characterization of the wireless channel, the cellular concept, digital modulation techniques, spread spectrum, multiple access techniques including CDMA and OFDMA, diversity techniques. Advanced techniques such as MIMO, 3G and 4G wireless technologies are introduced. Matlab is used for examples and assignments. Term projects based on advanced wireless technologies.

Instructor: Alex Haimovich
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Office Hours: Mon. 2-3, Wed. 11-12, and by appt.

Pre-requisites: ECE 642

Textbook:
Rappaport, *Wireless Communications: Principles and Practice*, 2/e

Class notes and assignments are available on Moodle

Course Policy:
- 1 midterm 2.5 hours, 40%
- Term project 40%
- Homework assignments 20%
- 5% bonus points for active participation in class at the discretion of the instructor
- Exam is closed book with one sheet of equations allowed

Homework assignments
> All the assignments are available on Moodle
> Problem sets associated with a module are to be submitted (hardcopy) a week after a module is completed in class. Students should know how to solve listed textbook problems, but those are not part of the assignments.

Matlab
> Basic Matlab skills are required (may be acquired during the course)
> Basic Matlab needed for homework assignments and term project

Outline

- Week 1 9/8
  - Module 1: Overview of wireless communication systems

- Week 2 9/15
  - Module 2: Pathloss models

- Week 3 9/22
  - Module 3: Multipath channel models

- Week 4 9/29
  - Module 4: Cellular concept

- Week 5 10/6
  - Module 5: Basics of digital communications

- Week 6 10/13
  - Module 6: Modulation methods

- Week 7 10/20
  - Module 6 continued

- Week 8 10/27
  - Module 7: Spread spectrum

- Week 9 11/3
  - Module 8: Multiple access

- Week 10 11/10
  - **Midterm channel models, cellular concept, modulations, multiple access**

- Week 11 11/17
  - Module 9: Diversity, equalization and coding

- Week 12 11/24
  - Module 10: 3G WCDMA

- Week 13 12/1
  - Module 11: MIMO

- Week 14 12/8
  - Module 12: LTE

Course Learning Outcomes

A student who successfully completes Wireless Communications will:

1. Understand the basics of propagation of radio signals
2. Gain an understanding of the design principles of cellular systems
3. Understand how radio signals can be used to carry digital information in a spectrally efficient manner.
4. Gain knowledge of multiple access techniques based on frequency division, time division and code division.
5. Gain insights into how diversity afforded by radio propagation can be exploited to improve performance
6. Gain knowledge of the basics of wireless standards such as WiFi, WCDMA, and LTE.
7. Gain the experience of working in a group towards a final project that will involve reading articles, analysis and modeling of exemplary aspects of wireless techniques and/or systems.

Term Projects Instructions

See separate project instructions.