New Jersey Institute of Technology

ECE 644 Wireless Communications

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 LTE, MIMO, 5G NR technologies are introduced. Matlab is used for examples and assignments.

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Prerequisites: ECE 321 + highly recommended to have taken a communications systems course such as ECE 481 or ECE 642.

Textbooks: T. S. Rappaport, Wireless Communications: Principles and Practice (2nd Edition). ISBN: 0130422320

Course Learning Outcomes (CLOs):

The 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 LTE and 5G.

Course policy:

- Midterm, 2 hours, 45%
- Final, 2 hours, 45%
- 1 page with equations allowed in each of the exams. Calculators also allowed. No other material allowed.
- Homework assignments 10%
- Class participation 5%

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

Syllabus

Week	Topic
1	Module 1: Overview of wireless communication systems
2	Module 2: Pathloss models
3	Module 3: Multipath channel models
4	Module 4: Cellular concept
5	Module 5: Basics of digital communications
6	Module 6: Modulation methods
7	Module 6: Modulation methods (continued)
8	Module 7: Spread spectrum
9	Midterm exam
10	Module 8: Multiple access
11	Module 9: Diversity, equalization and coding
12	Module 10: OFDM and LTE
13	Module 11: MIMO
14	Module 12: 5G NR