

EE108 – Wireless Communications

Bulletin Description: Wireless propagation characteristics, path loss, shadowing and fading; statistical channel models; wireless channel capacity; fading and diversity techniques, multiple antenna and MIMO techniques, multicarrier and OFDMA techniques; multiuser systems, cellular and ad hoc wireless networks.

Objectives

At the end of this course, students will be able to

- Understand the wireless propagation environment and the associated channel models
- Understand the capacity of wireless and impacts of channel parameters on the capacity
- Have knowledge of diversity techniques to combat fading
- Have knowledge of MIMO techniques including space-time codes, beamforming, precoding, and receivers design.
- Have knowledge of multicarrier and multiple access techniques including OFDMA.
- Have concept of multi-user systems.
- Relate to examples in cellular communications and ad hoc networks.

Prerequisites

Communication Systems (EE107 or equivalence), Probability and statistics (EE104 or equivalence)

Grading scheme

Homework 20%, Midterm 20%, Final 35%, Project 25%.

- Class will have bi-weekly homework.
- The midterm exam is in-class.
- The final is a take-home 24 hour exam.
- The project entails research on some aspect of wireless communications.

Textbook and references

- Andrea Goldsmith, *Wireless Communications*, Cambridge University Press, 2005.
- T. S. Rappaport, *Wireless Communications - Principles and Practice*, 2nd Ed. Prentice Hall, 2001.
- D. Tse and P. Viswanath, *Fundamentals of Wireless Communication*, Cambridge Univ. Press, 2005.
- Andreas Molisch, *Wireless communications*, Wiley-IEEE Press, 2nd Ed, 2009.
- A. Paulraj, R. Nabar, and D. Gore, *Introduction to Space-Time Wireless Communications*, Cambridge University Press, 2003.
- J.G. Proakis and Salehi, *Digital Communications*, 5th Ed., McGraw-Hill: 2008.

Outline of Topics

	# lectures
1. Introduction, wireless communication history and overview	1
2. Wireless propagation characteristics	2
3. Channel models	2
a. Statistical channel model, MIMO channels	
b. Wireless channel acquisition	
4. Diversity techniques	3
5. Wireless channel capacity	3
6. MIMO systems	
a. Space-time codes and precoding/beamforming	3
b. Impacts of channel state information	1
c. Receiver structures	2
7. Multicarrier and OFDMA techniques	3
8. Multi-user systems	3
9. Cellular and ad hoc networks	2