University of California, Santa Barbara
Department of Electrical and Computer Engineering

ECE 250 Wireless Communications and Networking

A. Basic Course Information

This course covers the fundamentals of wireless communications and networking. The emphasis is on understanding the physical layer associated with the wireless medium and the physical layer technologies that drive the wireless network evolution.

Instructor: Prof. Volkan Rodoplu
Room 4113, Engineering I
Email: vrodoplu@ece.ucsb.edu
Office Hours: TBA (will start in the second week)

Lecture Hours and Location:
5:00 PM - 6:50 PM Monday & Wednesday Room 2162, Eng. I

Course web page:
http://www.ece.ucsb.edu/courses/ECE250/250_S05Rodoplu

Textbook and References:

(Required) Theodore S. Rappaport, "Wireless Communications: Principles and Practice", 2nd Edition, Prentice Hall.

Grading: 40% Midterm Exam
60% Final Exam

Homework will be assigned every week, but will not be graded. Solutions will be distributed 1 week after each assignment.

Exam Dates:
Midterm Exam: May 4, 2005 5:00 PM - 6:50 PM (in class)

Final Exam: Check the course catalog for time. Place will be announced on the web page.

Prerequisites:
An undergraduate course in digital communications, and a solid understanding of basic probability.

B. Tentative Course Calendar and Topics:

Week of	Monday Lecture	Wednesday Lecture
Mar. 28	(Lecture 1) Course Overview and logistics; Motivation and introduction Reading: Ch. 1	(Lecture 2) Cellular concept- system design fundamentals, frequency reuse, handoff, interference and system capacity, trunking; cell splitting, sectoring Reading: Ch. 2
Apr. 4	(Lecture 3) Mobile Radio Propagation - Large-scale Path Loss; free space propagation model, reflection, diffraction, scattering, log-distance path loss model, shadowing, coverage area, Okumura and Hata models, indoor propagation models, ray tracing Reading: Ch. 3	(Lecture 4) Mobile Radio Propagation - Small-scale fading and multipath; Doppler shift, multipath channel; delay spread and coherence bandwidth; Doppler spread and coherence time; flat fading and frequency-selective fading; fast fading and slow fading. Reading: Ch. 4.1-4.5
Apr. 11	(Lecture 5) Mobile Radio Propagation - Small-scale fading and Multipath: Rayleigh and Ricean distributions; multipath fading channels; level-crossing and fading statistics. Reading: Ch 4.6 - 4.7 [HW # 1 due]	(Lecture 6) Modulation Techniques for Mobile Radio: Analog techniques (AM, FM); review of digital modulation; Shannon's formula for AWGN channels; pulse shaping, Nyquist criterion, geometric representation of modulated signals, linear modulation (BPSK, DPSK, QPSK), constant envelope modulation (BFSK, MSK, G-MSK). Reading: Ch. 5.1-5.8
Apr. 18	(Lecture 7) Modulation Techniques for Mobile Radio: Combined linear and constant envelope modulation (MPSK, M-QAM, MFSK), Spread spectrum modulation, PN sequences, DS-	(Lecture 8) Performance of digital modulation techniques in the presence of fading. Reading: Ch. 5.11

	SS and FH-SS techniques Reading: Ch 5.9 - 5.11 [HW # 2 due]	
Apr. 25	(Lecture 9) Equalization and diversity Reading: Ch. 6 [HW # 3 due]	(Lecture 10) Channel coding techniques for wireless communications Reading: Ch. 6.12
May 2	(Lecture 11) Midterm Review	MIDTERM EXAM
May 9	(Lecture 12) Multiple access schemes for cellular systems: FDMA, TDMA, CDMA; performance of multiple access schemes; Random multiple access schemes for wireless networks: CSMA/CA, MACA, MACAW; performance. Reading: Ch. 8 [HW # 4 due]	(Lecture 13) Multiuser detection: decorrelating Detector, MMSE MUD, successive interference cancellation techniques; performance comparison. Reading: Lecture Notes
May 16	(Lecture 14) Adaptive Modulation: Data-rate-adaptive modulation, power-adaptive modulation. Reading: Lecture Notes [HW # 5 due]	(Lecture 15) OFDM systems; performance, comparison with DMT. Reading: Lecture Notes
May 23	(Lecture 16) Ad Hoc Networks Reading: Lecture Notes [HW # 6 due]	(Lecture 17) Energy-limited Sensor Networks Reading: Lecture Notes

May 30	HOLIDAY (NO LECTURE)	(Lecture 18) Course Review; looking ahead to industrial work and academic research; in-class discussion; course evaluations

C. Graded Course Work and Rules:

C. 1. Exam Rules and Recommendations:

Rules:

The exam rules apply to all of the exams. At the end of the exam, we will tell you to stop writing and raise your exam booklet high. If you continue writing, we will deduct roughly 5% per minute from your exam score. Wait in your seat until we announce that ALL of the exams in the exam room have been collected.

If you finish your exam early, you may hand in your exam and then leave the exam room until 10 minutes before the exam is over. Once you hand in your exam, you may not get it back to make further changes. After we enter the last 10 minutes of the exam, even if you finish early, you need to wait in your seat for time to be called.

If you arrive late for an exam, you will not be given extra time at the end of the exam.

If you need any special accommodations for the exam room, you need to talk to me in advance and as soon as you become aware of such special needs.

You must write the exam on your own. Receiving or giving help during the exam is prohibited. All exams will be in class and will be closed book. You may use scientific calculators during the exam, and you may use all the functionality of these calculators. (For example, some HP calculators have the erfc, or the Q( ) function. The use of these functionalities is allowed.) However, you may not use laptops, PDAs (such as Palm Pilots) or computers during an exam. (If you have any doubts about your particular device, make sure to talk to me 1 month before any exam.) In addition, you may not bring any wireless devices that can retrieve data. If you are found with any illegitimate device during the exam, procedures for Honor Code violations will be followed strictly.

If we cannot read your answer, we cannot give you any credit. If you have very bad handwriting, please see me at the beginning of the quarter.

If you do not show up for an exam, you receive a zero for that exam. The only exception to this rule is an emergency that is well-documented. As soon as you become aware of such an emergency, you need to contact me so that I can find a reasonable solution.

You must write your name on the sheet that contains the exam questions and hand in this sheet along with your exam. We will return the exam questions along with graded exams.

It is usually impossible to take the midterm or final exams earlier or later. However, in case of emergencies, we may give you an early or late exam. We cannot give guarantees on how much more difficult the make-up exam will be and will not make adjustments to the score according to the level of difficulty of the make-up exam.

Coverage:
The exams will cover ALL of the material from the beginning of the course up to the exam. (Note that the final exam is comprehensive.)

D. Policy on Student Misconduct:

We will be vigilant to detect student misconduct and to investigate any reported cases. In this course, using books in a closed-book exam, copying from someone else during an exam, are first-degree offenses. If we find any evidence of these or other offenses, we will refer the case immediately to the committee on student misconduct.