EE381V Advanced Wireless: Modulation and Multiple Access

Instructor:	Prof. Jeff Andrews
Lecture Hours:	TTh 5-6:15 PM, ENS 126
Office Hours:	Tuesday 2-4pm
Office:	ENS 434, phone 471-0536
E-Mail:	jandrews@ece.utexas.edu
Web:	http://www.ece.utexas.edu/~jandrews
Unique Course Number:	16815
Grader:	Jong Taek Lee
E-mail:	jongtaeklee@mail.utexas.edu
Guest Instructor:	Wan Choi
E-mail:	wchoi@mail.utexas.edu

Prerequisites

Digital Communications (EE 381K-2) and its prereqs, especially EE381J or an advanced probability course.

This is a *strongly* recommended prerequisite, since I also instruct that course and would like to avoid devoting excessive time to reviewing communication fundamentals. It will be assumed that the student is comfortable with basic modulation principles, inter-symbol interference and its suppression (equalization and OFDM, especially), and the computation of performance measures like probability of error. A grasp of basic information theory (i.e. Shannon's formula and its meaning) and digital signal processing will also prove useful.

Topical Outline

This course is meant to provide a strong foundation for students who wish to work in the areas of wireless system design, and wireless communication research. It is primarily focused on the digital aspects of wireless communication, and on communication theory.
Primary topics for the course:

- Wideband and narrowband channel models
- Digital modulation in wireless channels
- Diversity (both receive and transmit)
- Multicarrier modulation (brief – covered in detail in EE381K-2)
- Capacity of fading channels
- Adaptive modulation
- Spread spectrum, RAKE receivers, and CDMA
- Multiple access channels and their capacities
- Multiuser diversity

- Ad hoc and mesh networks: physical layer view and capacity

Required Textbook

A.J. Goldsmith, *Wireless Communications*, Cambridge. This is an excellent recently published book that achieves a good balance between broad insights, theoretical detail, and practical design insights. Additional course notes and unpublished materials will be provided as needed.

Supplemental Textbooks

- D. Tse and P. Viswanath *Fundamentals of Wireless Communication.*
- G. Stuber, *Principles of Mobile Communication.* This is a thorough book that is a good research reference.
- T.S. Rappaport, *Wireless Communications: Principles and Practice.* This is a best-seller and more readable than Stuber.
- J. Proakis, *Digital Communications.* This is a definitive reference on digital communication.

Web Resources

The class webpage will be accessible at:
http://www.ece.utexas.edu/wncg/ee381v/

Here, you will be able to find all handouts for the class, except homework solutions, for which only hardcopies will be available. Supplemental reading is also listed here, along with PDF versions of the recommended papers.

The online class system is called Blackboard. Most handouts will be distributed on the public web page (above), but we'll send group e-mails and do online grading through Blackboard (so you can view your grades there). Please make sure you know how to access Blackboard and that you are listed there as a student.

Grading

25% Exam 1
25% Exam 2
10% Homework
35% Project
5% Class Participation and quizzes

Other Information

Homework will typically be assigned Thursday, due the following Thursday by 5:00 pm (the start of class) to a drop box outside Prof. Andrews's office. Students are encouraged to try the homework problems on their own, and then refine their understanding and solution with another student or group of students. *You must write the names of all the students you collaborated with at the top of your homework*, but turn in your own version. Simply copying another student's paper is not acceptable though, even if referenced as such. Copying without referencing will be treated as especially serious. Late homework will be accepted only in the most extraordinary of circumstances.

Homework will taper off considerably towards the latter part of the course as students focus on their projects.

Short (10 minute) pop quizzes will be given throughout the course. They will not figure heavily in your grade (just 5% total), but will help both you and the professor assess whether you are learning the key concepts presented in lecture. The quizzes will be worth 10 points, and your lowest quiz grade will be dropped. They will typically be given on Thursday and discussed on Tuesday but this is subject to change. There are no make up quizzes.

The exams will be in class, at about the midpoint and during finals week, and are evenly weighted.

Applying the concepts of this class to a project is a very important aspect of this course. The instructor's goal is for students serious about wireless research to begin an original work that will ultimately result in a research contribution and an appropriate publication. Students also have a variety of other options: an in depth review of recent literature or a simulation of an advanced communication system with a performance discussion are two examples. A proposal, progress report, and final report will be required. Collaboration with a partner is optional but encouraged, although this will naturally increase the expectations for the scope and quality of the project. The exact mechanics of the project will be discussed in a handout.

Regrade Policy

All requests for regrades, on homework or exam, must be submitted in writing within a week of their return to you. No verbal complaints will be considered. Mistakes can be made in the grading process and we will correct those, but it is unlikely that more partial credit will be given. The basic idea here is that we don't want to indirectly penalize those students who don't ask for regrades. Also be aware that the result of a regrade can actually be a lower score as we will regrade the entire problem being protested.

College Drop/Add Policy

An engineering student must have the Dean's approval to add or drop a course after the fourth class day of the semester.

Students with Disabilities

The University of Texas at Austin provides upon request appropriate academic accommodations for qualified students with disabilities. For more information, contact the Office of the Dean of Students at 471-6259, 471-4641 TDD or the College of Engineering Director of Students with Disabilities at 471-4382.