

**Northwestern University**  
Department of Electrical and Computer Engineering

ECE 510: Advanced Wireless Networks

Spring 2005

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**Information Sheet:**

**Instructor:**

Prof. Randall Berry

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Office Hours: by appointment

**Time and Place:**

TTh 9:30-10:50 AM, L158 Tech

**Prerequisites by courses:**

- ECE 378, ECE 422 (basic familiarity with stochastic processes), ECE 380 (it should be fine if you take ECE 380 and this course simultaneously)

**Prerequisites by topic:**

- Familiarity with basic digital communication systems (modulation, coding, capacity), stochastic processes (Markov chains, ergodicity), wireless channel models (fading, path loss etc.), basic network architecture.

**Text:**

The primary reference will be a draft of a text book by David Tse and Pramod Viswanath. A copy of this draft is available at <http://www.ifp.uiuc.edu/~pramodv/pubs/book090904.pdf>. Copies of the relevant sections will be handed out in class. We also often refer to journal articles – a list of the relevant articles can be found on the course web page and most can be accessed on-line through the Northwestern Library.

**Course Overview:**

In recent years, there has been a flurry of research activity addressing wireless communication systems. Examples of these systems include cellular networks, wireless LAN's and sensor networks. In this course we will try to gain an understanding of the fundamental performance limitations and trade-offs in wireless communication systems. Both physical layer issues as well as some higher layer “networking” issues will be addressed. The emphasis of the course will be on theoretical approaches and understanding; some examples from current protocols may be used, but “implementation” details will not be stressed.

### **Course Handouts:**

Handouts not picked up during class and other announcements will be available on the course web site at <http://www.ece.northwestern.edu/~rberry/ECE510/>.

### **Problem Sets:**

Several problem sets will be assigned during the quarter. Working together in small groups on the problem sets is encouraged, however each person should write up their own solution to hand in. The problem sets are intended to help you learn the material and whatever maximizes learning for you is desirable. Problem sets must be handed in by the end of the class in which they are due. Late problem sets will not be accepted.

### **Course Grade:**

Your final grade in the course is based upon our best assessment of your understanding of the material. The weightings used to determine the final grade are:

Problem Sets	30%
Take home exam	30%
Final project	40%

### **Exams:**

There will be one take-home exam given during the quarter. You will be expected to not collaborate on this.

### **Final Project:**

A portion of your grade will be based on a final project. Projects can be done individually or in groups of two. Group projects are expected to have a larger scope than individual projects. The project can be on any topic related to the material covered in this course and is expected to contain an analytical component. Possibilities include extending a result discussed in class, a comparison of several different approaches for a problem, or performing a simulation study. A one-page proposal discussing your project is due by May 13. A write-up of no more than 10 pages per person is due by June 3. Your write-up will be graded based on both technical content and clarity of presentation. Be sure to include a bibliography and adequately cite any references used.

### **Syllabus (tentative):**

- I. Fading Channels – channel models
- II. Communication over fading channels diversity, coding, capacity definitions.
- III. Single user resource allocation and transmission scheduling.
- IV. Multi-user channels – capacity regions, resource allocation, random access protocols, scheduling.