

# CEEN-9980 Special Topics: Space-Time Wireless Communications, Spring 2007

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Office hours: TF 2:00pm-4:30pm (other times by appointment)  
Meeting time: TR 5:30pm-6:45pm  
Classroom: PKI 161

## Course Description:

Use of multiple antennas at both ends of the transmitter and the receiver has shown the potential for a large capacity increase. This course will introduce the theory of space-time (ST) wireless communication systems. Emphasis will be placed on spatial diversity, smart antenna systems, MIMO capacity of multi-antenna fading channels, space-time signaling, space-time receivers and interference mitigation. In addition, the course will overview more advanced topics such as MIMO-OFDM and current trends in research and industry.

**Required Text:** *Introduction to Space-Time Wireless Communications*,  
Arogyaswami Paulraj, Rohit Nabar and Dhananjay Gore  
Cambridge University Press, 2005  
ISBN: 0521826152

Recommended textbooks and supplementary materials will be posted on the Blackboard.

**Pre-requisites:** CEEN 8636, CEEN 8766, knowledgeable of linear algebra and matrix computation.

Topics to be covered but not limited as follows:

1. Radio channel characteristics
2. ST Channel and signal models
3. Capacity of ST channels
4. Transmit diversity versus receive diversity
5. Beamforming and smart antenna system
6. Spatial multiplexing
7. MIMO multiple-access
8. MIMO-OFDM modulation
9. Multi-user diversity in multi-antenna systems
10. ST co-channel interference mitigation
11. Performance limits and trade-offs in MIMO Channels
12. MIMO channel sounder and measurements

## Course Landmark Schedule:

2/22/07	Project proposal due
3/22/07	Midterm (open books and notes)
5/2/07	Final report due
TBD	Final exam (take home)

<b>Grading Weights:</b>	Homework	20%
	Midterm	20%
	Project	30%
	Final exam	30%

## **Important notes:**

### **Assignment:**

Homework will be assigned weekly, which will be due at the beginning of class on the date indicated. For your own benefit, please attempt the problems before consulting your friends or myself. The final write-up of the homework must be your own. Copying another student's homework is considered cheating and the appropriate action will be taken.

### **Midterm and exam:**

Both the midterm and the final exam will be comprehensive, but open book and open notes. The exam topics will cover through the lecture one week before the exam date. Each exam will typically consist of five problems. You should work on it by yourself and no discussion will be allowed. The dates for these exams will be given and cannot be changed. Please schedule your planned trips or interviews so that they do not conflict with exam dates. But a waiver may be granted by the instructor in case of an emergency.

### **Regrades:**

Regrade requests on any assignment must be submitted in writing within one week of the date when the material was returned to you. After this time, no further change in grade will be considered. When you return your paper for a regrade, please put date/time on the front sheet and indicate where and why you think that your assignment was graded incorrectly.

### **UNL Services for Students with Disabilities (SSD)**

The University of Nebraska-Lincoln (UNL) provides, upon request, appropriate academic adjustments for qualified students with disabilities. The UNL encourages all students to participate fully in the academic opportunities, cultural enrichment, and the wide array of social activities offered. Special attention has been given to remove physical barriers on campus and to provide support services to students with disabilities.

The UNL Services for Students with Disabilities (SSD) provides special assistance to students with disabilities through individualized help and counseling. Adjusting to college life and its academic demands is a new experience. SSD is committed to providing disabled students with the support that will enable them to confront challenges and reach their academic goals.

For more information concerning the following services SSD provides, please contact: [Veva Cheney](#), Director of UNL Services for Students with Disabilities