# CEEN-4940/8946-002 Special Topics: Introduction to Antennas and Radar Systems, Fall 2008

| Instructor:   | Prof. Yaoqing (Lamar) Yang                    |
|---------------|---|
| Office:       | PKI 201B                                      |
| E-mail:       | yyang3@unl.edu                                |
| Telephone:    | 402-554-3916                                  |
| Office hours: | TR 2:00pm-4:30pm (other times by appointment) |
| Meeting time: | MW 4:00pm-5:15pm                              |
| Classroom:    | PKI 335                                       |
|               |   |

#### **Course Description:**

This course will provide an introduction to antenna designs and Radar Systems. It addresses most of the basic antenna characteristics: directivity, polarization, gain, impedance matching, antenna transfer function, and radar systems. It covers the narrowband and broadband antennas, as well as basic antenna arrays (uniform linear array: ULA and uniform circular array: UCA). Antenna applications such as for the radio frequency identification (RFID) and radar principles are elaborated. The course objective is directed toward practical antenna design for high radio frequency (RF) and microwave (MW) engineering (order of GHz range), with an emphasis on current modeling software and techniques, such as Numerical Electromagnetic Code (NEC), Ansoft Designer and High Frequency Structure Simulator (HFSS), etc. Laboratory experiments along with the NSF Tekbot project and comprehensive measurement techniques are also included. Design projects with hands-on antennas will be assigned as the main part of course.

| Required Text: | 1. Antennas for all Applications, 3 <sup>rd</sup> edition<br>John D. Kraus, Ronald J. Marhefka<br>McGraw-Hill Higher Education, 2002<br>ISBN 13: 978-0-07-232103-6 |  |
|----------------|--|--|
|                | 2. Introduction to Radar Systems, 3 <sup>rd</sup> edition  |  |
|                | Merrill I. Skolnik<br>McGraw-Hill Higher Education, 2001<br>ISBN: 0072881380   |  |

Supplementary materials will be handed out in class.

**Pre-requisites:** undergraduate electrical circuits and basic knowledge of electromagnetic theory (CEEN 2140). The prerequisites and the presentation of concepts have been structured so that the course is accessible to senior undergraduate as well as graduate students.

Topics to be covered but not limited as follows:

- 1. Antenna basics
- 2. The antenna family
- 3. Point sources
- 4. Array of point sources
- 5. The electric dipole and thin linear antenna
- 6. The loop antennas
- 7. End-fire antennas: The Helical beam antenna and the Yagi-Uda array
- 8. Slot, patch and horn antennas
- 9. Broadband and frequency-independent antennas
- 10. Antennas for RFID
- 11. Antenna temperature, remote sensing and radar cross section
- 12. Propagation of radar waves
- 13. The radar antennas
- 14. Radar transmitter and receiver

## **Course Landmark Schedule:**

| 9/21/08  | Project proposal due           |
|----------|--------------------------------|
| 10/20/08 | Midterm (open books and notes) |
| 12/1/08  | Final report due               |
| TBD      | Final exam                     |
|          |                                |
|          |                                |

| Grading Weights: | 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