EE 372L Engineering Electromagnetics Laboratory

**Designation:** Elective

**Catalog Description:** Engineering Electromagnetics Lab (1) (1 3-hr Lab) Virtual and lab experiments illustrating the basic principles of electromagnetics. Pre: 371 and PHYS 274 (or concurrent); or consent. Co-requisite: 372.

**Credits:** 1


**Class/Lab Schedule:** 3 lab hours every other week (6-7 experiments)

**Topics Covered:**
- Computer usage and equipment safety education (3 hours)
- Wave types: transverse, longitudinal, and circular (3 hours)
- Properties of plane electromagnetic (EM) waves and polarization: orthogonality of E, H, and k; linear, circular, and elliptical polarizations (3 hours)
- Principles of Interferometry: Lasers and the Michelson interferometer (3 hours)
- Waves in waveguide and along transmission lines: modes, cut-off frequency (3 hours)
- Antenna: dipole, Yagi-Uda antenna array, effect of ground (3 hours)
- Wave propagation in urban and indoor environments: application of ray-tracing method in the prediction of path loss; optimization of base station locations to get maximum coverage of wireless communication systems (6 hours)

**Text Book and Other Required Materials:** Laboratory manual designed for lab

**Course Objectives and Their Relationship to Program Objectives:**
The student should understand (i) wave properties of electromagnetic waves, (ii) the propagation of EM waves in free space and waveguide, (iii) principles of antennas, and (iv) wave propagation prediction for wireless communication system design. The student should be able to design and technically analyze simple antennas and antenna arrays. The student should also be able to determine base station locations to obtain best wireless coverage using ray-tracing software. [Program Objectives this course addresses: 1, 2, and 4.]

**Course Outcomes and Their Relationship to Program Outcomes:**
The following are the course outcomes and the subset of Program Outcomes (numbered 1-11 in square braces "[ ]") they address:
- Understand different types of waves and the characteristics of EM waves [1]
- Understand the propagation of EM wave in waveguides and urban and indoor environments[1]
- Understand the interference of EM waves and fading effect on wireless communications systems [4]
- Design of simple antennas and array antennas [2]
- Be able to determine locations of base stations to achieve best coverage of wireless
communication systems [3,5,11]
- Complete laboratory assignments in teams of three students [4,7]

**Contribution of Course to Meeting the Professional Component**

Engineering Topics: 100%

**Computer Usage:**
The course has virtual labs that require use of computers. Students are encouraged to use the Internet for reference searching. Word processing programs are also needed for writing article summaries and lab reports. The course has a web site with downloadable course materials and reference links. All lab reports must be typed and data plotted by computer programs such as MS Word, MS Excel, MatLab, etc.

**Design Credits and Features:**
EE 372L has 0.5 design credits. Approximately 15% of the assignments involve design.

**Person(s) Preparing Syllabus and Date:** Zhengqing Yun, 9/25/2007