EE 577D  Antennas for Wireless Communications

1. Catalog Description – (3 credits) Electromagnetic field theory and its application to antenna design.

2. Pre-requisites – EE463

3. Course Outline - This course introduces the fundamental principles of antenna theory and applies them to the design and analysis of antennas for wireless communications systems. Students will learn how to characterize and use antennas. Different types of antennas and their applications will be introduced, with focus on linear wire antennas, loop antennas, microstrip patch antennas, GPS antennas, antenna arrays, and the design considerations of using antennas in wireless communication systems. Several different frequency bands of commercial antennas are used to be tested and analyzed.

Reference Books:
Microwave Antenna Theory and Design by S. Silver
Antennas by J. D. Kraus and R. J. Marhefka
Antenna Theory and Design by W. L. Stutzman and G. A. Thiele
Antenna Theory and Design by R. S. Elliott

OUTLINE

I. Introduction to Antennas for Wireless Communications

III. Antennas 1
   a. Types of antennas
   b. Radiation mechanism
   c. Current distribution
   d. Historical advancement

IV. Fundamental Parameters of Antennas
   b. Radiation pattern
   c. Radiation density
   d. Radiation intensity
   e. Directivity
   f. Gain
   g. Efficiency, beamwidth, and bandwidth
   h. Polarization
   i. Input impedance
   j. Antenna as an aperture
   k. Friis transmission equation and Radar range equation
   l. Antenna temperature
V. Radiation Integrals
a. Vector potential $A$

b. Vector potential $F$

c. Far-field radiation

d. Duality, reciprocity, and reaction theorem

VI. Wire Antennas
a. Short wire

b. Finite length dipole

c. Inverted F antenna, Planar inverted F antenna, and spiral antenna

c. Ground effects

VII. Loop Antennas
a. Small circular loop

b. Large circular loop

c. Ground effects

d. Polygonal loops

VIII. Arrays
a. Linear array

1. Broadside

2. Endfire

3. Scanning

4. Binomial

5. Dolph-Tchebyscheff

b. Planar array

c. Circular array

X. Microstrip Antennas