EEE 443/591  Antennas for Wireless Communications  3 hours rec.

Prerequisites:  EEE 341 or equivalent


Reference  Microwave Antenna Theory and Design by S. Silver
Books:  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

Syllabus:

The course introduces the fundamental principles of antenna theory and applies them to particular antennas for wireless communications systems and other advanced antenna systems. In addition, the course develops appreciation for research issues of antennas for mobile wireless and advanced communications systems. Particular topics covered are: Introduction and examples of wireless communications; overview of wireless communications systems; antenna types; fundamental parameters of antennas; engineering principles; radiation integrals; linear wire antennas; loops; arrays; smart/intelligent/adaptive antennas; numerical computations; measurements.

OUTLINE

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<thead>
<tr>
<th>TOPIC</th>
<th>Approximate number of 75-minute periods</th>
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<tr>
<td>I. Antennas</td>
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<td>a. Types of antennas</td>
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<td>b. Radiation mechanism</td>
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<td>c. Current distribution</td>
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<td>d. Historical advancement</td>
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<td>II. Fundamental Parameters of Antennas</td>
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<td>a. Antenna</td>
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<td>b. Radiation mechanism</td>
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<td>c. Radiation pattern</td>
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<td>d. Radiation intensity</td>
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<td>e. Directivity</td>
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<td>f. Gain</td>
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<td>g. Efficiency, beamwidth, and bandwidth</td>
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<td>h. Polarization</td>
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<td>i. Impedance</td>
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<td>j. Antenna as an aperture</td>
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<td>Test 1</td>
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III. **Radiation Integrals**
   a. Vector potential $\mathbf{A}$
   b. Vector potential $\mathbf{F}$
   c. Far-field radiation
   d. Duality, reciprocity, and reaction theorem

IV. **Wire Antennas**
   a. Short wire
   b. Finite length dipole
   c. Ground effects

V. **Loop Antennas**
   a. Small circular loop
   b. Large circular loop
   c. Ground effects
   d. Polygonal loops

**Test 2**

VI. **Arrays**
   a. Linear array
      1. Broadside
      2. Endfire
      3. Scanning
      4. Binomial
      5. Dolph-Tchebyscheff
   b. Planar array
   c. Circular array
   d. Designs
      1. Dolph-Tschebyscheff
      2. Yagi-Uda
      3. Log-Periodic
   d. Smart/Intelligent/Adaptive Antennas

VII. **Synthesis Methods-Overview**

VIII. **Microstrip Antennas**

IX. **Smart Antennas/Adaptive Arrays**

X. **Measurements**
   a. Antenna ranges
   b. Radiation patterns
   c. Gain measurements
   d. Directivity
   e. Polarization measurements
   f. Scale model measurements

**Final Exam**

*September 21, 2017*
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September 21, 2017