



Course Syllabus

Course Code	Course Title	ECTS Credits
ECE-444	Antennas for Wireless Communications	6
Prerequisites	Department	Semester
ECE-342	Engineering	Fall or Spring
Type of Course	Field	Language of Instruction
Elective	Engineering	English
Level of Course	Lecturer(s)	Year of Study
1 st Cycle	Prof. Anastasis Polycarpou	4 th
Mode of Delivery	Work Placement	Corequisites
Face-to-Face	N/A	None

Course Objectives:

The main objectives of the course are to:

- Provide an in-depth understanding of antenna operation in either transmitting or receiving mode;
- Provide the tools and figures of merit for the characterization of antenna performance;
- Introduce analytical techniques for the analysis of antennas and accurate prediction of antenna performance characteristics;
- Present the most commonly used antenna configurations and explain their radiation characteristics and methods of analysis;
- Teach students how to design antennas for various frequency bands and applications;
- Introduce software and tools for the numerical analysis and design of wire and printed antennas.

Learning Outcomes:

After completion of the course students are expected to be able to:

- State the basic principles of antenna radiation;
- Explain the voltage and current distribution on an antenna ;
- Explain the equivalent circuit of an antenna operating in the receiving or transmitting mode;
- Evaluate antenna performance based on important figures of merit including input impedance, radiation patterns, gain, directivity, beamwidth, bandwidth, efficiency, polarization, etc.;

- Calculate analytically antenna performance characteristics (e.g., radiation patterns, directivity, etc.) knowing the current distribution on the antenna;
- State the theory and operation of resonant antennas;
- Explain the operation and main performance characteristics of wire antenna, loop antennas, and microstrip patch antennas;
- Analyze arrays of antennas including different types of arrays such as broadside, endfire, binomial, Dolph-Tchebyscheff, etc.;
- Measure basic antenna figures-of-merit;
- Analyze or design practical antennas using well-known software packages.

Course Content:

- Overview of a generic wireless communication system and different types of antennas;
- Description of the radiation mechanism, voltage and current distribution, and historical advancements;
- Presentation of the fundamental parameters of an antenna such as radiation patterns, radiation intensity, directivity, gain, efficiency, beamwidth, bandwidth, polarization, and input impedance;
- Use of radiation integrals, the vector potentials A and F , computation of far-field radiation, duality, reciprocity and reaction theorems;
- Analysis and design of wire antennas such as short dipole, finite-length dipole, and ground effects on radiation characteristics;
- Analysis and design of loop antennas such as small circular loop, large circular loop, and polygonal loops;
- Analysis and design of linear and planar arrays. Different types include broadside, endfire, binomial, Dolph-Tchebyscheff, Yagi-Uda, Log-periodic, etc.;
- Analysis and design of microstrip patch antennas including rectangular and circular patches. Emphasis on quality factor, bandwidth, efficiency, input impedance, circular polarization;
- Measurement techniques with emphasis on antenna ranges, radiation patterns, gain, directivity, and polarization;
- Project on antenna design. Computer simulations using software packages and comparison of the results with measurements performed in the lab.

Learning Activities and Teaching Methods:

Lectures, in-class examples, exercises, experiments

Assessment Methods:

Homework, project, exams, final exam

Required Textbooks / Readings:

Title	Author(s)	Publisher	Year	ISBN
Antenna Theory: Analysis and Design	Constantine A. Balanis	John Wiley & Sons	2016	978- 1118642061

Recommended Textbooks / Readings:

Title	Author(s)	Publisher	Year	ISBN
Antennas	John D. Kraus and Ronald J. Marhefka	McGraw- Hill	2001	007123201X
Antenna Theory and Design	W. L. Stutzman and G. A. Thiele	John Wiley & Sons	2012	978- 0470576649
Antenna Theory and Design	R. S. Elliott	Wiley-IEEE Press	2003	978- 0471449966