UNIVERSITY of NICOSIA

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

Objectives of the Course:

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:

Upon completion of the course students are expected 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 Contents:

- 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, exams, project, final exam.

Required Textbooks/Reading:

Authors	Title	Publisher	Year	ISBN
Constantine A. Balanis	Antenna Theory: Analysis and Design	John Wiley & Sons	2005	047166782X

Recommended Textbooks/Reading:

Authors	Title	Publisher	Year	ISBN
John D. Kraus and Ronald J. Marhefka	Antennas	McGraw-Hill	2001	007123201X
W. L. Stutzman	Antenna Theory and	John Wiley	1997	0471025909

and G. A. Thiele	Design	& Sons		
R. S. Elliott	Antenna Theory and Design	Wiley-IEEE Press	2003	0471449962