UNIVERSITY of NICOSIA

Course Code	Course Title	Credits (ECTS)
ECE-545	Applied Electromagnetics	8
Department	**Semester**	**Prerequisites**
Engineering	Fall or Spring	ECE-542
Type of Course	**Field**	**Language of Instruction**
Elective	Engineering	English
Level of Course	**Year of Study**	**Lecturer(s)**
2st Cycle	2nd	Prof. 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 the graduate student with an in-depth understanding of advanced topics in electromagnetic wave propagation, scattering, and guided structures
- Provide knowledge and tools for the analysis of complex electromagnetic problems using fundamental principles, vector calculus, and theorems.
- Explain thoroughly wave propagation in air-filled and dielectric or partially filled rectangular and/or cylindrical waveguides supporting TE/TM and/or Hybrid modes
- Formulate wave propagation in radial waveguides
- Introduce students to the concepts of Artificial Magnetic Conductor (AMC), Electromagnetic Band Gap (EBG) and Photonic Band Gap (PBG). Implementation of these Frequency Selective Surfaces (FSS) using microstrip/via technology
- Provide the tools and theorems (e.g. orthogonality, transformations) for the solution of scattering problems in various coordinate systems
- Formulate integral equations for scattering or radiation and solve simple problems using the Method of Moments (MoM)

Learning Outcomes:

Upon completion of the course students are expected to:

- Explain phenomena related to electromagnetic wave interaction, scattering and propagation in guided structures and complex media
- Solve complex electromagnetic problems using fundamental theorems and mathematical tools (e.g. transformations, orthogonality, etc)
- Formulate and solve electromagnetic problems related to rectangular/cylindrical waveguides which may be air-filled or partially filled with dielectrics
- Solve for the propagation modes of a dielectric slab waveguide
- Explain concepts related to AMC, EBG, and PBG surfaces
- Solve scattering problems for conducting geometries that conform to the three types of coordinate system (Cartesian, cylindrical, spherical)
- Formulate integral equations for the solution of scattering or radiation by wire geometries
- Implement the MoM for the solution of scattering and/or radiation problems

Course Contents:

- Electromagnetic theorems and principles (image theory, reciprocity theorem, equivalence theorem)
- Review of waveguides (rectangular & circular)
- Partially filled waveguides and dielectric waveguides
- Artificial impedance surfaces (AMC, EBG, PBG)
- Radial waveguides and circular dielectric waveguides
- Scattering (Infinite line source, plane-wave scattering, cylindrical wave transformations and theorems)
- Scattering by circular cylinders (normal and oblique incidence)
- Scattering by a conducting wedge
- Spherical wave orthogonalities, transformations and theorems
- Scattering by a sphere
- Introduction to integral equations and to the Method of Moments (MoM)
- Project on the MoM or on the design and analysis of AMC/EBG structures

Learning Activities and Teaching Methods:

Lectures, in-class examples, exercises, project

Assessment Methods:

Homework, mid-term and final exams, project report.

Required Textbooks/Reading:

Authors	Title	Publisher	Year	ISBN
Constantine A. Balanis	Advanced Engineering Electromagnetics	John Wiley & Sons	1989	0-471-62194-3

Recommended Textbooks/Reading:

Authors	Title	Publisher	Year	ISBN
Roger F. Harrington	Time Harmonic Electromagnetic Fields	McGrow-Hill	1961	07-026745-6
David K. Cheng	Fundamentals of Engineering Electromagnetics	Addison-Wesley	1993	0-201-56611-7