UNIVERSITY of NICOSIA

Course Syllabus

Course Code	Course Title	ECTS Credits
ECE-342	Electromagnetics II	6
Prerequisites	**Department**	**Semester**
ECE-340	Engineering	Spring
Type of Course	**Field**	**Language of Instruction**
Required	Engineering	English
Level of Course	**Lecturer(s)**	**Year of Study**
1st Cycle	Prof. Anastasis Polycarpou	3rd
Mode of Delivery	**Work Placement**	**Corequisites**
Face-to-Face	N/A	None

Course Objectives:

The main objectives of the course are to:

- Introduce students to a physical understanding of the main principles and fundamental laws on which electromagnetic wave propagation is based;
- Explain the behavior of electromagnetic waves in different media including material discontinuities and material with dielectric losses;
- Provide students the knowledge and the ability to solve typical electromagnetic wave problems;
- Introduce the concept of transmission line and provide tools (e.g., Smith Chart) that can be used for the solution of such problems;
- Provide a deep understanding of wave propagation inside waveguides including reference to cavity resonators;
- Provide an overview of antennas and antenna systems including important characteristics and figures of merit.

Learning Outcomes:

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

- Interpret the physical meaning of Maxwell's equations;
- Solve for the electromagnetic fields in different media using boundary conditions at media interfaces;

- Formulate electromagnetic propagation in lossless and lossy media using mathematical expressions and calculate parameters such as attenuation and propagation constants, phase velocity, power density, etc.;
- Determine the polarization of an electromagnetic wave;
- Determine the reflection and transmission coefficients of a normally or obliquely incident wave on a dielectric interface for parallel and perpendicular polarization;
- Explain the meaning of critical angle and Brewster angle and their use in different applications as in optical fibers, lenses, etc.;
- Solve transmission line problems using analytical and graphical tools such as Smith chart.
- Solve impedance matching problems using shunt stabs;
- Identify the physical meaning of electromagnetic wave propagation inside waveguides;
- Solve waveguide problems using the governing equations and theory;
- Use basic antenna theory to calculate important figures of merit and antenna polarization;
- Analyze and evaluate the performance of antenna transmit/receive systems.

Course Content:

- Time-varying fields including Faraday's law of electromagnetic induction, Maxwell's equations, boundary conditions, wave equations, and time-harmonic fields;
- Plane electromagnetic waves in lossless and lossy media, phase and group velocity, electromagnetic power density and the Poynting vector, normal and oblique incidence on conducting or dielectric interfaces for different polarizations, transmission and reflection coefficients, and wave impedance;
- Transmission line theory, transmission line model and governing equations, wave propagation, types of transmission lines, Smith chart, and impedance matching;
- Waveguides, governing modes, cut-off frequencies, wave propagation, and cavity resonators;
- Antennas and radiating systems. Radiation fields of elemental dipoles, radiation patterns, antenna types, and transmit-receive systems.

Learning Activities and Teaching Methods:

Lectures, in-class examples and exercises

Assessment Methods:

Homework, exams, final exam.

Required Textbooks / Readings:

Title	Author(s)	Publisher	Year	ISBN
Fundamentals of Engineering Electromagnetics	David K. Cheng	Addison-Wesley	1993	0-201-56611-7

Recommended Textbooks / Readings:

Title	Author(s)	Publisher	Year	ISBN
Fundamentals of Applied Electromagnetics	F. T. Ulaby and U. Ravaioli	Pearson Education	2015	978-1-292-08244-8
Engineering Electromagnetics	W. H. Hayt and J. Buck	McGraw Hill	2011	978-0073380667