UNIVERSITY of NICOSIA

Course Code	Course Title	Credits (ECTS)
ECE-547	Computational Methods in 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:

- Review the main principles and governing laws of Electromagnetics
- Provide the mathematical foundation for the development of numerical methods in Electromagnetics
- Explain the role of partial differential equations (PDEs) and integral equations (IEs) in the solution of electromagnetic problems
- Formulate Finite Difference (FD) schemes for the solution of parabolic, elliptic, and hyperbolic PDEs with emphasis on the truncation boundaries, accuracy, and stability
- Use of the Method of Moments (MoM) approach to solve the governing IEs (e.g. EFIE, MFIE, CFIE, etc) describing a variety of electromagnetic problems
- Use the Finite element Method (FEM) for the solution of PDEs (e.g., Poisson's equation, wave equation, etc) in 1-D and 2-D problems
- Solve a variety of electromagnetic problems ranging from scattering and radiation to waveguide propagation and eigenvalue problems
- Teach graduate students how to write efficient software codes that effectively and accurately solve real-world problems in the field of electromagnetics
- Provide the graduate students with substantial knowledge and experience to effectively debug their code and obtain accurate results in reasonable amount of time

Learning Outcomes:

Upon completion of the course students are expected to:

- State the main principles and laws that govern electromagnetic wave propagation
- Identify the most suitable numerical technique for the solution of a particular problem in Electromagnetics
- Employ the numerical tools and techniques taught in the course in order to solve effectively electromagnetic problems (e.g., scattering, radiation, etc) using the FD, FDTD, FEM, and MoM.
- Write efficient and bug-free software codes that can solve real-world problems in Electromagnetics

- Identify important issues related to computational electromagnetic including accuracy, stability, convergence, rate of convergence, truncation errors, round-off errors, weak formulations, implicit and explicit schemes, etc
- Write correct and well-organized technical reports where they clearly present their results and conclusions

Course Contents:

- Review of Electromagnetic theory
- Introduction to Partial Differential Equations (PDEs) and Integral Equations (IEs)
- Finite Difference methods (e.g., FD, FDTD, etc)
- Method of Moments (MoM) and Green's functions
- Finite Element Methods (FEM)
- Application problems in Scattering, Radiation, Waveguide propagation, etc.

Learning Activities and Teaching Methods:

Lectures, in-class examples, exercises, computer assignments, numerical projects.

Assessment Methods:

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

Required Textbooks/Reading:

Authors	Title	Publisher	Year	ISBN
Matthiew N.O. Sadiku	Numerical Techniques in Electromagnetics with MATLAB	CRC Press	2009	142006309X

Recommended Textbooks/Reading:

Authors	Title	Publisher	Year	ISBN
Anastasis C. Polycarpou	Introduction to the Finite Element Method in Electromagnetics	Morgan & Claypool Publishers	2006	1598290460
Allen Taflove	Computational Electrodynamics: The Finite-Difference Time-Domain Method	Artech House	2005	1580538320
Roger F. Harrington	Field Computation by Method of Moments	Wiley-IEEE Press	1993	0780310144