



Course Code ECE-340	Course Title Electromagnetics I	ECTS Credits 6
Department Engineering	Semester Fall	Prerequisites MATH-270, MATH-330, PHYS-160
Type of Course Required	Field Engineering	Language of Instruction English
Level of Course 1 st Cycle	Year of Study 3 rd	Lecturer(s) Dr Anastasis Polycarpou
Mode of Delivery Face-to-face	Work Placement N/A	Co-requisites None

Objectives of the Course:

The main objectives of the course are to:

- Develop knowledge and understanding of vector algebra and vector calculus including coordinate systems and integration along lines, surfaces and volumes
- Introduce the laws of electrostatics and boundary conditions across dielectric interfaces
- Develop skills and techniques that can be used to calculate the voltage potential and electric field from a distribution of charges in either one of the three coordinate systems
- Introduce Laplace's and Poisson's equations along with boundary conditions, and use of analytical and computational techniques for the solution of boundary value problems
- Develop an understanding of the postulates and governing laws of magnetostatics and use of this knowledge to calculate the magnetic field from current distributions in either one of the three coordinate systems
- Use the fundamentals of electrostatics and magnetostatics to calculate capacitance, resistance, and inductance of structures that conform to the Cartesian, Cylindrical, or Spherical coordinate system.

Learning Outcomes:

After completion of the course students are expected to:

- Solve problems related to vector algebra, vector calculus, and orthogonal coordinate systems
- Explain the relationship between electric charges and the induced electric field
- Formulate a mathematical representation of the electric field in space due to a canonical distribution of charges
- Explain the relationship between steady electric current and induced magnetic field
- Formulate a mathematical representation of the magnetic field in an unbounded

- medium due to a steady electric current
- Explain the effects of material parameters and discontinuities on the static electric and magnetic fields
- Use basic principles, laws and mathematical techniques to solve electrostatic and magnetostatic problems

Course Contents:

- Electromagnetic concepts
- Vector algebra and calculus including orthogonal coordinate systems, line/surface/volume integrals, gradient of a scalar field, divergence and curl of vector fields
- Static electric fields including Coulomb’s law, Gauss’s law and applications, electric potential, electric dipole, conductors and dielectrics, boundary conditions, capacitance, energy and forces
- Introduction of the Poisson’s and Laplace’s equations, method of images, and solutions of boundary value problems (BVPs)
- Steady electric currents including current density, Ohm’s law, EMF, Kirchoff’s voltage and current laws
- Static magnetic fields including the fundamental postulates of magnetostatics, vector potential, Biot-Savart law, magnetic dipole, magnetic boundary conditions, inductance, magnetic energy, forces and torques

Learning Activities and Teaching Methods:

Lectures, in-class examples and exercises, project

Assessment Methods:

Homework, project, exams, final exam.

Required Textbooks/Reading:

Authors	Title	Publisher	Year	ISBN
David K. Cheng	Fundamentals of Engineering Electromagnetics	Addison-Wesley	1993	0201566117

Recommended Textbooks/Reading:

Authors	Title	Publisher	Year	ISBN
W. H. Hayt and J. Buck	Engineering Electromagnetics	McGraw Hill	2005	0073104639