

ELEC3600 Electromagnetics: From Wireless to Photonic Applications

Course Description

This area course introduces engineering electromagnetics from fundamentals to applications. Topics include vector algebra and vector calculus, electrostatics in free space and materials, magnetostatics in free space and materials, Maxwell's equations, time-harmonic fields, electromagnetic wave and light wave propagation, antenna fundamentals or transmission lines. *Prerequisite(s): MATH2011 (Introduction to Multivariable Calculus) or MATH2023 (Multivariable Calculus), MATH2351 (Introduction to Differential Equations) and PHYS1114 (General Physics II)*

Tentative list of topics for 13 weeks

- 1 Introduction, Review of vector algebra, Coordinate systems and transformations
- 2 Vector calculus, Gradient, Divergence and Curl operators, Divergence's and Stokes' theorems, Vector fields
- 3 Electrostatic Fields, Coulomb's Law, Gauss' Law, Electric Potential, Electrostatic Energy
- 4 Electric Field in Material Space, Conductors and Dielectrics, Resistance and Capacitance, Continuity Equation, Boundary Conditions
- 5 Magnetostatic Fields, Biot-Savart's law, Ampere's Law, Magnetic Forces, Magnetic Dipoles, Magnetization, Magnetic Energy, Brief discussions on Magnetic Materials
- 6 Maxwell's Equations, Displacement Current, Time-Harmonic Fields (Lab 1 on Magnetic Induction and Wireless Power Transfer)
- 7 Electromagnetic Wave Propagation, Plane Waves, Poynting Vector, Light wave propagation, Reflection of plane waves at normal incidence, Standing waves (Lab 2 on Polarization of Light)
- 8 Antenna Fundamentals or Transmission Lines (Lab 3 on Antennas or Transmission Lines)

Textbook:

Matthew N.O. Sadiku, *Elements of Electromagnetics*, 6th edition or the latest, Oxford University

Reference(s):

William H. Hayt, JR., John A. Buck, *Engineering Electromagnetics*, 7th edition or the latest, McGraw-Hill

N. N. Rao, *Elements of Engineering Electromagnetics*, 6th edition or the latest, Prentice Hall

Many other references on engineering electromagnetics available in the library or online.

Grading Scheme:

Homework (8)	40%
Quizzes on CANVAS (4)	20%
Final exam	30%
Labs (3)	10%
Term project	10% (bonus)

Updated: January 2023