ENEE380: Electromagnetic Theory

Credits: 3

Description

Prerequisite: Minimum grade of C- in ENEE205; and minimum grade of C- in MATH241, PHYS270, and PHYS271; and permission of ENGR-Electrical & Computer Engineering department.

Restriction: Must be in Engineering: Electrical program.

Introduction to electromagnetic fields. Coulomb's law, Gauss's law, electrical potential, dielectric materials capacitance, boundary value problems, Biot-Savart law, Ampere's law, Lorentz force equation, magnetic materials, magnetic circuits, inductance, time varying fields and Maxwell's equations.

Semesters Offered

Fall 2017, Spring 2018, Summer 2018, Fall 2018, Spring 2019, Fall 2019, Spring 2020, Fall 2020, Spring 2021

Testudo

Learning Objectives

- Understand Maxwell's equations
- Understand electromagnetic fields, charges, currents
- Applications of 3-dimensional calculus
- Understand basic units (charge, voltage, physical understanding of these terms)
- Understand field concept underlying common electrical components (e.g., inductors, transistors)

Topics Covered

- Electromagnetic Model, Vector Analysis Review
- Coulomb's law and electric field
- Gauss's law and applications
- Electric potential
- Conductors and dielectrics in static electric field
- Electric flux density and dielectric constant
- Boundary conditions for electrostatic fields
- Capacitance and Capacitors
- Electrostatic energy and forces

- Poisson's and Laplace's equations and uniqueness
- Method of images
- Boundary-value problems
- Current density and ohm's law
- Kirchhoff's voltage and current laws
- Joule's law, boundary conditions, resistance
- Magnetostatics in free space
- Vector magnetic potential, Biot-Savart law
- Magnetic dipole, magnetization
- Magnetic field intensity, magnetic circuits
- Magnetic materials, boundary conditions, inductance
- Magnetic energy, magnetic forces, torque
- Time varying fields and Maxwell's equations introduction