EEE 222 - Electromagnetics I

Prerequisite(s):
MATH 152 and PHYS 102

Catalog Description:
Review of vector calculus. Electrostatics in vacuum. Coulomb's and Gauss's laws. Electrostatic potential. Poison's and Laplace's equations. Conductors in the presence of electrostatic fields. Method of images. Dielectrics; polarization. Dielectric boundary conditions. Capacitance. Electrostatic forces by the virtual work principle. Steady currents. Ohm's and Joule's laws. Resistance calculations. Magnetostatics in vacuum. Ampere's force law. Biot-Savart law. Magnetic vector potential, Ampere's circuital law. Magnetic boundary conditions. Magnetic dipole. Magnetization. Magnetic circuits. Hysteresis curve. Self and mutual inductance. Magnetic stored energy. Magnetic forces by the virtual work principle.

Textbook(s):
Fundamentals of Engineering Electromagnetics, David K. Cheng, Addison Wesley, 1993

Indicative Basic Reading List :

1. Electromagnetics, Schaums Outline Series, McGraw-Hill
2. Electromagnetic fields and waves, P. Lorrain, Freeman and company

Course Outline:

Week 1: **Course Registration Period**
Course objectives, course description,

Week 2 -3: Vector Analysis
- Vector algebra
- Orthogonal coordinate systems
- Gradient
- Divergence, divergence theorem
- Curl, Stokes' theorem
- Helmholtz theorem

Week 4-10: **Static Electric Fields:**
- Coulomb's Law
- Electric Field Intensity
- Gauss' Law
- Electric potential
- Conductors and Dielectrics
- Polarization and flux density vectors
- Boundary conditions
- Capacitance, electrostatic energy and forces.

Week 11: **Mid-Term Examination**

Week 11: **Static Electric Fields:** ***(continued)***
- Poisson's and Laplace's equations
- Method of images

Week 12: **Steady Electric Currents:**
- Current density and Ohm's law

	- Power dissipation and Joule's law - Boundary conditions for current density calculations
Week 13-14:	**. Static Magnetic Fields:** - Ampere's force law - Definition of magnetic flux density vector - Biot-Savart law - Magnetic vector potential - Ampere's circuital law - Magnetic dipole - Magnetization and the magnetic field intensity vector - Boundary conditions - Magnetic energy, forces and torque
Week 15:	**Final Examination**

Course Learning Outcomes:

(a) Coulomb's and Gauss's laws,
(b) Electrostatic potential,
(c) Poison's and Laplace's equations,
(d) Conductors in the presence of electrostatic fields,
(e) Method of images,
(f) Dielectrics, polarization, dielectric boundary conditions,
(g) Capacitance,
(h) Electrostatic forces by the virtual work principle,
(i) Ohm's and Joule's laws, resistance calculations.
(j) Ampere's force law. Biot-Savart law,
(k) Magnetic vector potential,
(l) Ampere's circuital law,
(m) Magnetic dipole, magnetization, magnetic boundary conditions, Hysteresis curve,
(n) Self and mutual inductance,
(o) Magnetic stored energy,
(p) Magnetic forces by the virtual work principle.

	Method	**No**	**Percentage**
Assessment	Midterm Exams	1	40%
	Quiz(s)+ Homework(s)	3+3	20 %
	Final Examination	1	40 %

Class Schedule:
Monday 15:00-16:50, Wed.: 15:00-16:50
4 hrs of lectures per week

Instructor: Prof. Mehmet Yüceer