EENG 232 - Electromagnetics I

Department:
Electrical and Electronic Engineering

Program Name:
Electrical and Electronic Engineering

Program Code: 27

Course Number:
EENG 232

Credits:
4

☒ Required Course ☐ Elective Course

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.

Course Web Page:
http://opencourses.emu.edu.tr Electromagnetics I

Textbook(s):
1) Elements of Electromagnetics, Matthew N.O.Sadiku, Oxford University Press, 2007

Indicative Basic Reading List :

1. Fundamentals of Engineering Electromagnetics, David K. Cheng, Addison Wesley, 1993
2. Engineering Electromagnetics, William H. Hayt, McGraw-Hill
3. Electromagnetics, John D. Kraus and Keith R. Carver, McGraw-Hill
4. Electromagnetics, Schaums Outline Series, McGraw-Hill

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 4-8: **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 9-10: **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:

1)On successful completion of this course, all students will have developed knowledge understanding of:

(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.

2) On successful completion of this course, all students will have developed their appreciation of and respect for values and attitudes regarding, carrying out directed private study using textbooks and other provided resources.

Class Schedule:	**Tutorial Schedule:**
4 hrs of lectures per week	1 hr of tutorial per week

	Method	**No**	**Percentage**
Assessment	Midterm Exams	2	25% each
	Quiz(s)+ Homework(s)	3+3	10 %
	Final Examination	1	40%

Contribution of Course to Criterion 5

Credit Hours for:

Mathematics & Basic Science : 0
Engineering Design : 4
General Education : 0

Relationship of Course to Program Outcomes
The course has been designed to contribute to the following program outcomes:

(a) An ability to apply knowledge of mathematics, science, and engineering
(e) An ability to identify , formulate and solve engineering problems

Prepared by: Rasime Uyguroglu	**Date Prepared:** 09 July 2018