Zarqa University
Faculty of Engineering Technology
Department: Electrical Engineering
Course title: Electromagnetic I (0904245)

Prerequisite: General Physics II (0300122) & Engineering Mathematics (0904201)
Instructor: TBD
Lecture's time: TBD
Office Hours: TBD

Course description:

In this course the students will study basic laws in vector algebra, rectangular, cylindrical, and spherical coordinate systems. Coulomb's Law and electric field intensity, electric flux density, Gauss's law, and divergence. Line integral, potential difference, potential gradient, and the electric dipole. Current, current density, continuity of current, Poisson and Laplace equations. Steady Magnetic Field: Biot-Savart law, Ampere's circuital law, Curl, Stokes' theorem, magnetic flux and magnetic flux density. Force on a moving charge, force on a differential current element, force and torque on a closed circuit, nature of magnetic materials, inductance and mutual inductance. Introduction to time-varying fields and Maxwell's equations: Faraday's law, displacement current, Maxwell's equations in point form, Maxwell's equations in integral form.

Aims of the course:

1. Apply vector calculus to understand the behavior of static and dynamic electric and magnetic fields in standard configurations.
2. State and apply the principles of Coulombs Law and the Superposition Principle to electric fields in the Cartesian, cylindrical and spherical coordinate systems.
3. Determine the electric field intensity resulting from various configurations of charge distributions.
4. Apply Gauss' Law to highly symmetric charge distributions.
5. Determine the electric potential and its relation to electric field intensity.
6. Study boundary-value problems by application Poisson's and Laplace's equations.
7. Analyze and classify magnetic materials, and solve magneto-static field problems using Biot-Savart law and Ampere's circuit law.
8. Understand time-varying electromagnetic field as governed by Maxwell's equations.
9. Study capacitance and inductance of dielectric and conductor materials, respectively.

Intended Learning Outcomes (ILOs):

A student who has passed this module should be able to:

1. Use vector analysis to solve problems in Science and Engineering.
2. Explain, solve, and calculate problems involving the electric and magnetic fields, forces, and properties of materials.
3. Apply Maxwell's equations in integral and point forms to calculate electric and magnetic fields of symmetrical charge distributions in Cartesian, cylindrical, and spherical coordinates.
4. Calculate capacitance and inductance of devices having symmetrical configurations.

Course structures:

Week (s)	C. Hrs	ILOs	Topics	Teaching Procedure	Assessment methods
1-2		1	Vector Analysis in Cartesian, cylindrical, and spherical coordinates.	Lecturing from the text and reference books	HWs
3-4		2	Coulomb's Law and Electric Field Intensity.	Lecturing from the text and reference books	HWs
5-6		3	Electric Flux Density, Gauss's Law, and Divergence.	Lecturing from the text and reference books	HWs & Quizzes 1st Exam **TBD**
7-8		3	Energy and Potential.	Lecturing from the text and reference books	HWs
9-11		2 & 3	The Steady Magnetic Field.	Lecturing from the text and reference books	HWs 2nd Exam **TBD**
12-13		3 & 4	Magnetic Forces, Materials, and Inductance.	Lecturing from the text and reference books	HWs & Quizzes
14-15		3	Introduction to Time-Varying Fields and Maxwell's Equations.	Lecturing from the text and reference books	HWs Final Exam

References:

1. "**Engineering Electromagnetics**", W. Hayt, and J. Buck, McGraw-Hill, 8th Edition, 2012.
2. "**Schaum's Outline of Electromagnetics**", Joseph Edminister, McGraw-Hill, 2nd Edition, 1993
3. "**Electromagnetics**", Kraus and Carver, McGraw-Hill, 2nd Edition, 1973.

Assessment Methods:

Methods	Grade	Date
Quizzes and HWs	10	**TBD**
First Exam	20	**TBD**
Second Exam	20	**TBD**
Final Exam	50	**TBD**