TOROS ÜNİVERSİTESİ

Faculty Of Engıneerıng
Electrıcal And Electronıcs Engıneerıng (Englısh)

Course Information

ELECTROMAGNETIC FIELD THEORY					
Code	**Semester**	**Theoretical**	**Practice**	**National Credit**	**ECTS Credit**
		Hour / Week			
EEE204	Spring	4	0	4	6

Prerequisites and co-requisites	
Language of instruction	English
Type	Required
Level of Course	Bachelor's
Lecturer	Asst. Prof. Cevher AK
Mode of Delivery	Face to Face
Suggested Subject	
Professional practise (internship)	None
Objectives of the Course	Introduce the Cartesian coordinate systems, scalar and vector operators. To understand the meaning of the effect of static electric charges. To understand the meaning of the effect of constant speed electric charges. To introduce time-varying fields. To show Maxwell equations.
Contents of the Course	Static electric fields created by static charges distributed across different space geometries. Gauss law and its applications. The effects of electrostatic fields on dielectric media. Capacitance of capacitor with any geometry. Magnetostatic fields created by electric charges moving at a constant speed, Ampere's law and its applications. The effects of magnetostatic fields on magnetic materials. The inertia of the coil with any geometry. Mutual inductance between circuits. Energy stored in electrostatic and magnetostatic fields. Faraday's law and induction. Maxwell equations.

Learning Outcomes of Course

#	Learning Outcomes
1	Getting knowledge about the vector analysis and orthogonal coordinate systems.
2	Getting knowledge about the gradient of a scalar field, divergence of a vector field, divergence theorem, curl of a vector field, Stokes’s theorem, two null identities and Helmholtz’s theorem.
3	Getting knowledge about the fundamental postulates of electrostatics in free space, Coulomb’s law, electric field due to a system of discrete charges and electric field due to a continuous distribution of charges.
4	Getting knowledge about the Gauss’s law and applications, electric potential due to a charge distribution, conductors in static electric field and equivalent charge distribution of polarized dielectrics.
5	Getting knowledge about the electric flux density and dielectric constant, dielectric strength, boundary conditions for electrostatic fields, capacitance and capacitors and series and parallel connections of capacitors.
6	Getting knowledge about the current density and Ohm’s law, electromotive force and Kirchhoff’s voltage law, equation of continuity and Kirchhoff’s current law, power dissipation and Joule’s law, boundary conditions for current density and resistance calculations.
7	Getting knowledge about the fundamental postulates of magnetostatics in free space, vector magnetic potential, Biot-Sawart’s law and applications, the magnetic dipole and scalar magnetic potential.
8	Getting knowledge about the magnetization and equivalent current densities, magnetic field intensity and relative permeability, magnetic circuits, behavior of magnetic materials and boundary conditions for magnetostatic fields, inductances and inductors, magnetic energy, magnetic energy in terms of field quantities and magnetic forces and torques.

Course Syllabus

#	Subjects	Teaching Methods

		and Technics
1	Cartesian, cylindrical and spherical coordinate systems, gradient, divergence, rotational, divergence and Stokes theorems.	lecture
2	Coulomb's law. Electric fields created by discrete and continuous charge distributions. Gauss law and its applications.	lecture
3	Conductors in a static electric field. Dielectrics in the static electric field; Equivalent polarity loads.	lecture
4	Capacitance and capacitors. Electrostatic energy stored in the electrostatic field. Electrostatic forces.	lecture
5	Current density and Ohm's law. Electromotive force and the Kirchhoff voltage law. Continuity equality and the Kirchhoff current law.	lecture
6	Power consumption and Joule's law. Boundary conditions for current density. Resistance account.	lecture
7	Midterm	exam
8	Static magnetic force between DC current carrying conductors. Biot-Savart law. Magnetic flux density vector. Magnetic potential and magnetic flux.	lecture
9	Magnetic materials. Magnetic dipole. Magnetization and magnetizing current densities.	lecture
10	Magnetic field strength vector. Boundary conditions for the magnetic field. Magnetic circuits.	lecture
11	Coils and inductance. Mutual inductance. Magnetic energy. Magnetic forces and torques.	lecture
12	Faraday's law and electromyographic induction; A fixed circuit in a time-varying magnetic field, a moving conductor in a static magnetic field, a circuit that moves in time-varying magnetic fields.	lecture
13	Maxwell equations; Integral and differential forms of Maxwell's equations. Potential functions.	lecture
14	Wave equations and solutions; solutions for potential solutions for the absence of resources.	lecture
15	Time-harmonic fields; Phasor concept, time-harmonic electromagnets, fields for the absence of source in simple environment.	lecture
16	Final Exam	exam

Course Syllabus

#	Material / Resources	Information About Resources	Reference / Recommended Resources
1	Field and Wave Electromagnetics, David K. Cheng, Addison-Wesley		
2	Introduction to Electromagnetic Fields, Clayton R. Paul, Keith W. Whites, Syed A. Nasar, McGraw-Hill		

Method of Assessment

#	Weight	Work Type	Work Title
1	40%	Mid-Term Exam	Mid-Term Exam
2	60%	Final Exam	Final Exam

Relationship between Learning Outcomes of Course and Program Outcomes

#	Learning Outcomes	Program Outcomes	Method of Assessment
1	Getting knowledge about the vector analysis and orthogonal coordinate systems.	1	1,2
2	Getting knowledge about the gradient of a scalar field, divergence of a vector field, divergence theorem, curl of a vector field, Stokes’s theorem, two null identities and Helmholtz’s theorem.	1	1,2
3	Getting knowledge about the fundamental postulates of electrostatics in free space, Coulomb’s law, electric field due to a system of discrete charges and electric field due to a continuous distribution of charges.	1	1,2
4	Getting knowledge about the Gauss’s law and applications, electric potential due to a charge distribution, conductors in static electric field and equivalent charge distribution of polarized dielectrics.	3	1,2
5	Getting knowledge about the electric flux density and dielectric constant, dielectric strength, boundary conditions for electrostatic fields, capacitance and capacitors and series and parallel connections of capacitors.	3	1,2
6	Getting knowledge about the current density and Ohm’s law, electromotive force and Kirchhoff’s voltage law, equation of continuity and Kirchhoff’s current law, power dissipation and Joule’s law, boundary conditions for current density and resistance calculations.	4	1,2

7	Getting knowledge about the fundamental postulates of magnetostatics in free space, vector magnetic potential, Biot-Sawart's law and applications, the magnetic dipole and scalar magnetic potential.	4	1,2
8	Getting knowledge about the magnetization and equivalent current densities, magnetic field intensity and relative permeability, magnetic circuits, behavior of magnetic materials and boundary conditions for magnetostatic fields, inductances and inductors, magnetic energy, magnetic energy in terms of field quantities and magnetic forces and torques.	5	1,2

PS. The numbers, which are shown in the column Method of Assessment, presents the methods shown in the previous table, titled as Method of Assessment.

Work Load Details

#	Type of Work	Quantity	Time (Hour)	Work Load
1	Course Duration	14	4	56
2	Course Duration Except Class (Preliminary Study, Enhancement)	14	4	56
3	Presentation and Seminar Preparation	0	0	0
4	Web Research, Library and Archival Work	0	0	0
5	Document/Information Listing	0	0	0
6	Workshop	0	0	0
7	Preparation for Midterm Exam	1	16	16
8	Midterm Exam	1	1	1
9	Quiz	0	0	0
10	Homework	0	0	0
11	Midterm Project	0	0	0
12	Midterm Exercise	0	0	0
13	Final Project	0	0	0
14	Final Exercise	0	0	0
15	Preparation for Final Exam	1	22	22
16	Final Exam	1	4	4
				155