Electromagnetic Fields / Fundamentals (ELE242)(CCE302)

Chapter (0) - Lec (01)

A bird's eye view on EM Field

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Chapter Contents

0.1 Course Description

ELE242 Electromagnetic Fields
CCE302 Electromagnetic Fundamentals

Prerequisites :

ELE141 Principles of Electrical Engineering

EMP202 Engineering Mathematics (4)

Course goals:

(ELE242)(CCE302) Vector analysis, Electrostatic fields: Coulomb's law and electric field intensity, electric flux density, Gauss's law and divergence, energy and potential, conductors, dielectrics and capacitance, Poisson and Laplace equations. Steady magnetic fields: Magnetostatic fields: Biot-Savart's law, Ampere's law, curl and Stokes's theorem, magnetic flux density, magnetic forces, Lorentz force, materials and inductance.

0.2 Course Aims

Upon a successful completion of this course, the student will be able to:

- Distinguish and adequately explain principal concepts of Electrical and Magnetic Fields.
- provide students with the basic knowledge and skills to know the different Vector algebra and analysis. Moreover, analysis of Coulomb's law, electric field intensity, Gauss's law and electric flux density for different electrode geometry.
- identify Conductors, dielectrics and capacitance. Finally, analysis of Energy and potential, Steady magnetic fields, the Curl and Stokes's theorem.

Learning Outcomes (LO's)

Cognitive Domain	
LO1	Identify the different applications in which knowing the Electric Fields is necessary
LO2	List the broad classifications of Electromagnetic Fields
LO3	Demonstrate Faraday's law and Ampere's law
Psychomotor Domain	
LO4	Recognize the proper dielectric material
LO5	Show the effect of Electromagnetic shielding to block electromagnetic radiation
Affective Domain	
LO6	Differentiate between Electric and Magnetic Fields

0.3 Course Administration

- Instructors: **Assoc. Prof. Dr. Moataz Elsherbini**
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  Office: Obour Building / Elkhalafawy Building
  Office Hours: Tuesday 10.30-12.00
  TAs: Eng. Amr Hamed
- URL: https://bu.edu.eg/staff/motazali3-courses/18966
- Text: William H. Hayt & John A. Buck, Engineering Electromagnetics, McGraw-Hill Education; 9th Ed., 2018

Notes: Lecture slides and Assignments are on the web.

0.4 Course Outline

Lec.	Items/Topics	Assignments
1	**Chapter 0: Introduction** Course Description-Course Objectives-Course Administration-Course Outline 0.5 Grade Distribution **Chapter 0: Overview on of Electromagnetic Fields** Introduction to EM Waves: Waves & Types - Frequency Allocations - EM Waves- Frequency spectrum and applications- Typical EM wave System - Microwaves and antennas	***Lab*** #1 Lab Orientation and Identify the S/W Interface
2	**Chapter 1. Vector analysis:** Scalars and vectors– Vector algebra – Vector calculus – Vector integral theorems – Coordinate systems	***Problem Set*** #1 Review of Electromagnetic Fields Quiz 1 (W3)
3-5	**Chapter 2,3. Electrostatic fields in vacuum:** Coulomb's law – Electric field intensity- Electric flux density,– Gauss's law.	***Problem Set*** #2 Electromagnetic Plane Wave Propagation Quiz 3 (W7)
6	**Chapter 4** Energy and Potential	
7	Midterm Exam (30) 9/11/2024	

0.4 Course Outline

Lec.	Items/Topics	Assignments
8	**Chapter 5:** Capacitance	***Problem Set*** #3 Electromagnetic Plane Wave Propagation Quiz 4 (W10)
9	**Chapter 6 :** Capacitance	
10	**Chapter 7: Steady state magnetic fields :** Ampere's Law of Force – The Steady Magnetic Field – Magnetostatic fields - Biot-Savart Law	
11	2nd Midterm (20)	
12	**Chapter 8: Magnetic Forces, Materials, and Inductance** Magnetic Vector Potential – Gauss' Law for Magnetic Field – curl and Stokes's theorem	
13	**Chapter 8: Magnetic Forces, Materials, and Inductance** Mmagnetic flux density, magnetic forces, Lorentz force, materials and inductance	***Problem Set*** #4 Waveguides Project/oral
14	Review	
	Final Exam	

Possible Researches

Selected Tonics in EM Fields Course

1. Application of EM Fields in communication systems.
2. Application of EM Fields in radar systems.
3. Application of EM Fields in remote sensing.
4. Application of EM Fields in medical diagnostics.
5. Application of EM Fields in medicine.
6. Application of EM Fields in agriculture.
7. Application of EM Fields in heating.
8. Application of EM Fields in processing of materials.
9. Application of EM Fields in industry.
10. Application of EM Fields in power systems.

0.6 Grade Distribution

Evaluation	**Quizzes W 3,9**	Midterm (30) **W7**	Midterm (20) W11	Final Exam **W14**	**Total**
Marks	10	30	20	40	100

Thank you for your attention

Dr. Moataz Elsherbini