ELEC 3600 - Electromagnetics: From Wireless to Photonic Applications Spring 2024 (Credits: 4)

Course Description

Electromagnetism provides the basic description, not only for electric and magnetic components, but also for radiowaves and light. The course starts with an introduction to vector algebra, electric and magnetic fields, capacitors and inductors and the laws of Maxwell. Many applications are discussed, such as the DC motor, AC power, electricity generation, electronic devices, magnetic memory, radio, microwaves, mm waves, THz Waves, radio-frequency (RF) circuits, optics and photonics, wireless/optical communications, ultraviolet light. Students will acquire hands-on experience to electromagnetics through laboratory sessions.

Prerequisite(s): (MATH 2011 OR MATH 2023) AND MATH 2351 AND PHYS 1114

List of Topics

Part I Review on vector analysis/calculus and essential Math tools
- Introduction, Vector algebra
- Coordinate systems and transformation
- Vector calculus

Part II Electrostatics and magnetostatics
- Electrostatic forces and fields
- Electrostatics potentials and energy
- Electrostatics in materials and components
- Magnetostatic forces and fields
- Magnetostatics in materials and components

Part III Electromagnetic waves and applications
- Maxwell's equations
- Electromagnetic wave propagation in free space
- Electromagnetic wave propagation in materials
- Antennas

Lecture Outline

	laboratory	tutorial	lecture	lecture			subject
	Mon 11:30 am	Mon 6 pm	Wed 4:30 pm	Fri 4:30 pm	week from	to	
week 1			Lec G002	Lec G002	29-Jan-2024	2-Feb-2024	vectors
week 2		Tut 5508	Lec G002	Lec G002	5-Feb-2024	9-Feb-2024	vectors
week 3		Tut 5508	Lec G002	Lec G002	12-Feb-2024	16-Feb-2024	vectors
week 4		Tut 5508	Lec G002	Lec G002	19-Feb-2024	23-Feb-2024	electrostatics
week 5		Tut 5508 / Quiz	Lec G002	Lec G002	26-Feb-2024	1-Mar-2024	electrostatics
week 6		Tut 5508	Lec G002	Lec G002	4-Mar-2024	8-Mar-2024	electrostatics
week 7		Tut 5508 / Quiz	Lec G002	Lec G002	11-Mar-2024	15-Mar-2024	magnetostatics
week 8	Lab 2133	Tut 5508	Lec G002	Lec G002	18-Mar-2024	22-Mar-2024	magnetostatics
week 9		Tut 5508 / Quiz	Lec G002		25-Mar-2024	29-Mar-2024	electromagnetics
week 10			Lec G002	Lec G002	1-Apr-2024	5-Apr-2024	electromagnetics
week 11	Lab 2133	Tut 5508	Lec G002	Lec G002	8-Apr-2024	12-Apr-2024	electromagnetics
week 12		Tut 5508 / Quiz	Lec G002	Lec G002	15-Apr-2024	19-Apr-2024	electromagnetics
week 13	Lab 2133	Tut 5508	Lec G002		22-Apr-2024		electromagnetics

Prof. Kristiaan Neyts
Department of Electronic and Computer Engineering
Room 2415, eeneyts@ust.hk

Lectures

L1 (2283)	We and Fr:	04:30PM - 05:50PM	G002, CYT Bldg (30)

Tutorials and Quizzes

T1 (2285)	Mo	06:00PM - 06:50PM	Rm 5508, Lift 25-26 (30)

Laboratories (not every week)

LA1 (2284)	Mo	11:30AM - 01:20PM	Rm 2133, Lift 19, 21, 22

Laboratory Outline

Three laboratories will be organized.
- Magnetic fields and magnetic coupling
- Polarization of light
- Polarization of dipole antennas

Intended Learning Outcomes:

On successful completion of this course, students will be able to:

CO1 - solve the main problems of the electric and magnetic fields distribution for different device constructions, taking into account the boundary problems.

CO2 - be familiar with the Maxwell equations both in the integral and differential forms as the fundamental laws of the Electromagnetism and to give a physical evidence that lead to their appearance.

CO3 - present a basic description of the electromagnetic wave propagation in various materials, including conductors, dielectrics and magnetic materials.

CO4 - apply the basic principles of the electromagnetism to the development of the transfer devices of the electromagnetic energy, such as transmission lines and antennas.

Textbook(s):

Elements of Electromagnetics
Author : Matthew N.O. Sadiku
Edition: 6th edition or the latest (online)
Publisher : Oxford University Press

Reference Books/Materials:

Liang Chi Shen / Jin Au Kong, Applied Electromagnetism, 3rd edition, Cengage Learning
Fawwaz T. Ulaby, Applied Electromagnetics, Pearson Education, Inc, Media Edition, 2004
N. N. Rao, Elements of Engineering Electromagnetics, 5th edition, Prentice Hall

Relationship of Course to Program Outcomes:

Please refer to the Report Section 4.3.2 (iii).

Grading Scheme:

Homework	35 %
Laboratory	10 %
Quizzes	20 %
Final Examination	35 %