

The Hong Kong University of Science and Technology
UG Course Syllabus

Electromagnetics: From Wireless to Photonic Applications

ELEC 3600

Credits: 4

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

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Office Hours: Monday 15:00 – 17:00, Academic building room 2415

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.

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

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:

ILO1 - solve the main problems of the electric and magnetic fields distribution for different device

constructions, taking into account the boundary problems.

ILO2 - 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.

ILO3 - present a basic description of the electromagnetic wave propagation in various materials,

including conductors, dielectrics and magnetic materials.

ILO4 - apply the basic principles of the electromagnetism to the development of the transfer devices of the electromagnetic energy, such as transmission lines and antennas.

Assessment and Grading

This course will be assessed using criterion-referencing and grades will not be assigned using a curve. Detailed rubrics for each assignment are provided below, outlining the criteria used for evaluation.

Assessments:

Assessment Task	Contribution to Overall Course grade (%)	Due date
Homeworks	30%	Multiple
Laboratory Report	10%	After each lab session
Quizzes	20%	Multiple
Final examination	40%	

* Assessment marks for individual assessed tasks will be released within two weeks of the due date.

Course AI Policy

Generative AI is allowed for homeworks or lab reports, but should be declared.

Communication and Feedback

Assessment marks for individual assessed tasks will be communicated via Canvas within two weeks of submission.

who have further questions about the feedback including marks should consult the instructor within five working days after the feedback is received.

Academic Integrity

Students are expected to adhere to the university's academic integrity policy. Students are expected to uphold HKUST's Academic Honor Code and to maintain the highest standards of academic integrity. The University has zero tolerance of academic misconduct. Please refer to [Academic Integrity | HKUST – Academic Registry](#) for the University's definition of plagiarism and ways to avoid cheating and plagiarism.

Textbook

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