**The Hong Kong University of Science and Technology**
**UG Course Syllabus Template**

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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## Course Description

Electromagnetism deals with the fundamental description of electric and magnetic components, and in addition, also of 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 DC motors, AC power, electricity generation, electronic devices, magnetic memory, radio waves, microwaves, mm waves, THz waves, radio-frequency (RF) circuits, optics and photonics, wireless/optical communication, visible and ultraviolet light. Students will acquire hands-on experience with electromagnetic phenomena through a series of laboratory sessions.

Part I Review of vector analysis/calculus and essential math tools
– Introduction, vector algebra
– Coordinate systems and transformations
– 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 problems of electric and magnetic field distributions for different devices, taking into account the boundary problems.
ILO2 - be familiar with the Maxwell equations both in integral and differential forms as the fundamental laws of Electromagnetism and be able to give a physical evidence for these laws.
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 electromagnetism to the development of the transfer devices of 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 | 25% | Multiple |
| Laboratory Report | 10% | After each lab session |
| Quizzes | 25% | 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.
Questions about the feedback including marks should be sent to 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