Course number	U-LAS12 10006 LE57		
Course title (and course title in English)	Fundamental Physics B-E2 Fundamental Physics B-E2	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Senior Lecturer,AMAR, Julien Samuel
Group	Natural Sciences	Field(Classification)	Physics(Foundations)
Language of instruction	English	Old group	Group B
Number of credits	2		
Number of weekly time blocks	1	Class style	Lecture (Face-to-face course)
Year/semesters	2026・Second semester		
Days and periods	Tue.3	Target year	Mainly 1st year students
Eligible students	For science students		

[Overview and purpose of the course]

This course aims to introduce the fundamental concepts of classical electromagnetic theory, which plays a fundamental role in many areas of science and engineering.

After learning the concepts introduced in this course, students will be able to (a) understand fundamental properties of electromagnetic fields and their governing equations in the language of vector calculus, (b) solve problems involving electromagnetic fields and motion under their influence, (c) mathematically and intuitively understand the concept of electromagnetic wave, and (d) advance their mathematical skills, particularly regarding vector calculus and 2D/ 3D polar coordinate systems.

[Course objectives]

(1) To explain fundamental concepts of electromagnetic theory, (2) To encourage practical problem solving and teach necessary mathematical tools, (3) To appreciate the foundational role of these concepts in theoretical and applied physics, (4) To provide a solid foundation for students to acquire advanced knowledge on the subject in future.

[Course schedule and contents)]

1. Introduction to electromagnetic theory, review of vector and introduction to field calculus. (Gradient, Divergence, Curl) (2 weeks)

2. Electrostatics: Coulomb's law of electrostatic interaction; superposition principle; continuous charge distributions; electrostatic field; divergence and curl of electrostatic fields; Gauss's law; electrostatic potential, work and energy in electrostatics (3 weeks)

3. Magnetostatics: Lorentz force law; interaction between electric current and magnetic field; continuity equation; steady current; Biot-Savart law and Ampere's law; divergence and curl of magnetostatic fields; concept of vector potential; (2 weeks)

4. Midterm exam and review of previous topics (1 week)

5. Electrodynamics: electromotive force and Faradays experiments, introduction and applications of Maxwell's equations, conservation laws for electrodynamic systems and Poynting vector. (3 weeks)

6. The electromagnetic wave: Wave equations, polarization, reflection refraction and transmission equations

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Fundamental Physics B-E2(2)

(3 weeks)

7. Feedback (1 week)

[Course requirements]

Basic understanding of high-school physics and calculus. Some understanding of vector analysis will be helpful.

[Evaluation methods and policy]

Evaluation will be based on active participation (10%), one Mid-term in-class exam (40%), one Final in-class exam (50%)

[Textbooks]

David J. Griffiths 『Introduction to Electrodynamics』 （Cambridge University Press） ISBN:978-1108420419

[References, etc.]

（References, etc.）

Introduced during class

[Study outside of class (preparation and review)]

Following study materials and working on assignment / homework

[Other information (office hours, etc.)]

To be discussed during lectures.

[Essential courses]