

Electromagnetism

Introducing

Description

Course Structure

The course is divided into six main chapters:

1- Magnetostatics:

- °Study of static magnetic fields and magnetic forces.
- °Application of Biot-Savart and Ampère's laws.
- °Analysis of magnetic circuits and magnetic materials.

2- Induction Phenomena:

- °Introduction to Faraday's law and Lenz's law.
- °Study of induced currents and electromotive forces.
- °Practical applications of induction phenomena in transformers and generators.

3- Maxwell's Equations in Vacuum:

- °Derivation and understanding of Maxwell's equations.
- °Relationship between electric and magnetic fields in vacuum.
- °Introduction to electric and magnetic potentials.

4- Electromagnetic Wave Propagation:

- °Study of the propagation of electromagnetic waves in different media.

5-Electromagnetic Energy and the Poynting Vector:

- °Calculation of energy stored in electric and magnetic fields.
- °Introduction to the Poynting vector and its role in the propagation of electromagnetic energy.

6-Study of the Special Case of Monochromatic Progressive Plane Waves:

- °Analysis of progressive plane waves and their properties.
- °Study of monochromatic waves and their polarization.

This course aims to provide a deep understanding of the fundamental concepts of electromagnetism and to develop your analytical and practical skills to solve complex problems in this field.

Objectives

Course Objectives:

- 1- Master the basic theoretical tools and concepts of electromagnetism, such as Maxwell's equations, induction phenomena, and quasi-stationary regimes. These foundational concepts will lay the groundwork for understanding the propagation of electromagnetic waves, which will be further developed in the following year.
- 2- Identify relevant variables in problems related to magnetostatics and time-varying electromagnetism.
- 3- Simplify real-world problems to calculate useful physical quantities.
- 4- Geometrize any electromagnetism problem in 3D, whether it is in a static or time-varying regime.
- 5- Extract the full set of physical properties of an electromagnetic wave from Maxwell's equations.

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Évaluation

L'évaluation des acquis d'apprentissage est réalisée en continu tout le long du semestre. En fonction des enseignements, elle peut prendre différentes formes : examen écrit, oral, compte-rendu, rapport écrit, évaluation par les pairs...

Practical info

Location(s)

 Toulouse