

PHYSICS, MATHEMATICS AND SCIENTIFIC CULTURE 1 FIELD_12 ECTS

Introducing

Description

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

Analysis 1

Introducing

Description

- The notion of differentiability of a function of multiple variables, partial derivatives
- The concept of norms, convergence of sequences in vectorial spaces, basic topological concepts: open and closed sets,
- Integrals of functions unbounded or on unbounded domains, with several variables

Objectives

At the end of this module, the student will have understood and be able to explain (main concepts):

- The notion of differentiability of a function of multiple variables, partial derivatives
- The concept of norms, convergence of sequences in vectorial spaces, basic topological concepts: open and closed sets,
- Integrals of functions unbounded or on unbounded domains, with several variables

The student will be able to:

- Carry out computations of integrals on bounded intervals, of unbounded functions.
- Study the differentiability of a function of multiple (real) variables, carry out an asymptotic expansion
- Manipulate norms of vectors and matrices, study the convergence of a sequence limits in vectors spaces.

Necessary prerequisites

Basic Calculus, Basic Linear algebra

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Practical info

Location(s)

 Toulouse

Algebra

Introducing

Location(s)

 Toulouse

Description

Euclidean spaces.
Orthogonal matrices.
Reduction of quadratic shapes.

Objectives

Reduce symmetric endomorphisms.
Manipulate scalar products and understand the notion of orthogonality in euclidean spaces.
Express quadratic forms as sums of squares.

Necessary prerequisites

1st year Mathematics course

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Practical info

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.

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

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Practical info

Location(s)

 Toulouse

Materials

Introducing

Description

- Introduction
- Atomic Structure
- Structures and ordering in condensed matter
- Phase diagrams
- Mechanical properties of crystalline materials
- Ceramics / Polymers
- Electronic properties of materials and their applications (electronic, thermal and optical properties).

Objectives

At the end of this module, the student will be able to:
Describe the main macroscopic properties of materials (mechanical, electronic, thermal, magnetic, dielectric and optical) and identify their origins in terms of structural arrangement and electronic structure.

Necessary prerequisites

No necessary knowledge.

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Practical info

Location(s)

 Toulouse