

## Course guide

### 3200032 - F2 - Physics II

**Last modified:** 11/04/2025

**Unit in charge:** Terrassa School of Industrial, Aerospace and Audiovisual Engineering  
**Teaching unit:** 748 - FIS - Department of Physics.

**Degree:** BACHELOR'S DEGREE IN CHEMICAL ENGINEERING (Syllabus 2009). (Compulsory subject).  
BACHELOR'S DEGREE IN ELECTRICAL ENGINEERING (Syllabus 2009). (Compulsory subject).  
BACHELOR'S DEGREE IN INDUSTRIAL ELECTRONICS AND AUTOMATIC CONTROL ENGINEERING (Syllabus 2009). (Compulsory subject).  
BACHELOR'S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2009). (Compulsory subject).  
BACHELOR'S DEGREE IN TEXTILE TECHNOLOGY AND DESIGN ENGINEERING (Syllabus 2009). (Compulsory subject).  
BACHELOR'S DEGREE IN INDUSTRIAL DESIGN AND PRODUCT DEVELOPMENT ENGINEERING (Syllabus 2010). (Compulsory subject).

**Academic year:** 2025    **ECTS Credits:** 6.0    **Languages:** Catalan, Spanish

#### LECTURER

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**Coordinating lecturer:** M. DEL CARMEN CASAS CASTILLO - RAMON HERRERO SIMÓN - CARMÉ HERVADA SALA - JUANJO FERNÁNDEZ SOLER - JORDI SELLARÈS GONZÁLEZ - JOSÉ FRANCISCO TRULL SILVESTRE

**Others:**

#### PRIOR SKILLS

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It is considered that the students must have knowledge of General Physics of the level required to the PAU (national university entrance test).

#### DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

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**Specific:**

CENG2-DIDP. Understanding and mastery of basic concepts related to the general laws of mechanics, thermodynamics, fields and waves, and electromagnetism; and their application to solving engineering problems. (Basic training module).

CE02-INDUS. Understanding and mastery of the basic concepts of the general laws of mechanics, thermodynamics, fields and waves, and electromagnetism and their application to the resolution of engineering problems. (Basic training module)

**Basic:**

CB2. That students can apply their knowledge to their work or vocation in a professional manner and possess the competencies typically demonstrated through the development and defense of arguments and problem-solving within their field of study.

## TEACHING METHODOLOGY

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### - Face-to-face lecture sessions

Lectures are given using digital presentations. The presentations will be made available to students on the virtual campus before classes begin to help them follow them. The assessment will be based on mid-semester examinations (or an optional final examination for students who fail the first one).

### - Face-to-face practical work sessions

During practical work sessions, students work individually or in small groups of 2-3 on problems and questions under the lecturer's supervision. A collection of problems will be made available on the virtual campus. Systems for self-assessment (with assessment criteria or rubrics), co-assessment (among students) and delivery of reports, corrected by the teacher and returned, are made available to facilitate independent learning.

### Face-to-face laboratory work sessions

Students work in pairs during laboratory sessions. Guidelines for practicals will be made available to students on the virtual campus at the start of the course. Students must hand in a report for each practical. Marks will be based on the work carried out in the laboratory and the reports handed in.

## LEARNING OBJECTIVES OF THE SUBJECT

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On completion of the course, students should be able to:

- Correctly use and interpret the language and basic concepts of Chemistry.
- Recognise the structure of matter and relate it to the physical and chemical properties of organic and inorganic substances.
- Apply stoichiometric calculations to solve problems.
- Recognise the equipment and apply the basic techniques of the chemistry laboratory.

## STUDY LOAD

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Type	Hours	Percentage
Hours medium group	15,0	10.00
Hours small group	15,0	10.00
Hours large group	30,0	20.00
Self study	90,0	60.00

**Total learning time:** 150 h

## CONTENTS

### TOPIC 1: ELECTROSTATICS

#### Description:

- 1.1. Electric field:
  - 1.1.1. Electric charges and the electric structure of matter. Conducting and insulating materials.
  - 1.1.2. Electric forces: Coulomb's law.
  - 1.1.3. Electric field. Electric dipole.
  - 1.1.4. Electric field lines.
  - 1.1.5. Electric flux. Gauss's law.
  - 1.1.6. Electric fields for different charge distributions (discrete and continuous).
  - 1.1.7. Field and charges in a conductor in electrostatic equilibrium.
- 1.2. Electric potential:
  - 1.2.1. Potential electrostatic energy of a point charge.
  - 1.2.2. Electric potential. Voltage.
  - 1.2.3. Equipotential surfaces.
  - 1.2.4. Potential of a conductor in electrostatic equilibrium.
- 1.3. Capacity and dielectric:
  - 1.3.1. Polarisation of a dielectric.
  - 1.3.2. Forces between charges in a dielectric.
  - 1.3.3. Capacity of a conductor.
  - 1.3.4. Capacitors. Capacity of capacitors.
  - 1.3.5. Energy of a charged capacitor.
  - 1.3.6. Energy density of an electric field.
  - 1.3.7. Networks of capacitors.

#### Related activities:

Theory classes.  
Problem-solving classes.  
Practical laboratory sessions in which knowledge of the topic is applied.

#### Full-or-part-time: 63h

Theory classes: 7h  
Practical classes: 42h  
Self study : 14h

## TOPIC 2: MAGNETOSTATICS

### Description:

- 2.1. Magnetic field:
  - 2.1.1. Force exerted by a magnetic field.
  - 2.1.2. Motion of a point charge in a uniform magnetic field.
  - 2.1.3. Lorentz force and its applications.
  - 2.1.4. Action of a magnetic field on a current element, a current loop and a magnet coil.
  - 2.1.5. The Hall effect.
- 2.2. Sources of magnetic fields:
  - 2.2.1. Magnetic fields produced by current elements. Biot-Savart law.
  - 2.2.2. Magnetic field produced by a point charge in motion along an indefinite rectilinear current and along the axis of a circular loop.
  - 2.2.3. Magnetic force between two parallel conductors. Definition of ampere and coulomb.
  - 2.2.4. Ampère's law.
  - 2.2.5. Magnetic field created by a coil.
- 2.3. Magnetic properties of matter.

### Related activities:

Theory classes.  
Problem-solving classes.  
Practical laboratory sessions in which knowledge of the topic is applied.

### Full-or-part-time: 36h

Theory classes: 8h  
Practical classes: 4h  
Self study : 24h

## TOPIC 3: ELECTROMAGNETIC INDUCTION

### Description:

- 3.1. Magnetic flux.
- 3.2. Induced electromotive force and the Faraday-Lenz law.
- 3.3. Motional electromotive force.
- 3.4. Current sources.
- 3.5. Eddy current.
- 3.6. Self-induction and mutual induction.
- 3.7. Magnetic energy.
- 3.8. Energy density of the electromagnetic field.

### Related activities:

Theory and problem classes.  
Problem-solving classes.  
Practical laboratory sessions in which knowledge of the topic is applied.

### Full-or-part-time: 18h

Theory classes: 4h  
Practical classes: 2h  
Self study : 12h

#### TOPIC 4: ELECTROMAGNETIC WAVES

**Description:**

- 4.1. Generalisation of Ampère's law. Displacement current.
- 4.2. Maxwell's equations in a vacuum.
- 4.3. Electromagnetic waves in a vacuum. Propagation speed.
- 4.4. Polarisation
- 4.5. Energy of an electromagnetic wave.
- 4.6. Electromagnetic spectrum.

**Related activities:**

Theory classes.  
Problem-solving classes.  
Practical laboratory sessions in which knowledge of the topic is applied.

**Full-or-part-time:** 18h

Theory classes: 4h  
Practical classes: 2h  
Self study : 12h

## ACTIVITIES

#### LABORATORY

**Full-or-part-time:** 15h  
Laboratory classes: 15h

## GRADING SYSTEM

- Examinations: 75%

There will be at least 2 exams, each of them with a minimum percentage of 15% of the exams grade.

- Laboratory sessions: 15%

- Application/practicals: 10%

- Retrieval of unsatisfactory results: failed grade for midterm exams with a percentage higher than 25% of the global qualification could be recovered. The final exam cannot be recovered. The grade obtained by the application of the retrieval will replace the initial grade as long as it is higher, with no limitation in the maximum grade that can be obtained. Recovery will be carried out included in the final exam or in a specific recovery exam in class hours.

## EXAMINATION RULES.

To pass the subject, students must complete the laboratory practicals and hand in the necessary reports.

## BIBLIOGRAPHY

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### Basic:

- Sears, Francis W.; Zemansky, Mark W.; Young, Hugh D. Física universitària [on line]. 13ª ed. Mèxico D.F: Pearson Educaci3n, 2013 [ Consultation: 09/05/2022 ]. Available on: [https://www-ingebook-com.recursos.biblioteca.upc.edu/ib/NPcd/IB\\_BooksVis?cod\\_primaria=1000187&codigo\\_libro=4618](https://www-ingebook-com.recursos.biblioteca.upc.edu/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=4618).
- Tipler, Paul Allen; Mosca, Gene. Físca per a la ciència i la tecnologia, vol. 1 [on line]. Barcelona [etc.]: Reverté, 2010 [Consultation: 09/05/2022 ]. Available on: <https://ebookcentral-proquest-com.recursos.biblioteca.upc.edu/lib/upcatalunya-ebooks/detail.action?pq-origsite=primo&docID=5758258>. ISBN 9788429144321.
- Tipler, Paul Allen; Mosca, Gene. Físca per a la ciència i la tecnologia, vol. 2 [on line]. Barcelona [etc.]: Reverté, 2010 [Consultation: 09/05/2022 ]. Available on: <https://ebookcentral-proquest-com.recursos.biblioteca.upc.edu/lib/upcatalunya-ebooks/detail.action?pq-origsite=primo&docID=5758259>. ISBN 9788429144338.

### Complementary:

- Feynman, Richard Phillips. Física (vol. 1 i 2). Buenos Aires: Addison-Wesley, 1987. ISBN 02010662.
- Gir3, Antoni; Canales, Manel; Rey, Rossend; Sesé, Gemma; Trullàs, Joaquim. Físca per a estudiants d'informàtica [on line]. Barcelona: UOC, 2009 [ Consultation: 09/05/2022 ]. Available on: <https://ebookcentral-proquest-com.recursos.biblioteca.upc.edu/lib/upcatalunya-ebooks/detail.action?pq-origsite=primo&docID=3206945>. ISBN 8497881443.
- Bloomfield, Louis A. How things work: the physics of everyday life. 2nd ed. New York: John Wiley & Sons, 2001. ISBN 0471381519.
- Beer, Ferdinand Pierre [et al.]. Mecànica vectorial para ingenieros, vol. 1, estática [on line]. 11ª ed. Mèxico: McGraw-Hill, 2017 [ Consultation: 08/03/2023 ]. Available on: [https://www-ingebook-com.recursos.biblioteca.upc.edu/ib/NPcd/IB\\_BooksVis?cod\\_primaria=1000187&codigo\\_libro=8077](https://www-ingebook-com.recursos.biblioteca.upc.edu/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=8077). ISBN 9781456255275.
- Beer, Ferdinand Pierre [et al.]. Mecànica vectorial para ingenieros, vol. 2, dinàmica [on line]. 11ª ed. Mèxico: McGraw-Hill, 2017 [ Consultation: 08/03/2023 ]. Available on: [https://www-ingebook-com.recursos.biblioteca.upc.edu/ib/NPcd/IB\\_BooksVis?cod\\_primaria=1000187&codigo\\_libro=8078](https://www-ingebook-com.recursos.biblioteca.upc.edu/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=8078). ISBN 9781456255268.