

## Course guide

### 340027 - FIS2-N2021 - Physics II

Last modified: 17/05/2023

**Unit in charge:** Vilanova i la Geltrú School of Engineering  
**Teaching unit:** 748 - FIS - Department of Physics.

**Degree:** BACHELOR'S DEGREE IN ELECTRICAL ENGINEERING (Syllabus 2009). (Compulsory subject).  
BACHELOR'S DEGREE IN INDUSTRIAL DESIGN AND PRODUCT DEVELOPMENT 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).

**Academic year:** 2023    **ECTS Credits:** 6.0    **Languages:** Catalan, Spanish

#### LECTURER

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**Coordinating lecturer:** MANUEL MORENO LUPIÁÑEZ

**Others:** MANUEL MORENO LUPIAÑEZ - XAVIER NAVARRO BOSQUE - JUAN SOLER RUIZ - ORIOL GARGALLO VICENTE - ALEXANDER LEBRATO GONZÁLEZ

#### DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

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##### Specific:

1. CE2. Comprehension and containment of basic concepts concerning general rules of mechanic, thermodynamic, field of shafts and electromagnetism; and its diligence to solve engineering problems.
2. D11. Knowledge of beginning of electric and electronic systems and its application to resolve engineering problems.

##### Transversal:

3. EFFECTIVE USE OF INFORMATION RESOURCES. Managing the acquisition, structure, analysis and display of information from the own field of specialization. Taking a critical stance with regard to the results obtained.
4. SELF-DIRECTED LEARNING. Detecting gaps in one's knowledge and overcoming them through critical self-appraisal. Choosing the best path for broadening one's knowledge.
5. EFFICIENT ORAL AND WRITTEN COMMUNICATION. Communicating verbally and in writing about learning outcomes, thought-building and decision-making. Taking part in debates about issues related to the own field of specialization.
6. TEAMWORK. Being able to work as a team player, either as a member or as a leader. Contributing to projects pragmatically and responsibly, by reaching commitments in accordance to the resources that are available.

#### TEACHING METHODOLOGY

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-In the theory classes, the theoretical fundamentals of the scheduled matters shall be explained and developed and some typical problems shall be solved. They will consist of theory explanations complemented with activities intended for stimulating the students' participation, discussion and critical analysis.

- In the practical classes (problem solving), problems about the matters dealt with shall be presented and solved. Students, individually or in groups, have to solve the established problems. At the due time, the solving of problems or other activities to be graded will be proposed. To reach a positive mark, these activities have to be carried out or delivered within the time scheduled.

-In the laboratory classes, students have to carry out the corresponding laboratory activities and simulations. They have to deliver the resulting laboratory report with the calculations and comments asked. At the beginning of each laboratory session, each student has to deliver a previous study or questionnaire (accessible at ATENEA) about the activity to be carried out. Within the laboratory category, some activities to be carried out outside the laboratory may be proposed (reports, simulations, bibliographic research, etc.).

## LEARNING OBJECTIVES OF THE SUBJECT

- Understand the basic principles of electromagnetism.
- To acquire the ability to analyze electrical and magnetic fields and learn to solve simple electrical circuits.
- Recognize the different electrical and magnetic behaviors of matter.
- To know and know how to use the fundamental concepts of waves and, in particular, the electromagnetic ones, as well as the associated phenomena.
- To learn to use measuring devices.
- Determine the experimental errors.
- Perform simple experiments, analyze their results and justify them.
- Use the computer as a tool for calculating and simulating physical processes

## STUDY LOAD

Type	Hours	Percentage
Hours small group	7,5	5.00
Hours large group	52,5	35.00
Self study	90,0	60.00

**Total learning time:** 150 h

## CONTENTS

### C1. Electric field and electric potential

#### Description:

Electric charge. Coulomb law. Field intensity. Electric field for discrete charge distributions  
Electric field flow. Gauss's theorem. Electric field for continuous charge distributions.  
Electric potential energy. Electric potential. Electric potential for continuous charge distributions. Energy of a load distribution.

#### Full-or-part-time: 33h

Theory classes: 6h  
Practical classes: 8h  
Self study : 19h

### C3. Magnetism. Electromagnetic induction

#### Description:

Magnetic induction. Lorentz force. Flow of the magnetic field. Electric charges moving in a magnetic field; applications.  
Magnetic induction generated by a current element; Law of Biot and Savart. Ampère's theorem. Magnetic field due to current distributions.  
Magnetic Force on a Current-Carrying Conductor. Action of the magnetic field on a loop; magnetic moment. Force between parallel conductors; definition of Ampere.

#### Full-or-part-time: 40h

Theory classes: 6h  
Practical classes: 8h  
Laboratory classes: 2h  
Self study : 24h

#### C4. Electromagnetic waves - Optics

**Description:**

Electromagnetic waves: structure and propagation. Energy of electromagnetic waves; intensity; radiation pressure. The electromagnetic spectrum.

The light. Fundamentals of geometric optics: reflection and refraction. Polarization. Wave optics: interference, diffraction. Doppler effect. Applications: mirrors and lenses, optical instruments, separation power.

**Full-or-part-time:** 30h 30m

Theory classes: 6h

Practical classes: 4h 30m

Laboratory classes: 2h

Self study : 18h

#### C5. Written tests. Simulation

**Description:**

Verification of the level of achievement of the knowledge and skills acquired until the completion of the test.

**Full-or-part-time:** 10h 30m

Laboratory classes: 1h 30m

Guided activities: 6h

Self study : 3h

#### C2: Capacitors. Electric current

**Description:**

Conductors and dielectrics. Field and potential of a conductor in electrostatic equilibrium; electrostatic influence; effects and applications.

Capacity of an isolated conductor. Capacitors; capacity of a capacitor. Energy of a capacitor. Capacitor association.

Electric current; current intensity. Ohm's law. Electric resistance; Resistance association. Generators; electromotive force. Motor, contraelectromotive force. Ohm's Law for a circuit. Kirchhoff's laws. RC circuit.

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

Theory classes: 6h

Practical classes: 8h

Laboratory classes: 2h

Self study : 20h

## GRADING SYSTEM

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The mark will be the higher of both following results:

$$15\%AC + 15\%PL + 35\%EP + 35\%EF$$
$$15\%AC + 15\%PL + 70\%EF$$

where the maximum value of every partial mark (AC, PL, EP i EF) is 10. The partial marks are:

AC = mark for activities (problem solving, simulations, etc.) carried out along the course (\*\*)

PL = mark for laboratory activities (\*\*)

EP = mark for a first partial exam approximately at the middle of the semester.

EF = mark for a final exam.

Only this exam (EF) will be a re-evaluable test, with the established weighing of 70%. The students who can do the re-evaluation are those established by the general regulations of the School.

(\*\*) These qualifications may be VALIDED for a series of test questions (usually no more than three) that will be made to the final exam and in an extraordinary way that of re-evaluation in sections that can be independent of the exam or form part of it. Once the qualification (AC and PL) has been obtained, it will be affected by a factor that will be proportional to the qualification of the validation questions of each of the parties. The type of proportionality and validation will be established by the teachers each year.

## EXAMINATION RULES.

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Each of the two tests, EP and EF, will consist of two parts: a theory test and/or very simple problems (which can be up to a maximum of 30% of the note) and a certain number of exercises (up to complete 100%). For the completion of the exercises, a list of formulas, and possibly other material that, as the case may be, responsible teachers will be established and announced sufficiently in advance. Only the final exam will be re-evaluable, with the established weighting of 70%.

In laboratory practices, the previous questionnaire will be scored, as appropriate, together with the results of the laboratory practice.

All the practices will have the same weight within the 1.5 points corresponding to the laboratory note.

During the course, problems will be proposed to solve individually (or in group) in the same session in or out of the classroom and/or other activities. The total of these activities represents 15% of the final grade of the course.

## BIBLIOGRAPHY

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### Basic:

- Tipler, Paul Allen; Mosca, Gene. Física para la ciencia y la tecnología. Vol. 2, Electricidad y magnetismo, Luz [on line]. 6a ed. Barcelona: Reverté, 2010 [Consultation: 20/02/2024]. Available on: [https://www-ingebook-com.recursos.biblioteca.upc.edu/ib/NPcd/IB\\_BooksVis?cod\\_primaria=1000187&codigo\\_libro=10373](https://www-ingebook-com.recursos.biblioteca.upc.edu/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=10373). ISBN 9788429144307.

- Young, Hugh D.; Freedman, Roger A.. Física universitaria con física moderna, Vol. 2 [on line]. México: Pearson Education, 2018 [Consultation: 20/02/2024]. Available on: [https://www-ingebook-com.recursos.biblioteca.upc.edu/ib/NPcd/IB\\_BooksVis?cod\\_primaria=1000187&codigo\\_libro=8237](https://www-ingebook-com.recursos.biblioteca.upc.edu/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=8237). ISBN 9786073244404.

- Tipler, Paul Allen; Mosca, Gene; Jou i Mirabent, David; Llebot, Josep Enric. Física per a la ciència i la tecnologia. Vol. 2, Electricitat i magnetisme. La llum. Física moderna: mecànica quàntica, relativitat i estructura de la matèria [on line]. Barcelona [etc.]: Reverté, 2010 [Consultation: 20/02/2024]. Available on: <https://ebookcentral-proquest-com.recursos.biblioteca.upc.edu/lib/upcatalunya-ebooks/detail.action?pq-origsite=primo&docID=5758259>. ISBN 9788429144338.

### Complementary:

- Alarcón Jordán, Marta [et al.]. Física: problemes resolts. Vol. 2, Electricitat i magnetisme. 3a ed. Barcelona: Edicions UPC, 2000. ISBN 8483014157.

- Rodríguez, Raül; Casas, M. Carmen; Navarro, Xavier; Soler, Joan. Electricitat, magnetisme i ones : tests d'avaluació [on line]. Barcelona: Edicions UPC, 2001 [Consultation: 09/03/2022]. Available on: <https://upcommons.upc.edu/handle/2099.3/36430>. ISBN 8483014882.

- Alarcón Jordán, Marta [et al.]. Física problemes resolts. Vol. 3, Ones, física quàntica i electrònica. Barcelona: Edicions UPC, 1997. ISBN 8483010194.

- Moreno Lupiáñez, Manuel; José Pont, Jordi. Simulacions en física. Barcelona: Edicions UPC, 1995. ISBN 847653504X.

- Bloomfield, Louis A. How things work : the physics of everyday life [on line]. 6th ed. Hoboken, New Jersey: John Wiley & Sons, Inc,



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[https://search-ebscohost-com.recursos.biblioteca.upc.edu/login.aspx?direct=true&AuthType=ip,uid&db=nlebk&AN=1639311&site=ehost-live&ebv=EB&ppid=pp\\_C1](https://search-ebscohost-com.recursos.biblioteca.upc.edu/login.aspx?direct=true&AuthType=ip,uid&db=nlebk&AN=1639311&site=ehost-live&ebv=EB&ppid=pp_C1). ISBN 9781119188520.

## RESOURCES

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### Hyperlink:

- Curso Interactivo de física en internet <http://www.sc.ehu.es/sbweb/fisica>. Simulacions de física per ordinador d'accés lliure