Course guide
340027 - FIS2-N - Physics II

Last modified: 10/07/2026

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).
BACHELOR'S DEGREE IN ELECTRICAL ENGINEERING AND RAILWAY SYSTEMS (Syllabus 2024). (Compulsory subject).

Academic year: 2026 **ECTS Credits:** 6.0 **Languages:** Catalan

LECTURER

Coordinating lecturer: JAVIER NAVARRO BOSQUE

Others: Navarro Bosque, Javier
Moreno Lupiañez, Manuel

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

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

-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. A 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.).
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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

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

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

GRADING SYSTEM

The course grade is obtained from the best of the two following results:

A1% AC + A2% PL + A3% EP + A4% EF
A1% AC + A2% PL + (A3+A4)% EF

where all variables (AC, PL, EP and EF) are scored out of 10 and correspond to the following concepts:
AC = grade of activities (problems, simulations, etc.) carried out during the course
PL = grade of practices and laboratory activities
EP = grade of a partial exam approximately halfway through the semester.
EF = final exam grade, which will cover all the course material (including the midterm exam material)
The weights of the different assessable concepts (A1, A2, A3 and A4) will be distributed in such a way that the fundamental assessment activities, EP and EF, have a much more relevant weight than the others, in this way the weights A1 and A2 can be between 5 and 15 and A3 and A4 between 35 and 45. Obviously A1 + A2 + A3 + A4 = 100
The following distribution is proposed for the next course: A1 = 5; A2 = 15; A3 = 35 and A4 = 45
AC: with current generative AI systems, the grades of the activities carried out with their help may be graded with a lower weight than that indicated in this assignment. At the beginning of each course, the subject teachers will indicate what this weight is. The modification of A1 will be distributed, more or less evenly among the others: A2 and/or A3 and/or A4. The qualification of these activities will be obtained through an interview, personal or in a group, with the teachers of the subject where they will be asked about the tasks assigned during the course or about a specific topic established by the teachers of the subject.

Only the test (EF) will be re-evaluable, with the established weighting of (A3+A4)%. The students who will be able to do the re-evaluation are those established by the general regulations of the School.

EXAMINATION RULES.

Each of the two tests, EP and EF, will consist of two parts: a test of theoretical concepts and/or simple problems (which may constitute between 20% and 40% of the grade) and a certain number of exercises (up to 100%). To complete the exercises, a list of formulas prepared by each student may be available, and possibly other material that, if applicable, the responsible teachers will establish and announce sufficiently in advance.

In laboratory practices, the previous questionnaire will be scored, if applicable, together with the results of the laboratory practice. All practices will have the same weight within the A2 corresponding to the laboratory grade.

· Exam grades are provisional until the faculty validates, if deemed appropriate (for example, through an oral interview), the student's authorship and knowledge

During the course, problems will be proposed to be solved individually (or in groups) in the same session in the classroom or outside it and/or other activities. The total of these activities represents A1 of the final grade for the course.

BIBLIOGRAPHY

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. 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. 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, 2016 [Consultation: 11/03/2024]. Available on: 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

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