Universidad Zaragoza

Academic Year: 2025/26

32105 - Physics II

Teaching Plan Information

Academic year: 2025/26
Subject: 32105 - Physics II
Faculty / School: 110 - Escuela de Ingeniería y Arquitectura
Degree: 653 - Degree in Biomedical Engineering
Ambit: Industrial engineering, mechanical engineering, automatic engineering, industrial organization engineering, and navigation engineering
Tipo de enseñanza: Presencial
ECTS: 6.0
Year: 1
Semester: Second semester
Subject type: Basic Education
Module:
Ámbito de conocimiento de asignatura: Industrial engineering, mechanical engineering, automatic engineering, industrial organization engineering, and navigation engineering

1. General information

Physics II is part of the basic training block of the Bachelor's Degree in Biomedical Engineering, aiming to provide students with basic knowledge of some physical systems important for biomedical engineering:

- The fundamentals of wave propagation applied to sound and light, later allowing to delve deeper into areas such as acoustics, vision, or the application to diagnostic techniques.
- The study of electrical phenomena as a basis for various aspects related both to biological signals and medical instrumentation.
- Magnetic and electromagnetic phenomena, foundational for the study of radio-diagnostic methods.
- An introduction to geometrical optics, the foundation of optometry.

2. Learning results

In general, it is expected that by the end of the course each student will:

- Understand the concepts and laws of fields, waves, and electromagnetism, and correctly apply them to basic engineering problems.
- Analyze problems that integrate various aspects of physics, using a comprehensive understanding and knowledge of it, being able to discern the several physical principles underlying a technical application, device, or real system.
- Know the units and orders of magnitude of the physical quantities defined in the different parts of the subject.
- Correctly use basic experimental measurement methods and handle, present, and interpret the obtained data, relating them to the appropriate physical quantities and laws.
- Identify and properly handle various sources of information and use clear and precise language in their explanations about physical issues.

These general outcomes should, in turn, be specified in more specific achievements. Thus, it is expected that each student will:

- Be able to analyse the propagation of mechanical waves in solids and fluids and understand the fundamentals of acoustics.
- Understand the energy-geometry aspects of three-dimensional waves, the basic phenomena related to propagation speed, and wave superposition.
- Know the main properties of electric and magnetic fields, the classical laws of electromagnetism that describe and relate them, their meaning, their experimental basis, and their application to basic engineering problems.
- Understand and use concepts related to capacitance, electric current, self-induction, and mutual induction.
- Comprehend the basic aspects of Maxwell's equations and the phenomena of electromagnetic wave propagation.
- Recognise the main properties of electromagnetic waves, in particular, identify the optical spectrum, handle phenomena such as reflection, refraction, dispersion, polarisation, and the basic aspects of interaction with matter.

3. Syllabus

Part I **Waves**

1. Wave Motion.

2. Superposition of Waves.

3. Acoustics.

Part II **Electricity**

4. Electrostatic Field and Potential.

5. Gauss's Law.

6. Electrostatic Field in the Presence of Conductors.

7. Electric Current.

Part III **Magnetostatics**

8. Magnetic Induction, Biot-Savart Law.

9. Ampère's Law in Vacuum.

Part IV **Electromagnetism**

10. Electromagnetic Induction.

11. Maxwell's Equations. Electromagnetic Waves.

Part V **Fundamentals of Geometrical Optics**

12. Reflection and Refraction Laws. Optical Instruments.

4. Academic activities

Lectures: The theory classes will be complemented by problem-solving sessions, where emphasis will be placed on the applications of the concepts. Participation will be encouraged through questions and active engagement. Some problems will be proposed for students to solve on the board.

Laboratory sessions: Students will have access to guidelines and a manual on the correct presentation of results. The laboratory practice program is designed to be synchronised with the theoretical development.

Representative problems proposed: As the syllabus progresses, problems will be proposed for submission and presentation, with available tutoring.

Tutorials

5. Assessment system

1. Several partial tests may be conducted, based on short questions and/or problems.

2. Problems will be proposed to be solved under the supervision of the professor, with the written material submitted being graded and, if applicable, defended.

3. Continuous evaluation of the laboratory work will be carried out.

4. During the official exam period, there will be a written test with a section on problems and another on theory and questions. Additionally, there will be a laboratory section for those who did not pass through continuous evaluation.

Final course grade:

a) Written tests: will account for at least 75% of the grade. If the student opts not to do the supervised work, this part will account for 85%.

i. Problem exam: 60% of the grade for this section.

ii. Theory and questions exam: 40% of the grade for this section.

Those who have passed partial tests (point) 1 may choose not to take the corresponding part of the final exam, retaining the grade obtained.

b) Proposed problems. Optional: 10% of the final grade.

c) Laboratory: accounts for 15% of the final grade. The student can pass all the practices through continuous evaluation along the course, or by taking a final practice exam if they fail one or more.

To pass the course, the following will be required:

- A minimum grade: of 4 in section a) and 5 in each laboratory practice (or final exam thereof).

6. Sustainable Development Goals

4 - Quality Education