

Course guide

220088 - F2 - Physics II

Last modified: 05/03/2025

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

Degree: BACHELOR'S DEGREE IN INDUSTRIAL TECHNOLOGY ENGINEERING (Syllabus 2010). (Compulsory subject).

Academic year: 2024 **ECTS Credits:** 6.0 **Languages:** Catalan, Spanish

LECTURER

Coordinating lecturer: Cojocarú, Crina Maria

Others: Cojocarú, Crina Maria
Torre, Iacopo
Serrat Jurado, Carles
Diego Vives, Jose Antonio
Lopez Manresa, Nacho
Otero Picón, Eva
Gancio Vazquez, Juan
Serret Mascarell, Emili
Torres Serra, Sergi

Aquesta assignatura té algunes classes en català i algunes en castellà. Consultar l'idioma concret de cada classe/grup als horaris

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:

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)

TEACHING METHODOLOGY

The directed learning consists of several processes. At first, it is necessary to consider the theory classes which develop in a big group. The teaching staffs introduce, in a brief way, general objectives of the chapter. Later, it is attempted to involve students with exercises for their active participation. The material of this part is in ATENEA: objectives, concepts, examples, evaluated programmed activities and bibliography. In second place, classes of problems, which develop in medium groups, are carried out. People work in reduced groups doing problems and exercises related with the objectives of the subject. This is an opportunity to develop transversal competences of work in team and to introduce, for the first time, concepts of cooperative learning. In last place, laboratory practices allow to develop basic concepts of methodology, objectives, experimental material, results and conclusions. Also it is a way to know the scientific method for the resolution of technological challenges. These practices are made in groups small, teams of two persons. Students have to prepare some part of work out of the laboratory classroom. This work could be individual or in group. Finally, it is necessary to stand out a time dedicated to autonomous learning different work as recommended readings and exercises proposed.

LEARNING OBJECTIVES OF THE SUBJECT

If the Physics I provides an understanding and domain of basic principles of the Physics in its Mechanics aspect, the Physics II will extend this domain to Oscillations, Waves and Thermodynamics.

On overcoming the subject, students will have acquired:

Understanding and domain of cinematic and dynamics of the oscillatory movements, of particles as well as of solids.

Understanding and domain the wavy phenomena.

Understanding and domain the basics concepts of Temperature, Heat and Thermodynamics.

STUDY LOAD

Type	Hours	Percentage
Hours medium group	14,0	9.33
Hours small group	14,0	9.33
Self study	90,0	60.00
Hours large group	32,0	21.33

Total learning time: 150 h

CONTENTS

1. Oscillations

Description:

Harmonic oscillations. Examples.

Damped oscillations.

Forced oscillations.

Superposition of harmonic oscillations.

Related activities:

1,2,3,4,5,6,7

Full-or-part-time: 64h 50m

Theory classes: 13h 30m

Practical classes: 6h

Laboratory classes: 7h

Self study : 38h 20m

2. Waves

Description:

General introduction to mechanical, acoustic and electromagnetic waves.

Physical description of waves.

Propagation of waves: reflection, refraction and Doppler effect.

Superposition of waves: standing waves, interference and diffraction

Related activities:

(ENG) 1,2,3,4,5,6,7

Full-or-part-time: 62h 20m

Theory classes: 11h

Practical classes: 6h

Laboratory classes: 7h

Self study : 38h 20m

3. Thermodynamics

Description:

Temperature.

Thermal energy and phase change.

First principle of thermodynamics.

Second principle of thermodynamics.

Related activities:

1,2,4,5,7

Full-or-part-time: 22h 50m

Theory classes: 7h 30m

Practical classes: 2h

Self study : 13h 20m

ACTIVITIES

ACTIVITY 1: THEORY SESSIONS

Description:

Autonomous preparation before and after the theory sessions and attendance.

Specific objectives:

Transfer the knowledge needed for a correct interpretation of the content developed in the theory sessions.

Preparation for the theoretical and practical part of the subject exams.

Resolution of doubts in relation to the subject syllabus

Material:

General bibliography of the course.

Specific material and slides on the virtual course platform - Atenea.

Delivery:

In some of the sessions exercises will be carried out in class, either individually or in small groups. The weight of the evaluation of these will be part of the NAC element indicated in the evaluation of the subject.

Full-or-part-time: 70h

Self study: 43h

Theory classes: 27h

ACTIVITY 2: Exercises sessions

Description:

Preparation before the problem sessions and attendance at these. Each week, after the theory session, the problems to be prepared for the following week are indicated. Students try to solve them before. In the problem session, the most important problems are solved and the doubts about the problems solved independently are resolved.

Specific objectives:

Acquire the skills necessary for a correct interpretation of the problems of the subject, as well as a satisfactory resolution of these.

Preparation for the practical part of the exams of the subject.

Transfer the knowledge necessary for a correct interpretation of the contents developed in the theory sessions.

Resolution of doubts in relation to the syllabus of the subject.

Material:

Collection of exercises available in the virtual course - Atenea.

Delivery:

During these sessions, teachers and students will carry out practical exercises, in class, individually or in small groups. The weight of the evaluation of these will form part of the NAC element indicated in the evaluation of the subject.

Full-or-part-time: 35h

Self study: 21h

Practical classes: 14h

ACTIVITY 3: LABORATORY (practical work)

Description:

One of the characteristic features this subject is the incorporation of experimental work in the laboratory.

These laboratory works will be carried out in groups of two students organized in sessions of 2h every 2 weeks. Before the lab session the students must have previously read the guidelines and write a summary that identifies the motivation, objectives, material, method, results and conclusions of the experimental device. In the Laboratory, the groups take the most relevant data of the physical phenomenon and make an initial treatment of the data, to see the consistency of their observations.

Later, working as a team, they will prepare a report on the practice carried out, which will include tables, graphs and an estimate of the uncertainties of the measurements.

Specific objectives:

At the end of the lab session, students should be able to:

1. Understand the motivation and the physical justification for it.
2. Identify the different instruments used.
3. Understand the method used to achieve the objectives (scientific method).
4. Know how to correctly synthesize and present the set of experimental data.
5. Graphically represent these data, and make the adjustment to a theoretical model, if needed.
6. Estimate the uncertainties inherent to the experimental measurements.
7. Promote teamwork, task planning and the assumption of responsibilities.

Material:

All the material are at student disposal in the laboratory. The guidelines are available at ATENEA.

Delivery:

1. Summary of the lab work prepared by the student before the lab session.
2. Report of lab work delivered maximum 15 days after the session in the laboratory.
3. Individual exam to evaluate the practical and theoretical concepts achieved in the lab.

The grade for the activity will be obtained from the correction of the reports made and from an individual exam.

The grade for the lab activity represents 15% of the final grade.

Full-or-part-time: 33h

Self study: 21h

Laboratory classes: 12h

ACTIVITY 4: FIRST EVALUATION TEST

Description:

Individual face-to face exam, consisting of two parts: theoretical questions and problems.

One of the parts of the Prova Segona Avaluació (vegeu l'activitat 5), of a voluntary nature, is designed to reconvey the grade obtained in this First Avaluació.

Specific objectives:

Once the First Assessment has been passed, the student should be able to:

Master the kinematics and dynamics of the harmonic oscillations of particles and rigid solids, damped and forced oscillatory motion and SHM superposition.

Solve problems of damped and forced SHM oscillations.

Material:

Formulario and calculator.

Delivery:

Exam solution. Represents 32% of the final grade.

Full-or-part-time: 2h 30m

Theory classes: 2h 30m

ACTIVITAT 5:

Description:

Individual test in the classroom.

For this final test, students will be given two types of exams at the same time to look at and choose which one they will take: the Second Partial or the Global Exam.

If they choose the Second Partial, all the questions or problems are from the second part of the course and the final grade for the course will take into account the grade they got in the first evaluation and the grade of this second evaluation.

However, everyone, regardless of the grade they got in the first evaluation, can voluntarily choose the Global Exam for the course, in which the questions and problems deal with the entire subject, that is, the first and second partial exams.

In this type of exam, if the grade of this global exam is better than that of the First Evaluation, it replaces it. This allows all students who, after the First Evaluation, have continued studying the topics of the first partial, to remediate the results that, in their opinion, have been unsatisfactory in their First Evaluation (Activity 4). The details of the scoring are explained in "Basic Information - Teaching Methodology - Grading System".

Both the Second Evaluation and the Global Exam modalities consist of several parts: multiple choice theory, multiple choice problems, written theory and written problems.

Specific objectives:

Once the Second Assessment has been passed, the student must be able to:

Understand and apply the general concepts related to waves.

Understand and solve problems involving waves.

Understand and apply the concepts of temperature, heat and Thermodynamics.

If the Global Exam has been passed, the student must be able to do what we have just said about the Second Assessment and what was said in the specific objectives of activity 4.

Material:

Formulario and calculator.

Delivery:

Test resolution. Scoring details are explained in "Basic information - Teaching methodology - Grading system".

Full-or-part-time: 2h 30m

Theory classes: 2h 30m

ACTIVITY 6: LABORATORY EVALUATION TEST

Full-or-part-time: 2h

Laboratory classes: 2h

ACTIVITY 7: EVALUATION TESTS

Full-or-part-time: 5h

Self study: 5h

GRADING SYSTEM

The final grade is calculated and the average of the following qualifications:

-If the final exam is chosen to be "Segundo Parcial" modality (explained in the Activity 5):

$$\text{Nota}_{\text{final}} = 0.32 \cdot \text{N1A} + 0.43 \cdot \text{N2A} + 0.15 \cdot \text{NL} + 0.10 \cdot \text{NAC}$$

-If the final exam is chosen to be " Examen Global " modality (explained in the Activity 5):

- when the grade of the Examen Global, NEG, is higher than the grade of the Primer Parcial, N1A:

$$\text{Nota}_{\text{final}} = 0.32 \cdot \text{NEG} + 0.43 \cdot \text{NEG} + 0.15 \cdot \text{NL} + 0.10 \cdot \text{NAC}$$

- when the grade of the Examen Global, NEG, is lower than the grade of the Primer Parcial, N1A:

$$\text{Nota}_{\text{final}} = 0.32 \cdot \text{N1A} + 0.43 \cdot \text{NEG} + 0.15 \cdot \text{NL} + 0.10 \cdot \text{NAC}$$

Nota_final: calificación final;

N1A: calificación de la Primera Evaluación (actividad 4);

N2A: calificación de la Segunda Evaluación (actividad 5);

NEG: calificación del Examen Global (actividad 5);

NL: calificación de la nota de Laboratorio (actividad 6);

NAC: calificación de la Evaluación Continua (actividad 7);

BIBLIOGRAPHY

Basic:

- Calaf, Jaume. Oscil·lacions: teoria i problemes [on line]. Barcelona: Iniciativa Digital Politècnica, 2012 [Consultation: 19/05/2020]. Available on: <http://hdl.handle.net/2099.3/36604>. ISBN 9788476539101.

- Tipler, Paul Allen [et al.]. Física para la ciencia y la tecnología, vol.1 [on line]. 6a ed. Barcelona: Reverté, 2010 [Consultation: 17/06/2022]. Available on: https://www-ingebook-com.recursos.biblioteca.upc.edu/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=10372.

Complementary:

- Serway, Raymond A [et al.]. Física. 3a ed. Madrid: International Thomson, 2003. ISBN 8497321685.

RESOURCES

Hyperlink:

- Apunts de l'assignatura a Atenea. <http://atenea.upc.edu/moodle>- Controls i notes en Aransa. <http://aransa.upc.es>- Física con ordenador (Ángel Franco García). <http://www.ehu.es>

Other resources:

Material published in ATENEA