

Academic Year/course: 2022/23

## 29901 - Physics I

### Syllabus Information

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**Academic Year:** 2022/23

**Subject:** 29901 - Physics I

**Faculty / School:** 110 - Escuela de Ingeniería y Arquitectura

**Degree:** 435 - Bachelor's Degree in Chemical Engineering

**ECTS:** 6.0

**Year:** 1

**Semester:** First semester o Second semester

**Subject Type:** Basic Education

**Module:**

## 1. General information

### 1.1. Aims of the course

**The subject and its expected results respond to the following approaches and objectives:**

The Physics I course is focused on the fundamentals of mechanics and its applications, such as mechanical oscillation, elasticity and fluid mechanics. Also, it provides the basic principles and working hypotheses of Thermodynamics, with emphasis on the study of heat transmission and thermal machines. Being a fundamentally basic discipline, these concepts are presented as a starting point for subsequent courses of the Chemical Engineering formation.

On the other hand, some aspects of the course, such as those related to the Laws of Conservation (e.g. momentum and energy) the vector nature of physical magnitudes; the use of Differential Calculus and the basic methodology for analyzing Laboratory data constitute an essential methodological basis for the student.

Finally, given the specific character of the Chemical Engineering discipline, those concepts of Physics will be applied to selected problems related to the Degree.

These approaches and objectives are aligned with some of the Sustainable Development Goals, SDGs, of the 2030 Agenda (<https://www.un.org/sustainabledevelopment/en/>) and certain specific goals, in such a way that the acquisition of the Learning outcomes of the subject provide training and competence to the student to contribute to a certain extent to their achievement:  
? Goal 7: Guarantee access to affordable, safe, sustainable and modern energy for all.  
Goal 7.3 By 2030, double the global rate of improvement in energy efficiency.

? Objective 12: Guarantee sustainable consumption and production patterns.

Goal 12.4 By 2020, achieve the environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with agreed international frameworks, and significantly reduce their release to the atmosphere, water and the soil in order to minimize its adverse effects on human health and the environment.

Target 12.5 By 2030, significantly reduce waste generation through prevention, reduction, recycling and reuse activities.

### 1.2. Context and importance of this course in the degree

The Physics I course constitutes a part of the Basic Formation Unit within the Degree, and represents the first part of the Physics Course that is completed by Physics II Course along the second Semester. It is a course of 6 ECTS that is provided along the first semester of the first year.

The course contains the conceptual basis of Mechanics, Fluid Mechanics, Thermodynamics and constitutes the Physics formation for students of Materials, Materials Engineering, Environmental ENgineering and Automated Systems Degrees. Additionally, these contents will be necessary for several other courses, optional and mandatory, of this specific Degree orientation

### 1.3. Recommendations to take this course

It is recommended a prior knowledge of **Physics and Mathematics at High School level**. Continued study and work are critical to pass this course with optimal learning. May doubts arise, it is important to solve them as soon as possible to ensure a smooth progress in this subject. To help answer eventual questions, the students have the advice of the teacher, both during class and, especially, in the tutorials specifically designed to do so

## 2. Learning goals

## 2.1. Competences

When approved on this Course, the student will have enhanced competence to:

### 1. SPECIFIC SKILLS:

Comprehension and control of the basic concepts on the general laws of Mechanics, Thermodynamics, waves and fields, and their application to electromagnetism on typical problems of the field.

### 2. General SKILLS:

- 2.1 Capacity to solve problems and take decisions with initiative, creativity and critical reasoning.
- 2.2 Capacity to learn continuously y develop strategies for autonomous learning

## 2.2. Learning goals

**To pass this subject, the student must demonstrate the following results:**

### 1. General learning outcomes:

1. To know the fundamental concepts and laws of mechanics and thermodynamics and their application to basic problems in engineering.
2. To analyze problems that integrate different aspects of physics, recognizing the various physical principles underlying a technical application, device or real system.
3. To know the units, orders of magnitude of the defined physical magnitudes and solve basic engineering problems, expressing the numerical result in appropriate physical units.
4. To correctly use basic methods of experimental measurement or simulation, To present and interpret the data, relating them to the appropriate physical quantities and laws.
5. ? To use bibliography and/or any of the available resources available today and to develop a clear and precise language in its explanations on questions of physics.

### 2. Specific learning outcomes:

- Correctly applying the fundamental equations of mechanics to various fields of physics and engineering: rigid body dynamics, oscillations, elasticity and fluid.
- Understand the meaning, usefulness and relations between magnitudes, elastic core modules and coefficients used in solids and fluids.
- Performs mass and energy balances correctly applied to fluid movements in the presence of basic devices.
- Correctly use the concepts of temperature and heat. Applies these concepts to calorimetry, expansion and heat transmission problems.
- Apply the first and second law of thermodynamics to processes, basic cycles and thermal machines.

## 2.3. Importance of learning goals

The learning outcome are crucial since they will provide the student with a set of knowledges and tools required to solve simplified problems of Machanics and Thermodynamics related to the Chemical Engineering activities. They are, in turn, the starting point for further knowledge in higher year courses in the Degree.

## 3. Assessment (1st and 2nd call)

### 3.1. Assessment tasks (description of tasks, marking system and assessment criteria)

**The student must demonstrate that he has achieved the expected learning outcomes through the following assessment activities:**

To promote the continued work of the student, programmed self-assessment activities will be carried out in the corresponding

class that ends each content block. This self-evaluation is of a non-obligatory and individual nature, and is offered with the purpose of giving the student the possibility of knowing better his / her performance regarding specific use of the subject before the two partial tests. This will result in a better use of the contents of the subject as they are developed in class.

Throughout the semester, **a minimum of 2 (two) partial written tests** will be taken, which will include conceptual and formal development problems on the subjects of the subject. The **threshold mark for approval of each partial test will be 5 (five) out of 10 (ten) points**. The marks obtained in each of these tests will contribute in identical fractions to the sum of the total of partial tests. This total **will account for 40% of the final mark**.

Those students who have not passed one or more of the partial tests must take a global written test that will be carried out at the end of the semester, according to the exam schedule of the center. The global test will have a structure analogous to that of the partial tests but covering the contents of the entire course. **This test will constitute 40% of the final mark**, with a threshold for approval of 5 (five) points out of 10 (ten).

The learning outcomes 1.1, 1.2 and 1.3 will be evaluated.

To pass the course, it will be necessary to obtain at least five points in each of the scores of the aforementioned tests, which will result in an overall average mark equal to or greater than 5 (five) points. However, an overall average of 5 (five) points is not a sufficient condition for approval, the student must pass each individual test with a minimum of 5 (five) points.

The learning outcomes 1.1, 1.2 and 1.3 will be evaluated.

At the end of the semester a **laboratory test** will be carried out, related both to the experimental methods and to the analysis of the data obtained. The content of this test will be developed from the activities carried out in the laboratory sessions. This **test will constitute 10% of the final mark**. It will be of eliminatory character, that is to say, it will have to be approved to be able to surpass the subject, and the minimum note for its approval will be of 5 points.

The learning outcomes 1.3 and 1.4 will be evaluated.

A tutored work of a practical nature will be proposed that will allow evaluating the learning results 1.1, 1.2 and 1.3 (occasionally 1.4 and 1.5). **This work constitutes 10% of the final mark** for the course, and will be compulsory and eliminatory, being approved with a minimum grade of 5 (five) points out of 10 (ten).

Those students who choose not to follow the previous evaluation process may take a final exam that comprises 100% of the global mark.

## 4. Methodology, learning tasks, syllabus and resources

### 4.1. Methodological overview

**The learning process that has been designed for this subject is based on the following:**

Lectures, given to the whole group, in which the teacher will explain the basic principles of the subject and the strategies and procedures for the application of these concepts to real and everyday situations and problems.

Throughout the course, classes will be included to develop the aforementioned strategies for solving problems. In these spaces, the possible ways to use the mathematical concepts and tools will be discussed to solve the problems and analyze the solutions (consistency, reasonableness and approximations in each case). Students' participation in this activity will be enhanced by announcing to students the dates for these activities, also indicating in advance what will be the real situations that will be analyzed in the classroom so that the student can reflect on them previously, and participate in its resolution.

Laboratory practices that are distributed throughout the semester and whose assessment will be part of the final grade of the subject. Groups of two or three students are formed to work on each laboratory assembly, counting with a script previously delivered by the professors and a questionnaire that collects the data are taken and their analysis.

Activities in small groups that can be: seminars that delve into a subject of the subject of interest in the degree, advanced laboratory experiences, supervised work of students, etc.

Autonomous work, studying the subject and applying it to the resolution of exercises. This activity is fundamental in the student's learning process and for overcoming the evaluation activities.

Tutorials, which can be related to any part of the subject and it will be emphasized that the student comes to them with conveniently clear and thoughtful approaches.

## 4.2. Learning tasks

The course includes the following learning tasks:

**Lectures.** Developed throughout the semester by 3 hours of weekly classes on schedule assigned by the centre. It is, therefore, highly recommended for the proper use of the subject face activity.

**Laboratory activities:** Will consist of 4 laboratory sessions of two hours each, made in subgroups of the main group of theoretical class. The labs are classroom activities that the student must do to pass the subject; evaluation will be done through a final exam. The time planning will be conducted by the centre and communicated at the beginning of the course.

**Seminar activities.** In this classroom activity, it will work on problems presented in lectures. There will be 7 sessions of one hour, in which the critical problem solving is encouraged.

**Study and autonomous work.** This is a part of the subject that is valued in about 85 hours, necessary for the study of theory, problem solving and review of laboratory scripts.

**Tutoring.** The professor will publish a schedule for the student's tutorial sessions so that they can go to make consultations. In order to carry out these consultations in an orderly manner, a personalized order will be established in each schedule, thus avoiding the overlapping of tutorials and improving the use at the individual level. In the cases in which any student is unable to attend within these times, and prior communication to the teacher by the student, a schedule adapted to the student's possibilities will be established.

## 4.3. Syllabus

The course will address the following topics:

### PART I

#### MECHANICS: FUNDAMENTALS

0. Class Zero. Presentation of the overall course. General information. FAQs about schedule, timetable, contents, evaluation, etc.

1. Kinematics.

? Position. Velocity. Speed. Definition and mathematical use.

? Reference systems. Relative movement.

2. Dynamics of a single particle.

Newton's laws. Inertial and non-inertial systems.

Special forces: friction, spring, gravity.

? Work and energy.

? Linear and angular momentum.

3. Dynamics of a particle system.

? Center of mass. Equation of motion.

? Conservation of linear and angular momentum in particle systems.

4. The rigid body.

? Moment of inertia. Dynamic rotation on a fixed shaft.

### PART II

#### MECHANICS: APPLICATIONS

5. simple mechanical oscillations.

? Harmonic oscillations.

? Free, damped and forced oscillations.

? Resonance.

6. Fluid Mechanics.

? Introduction: ideal fluid, basic concepts.

? Fluid Statics: principles of Pascal and Archimedes.

? Fluid dynamics: Bernoulli equation and applications.

### PART III

#### THERMODYNAMICS

7. Heat and temperature.

? Temperature: thermometers and thermometric scales.

? Heat and heat capacity.

? Heat transfer.

8. The first law of thermodynamics. Thermal processes.

? Internal energy, equilibrium states.

? Thermodynamic Processes in an ideal gas.

9. second law of thermodynamics. Thermal machines.

? Introduction: Entropy and second law.

? Thermal machines.

## 4.4. Course planning and calendar

Schedule sessions and presentation of works

Lectures and problem classes and practice sessions are held in the laboratory according to the schedule set by the centre and published prior to the start date of the course.

Each teacher will inform its hours of tutoring.

The start and end dates of the course and specific delivery times can be found on the website:

<http://eina.unizar.es/grados/quimica>

Moreover, from the very beginning of the semester students will have a detailed schedule of activities which shall contain the main milestones of the subject:

- Realization of all intermediate written tests
- Delivery of works directed
- Final laboratory test
- Other evaluations of any type.

#### **4.5. Bibliography and recommended resources**

[http://biblos.unizar.es/br/br\\_citas.php?codigo=29901&year=2019](http://biblos.unizar.es/br/br_citas.php?codigo=29901&year=2019)