General Physics: Mechanics and Waves

Code: 106797
ECTS Credits: 6

2025/2026

Degree	Type	Year
Nanoscience and Nanotechnology	FB	1

Contact

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Teaching groups languages

You can view this information at the end of this document.

Prerequisites

There are no prerequisites.

Objectives and Contextualisation

The main objective of the course is that the student acquires the basic knowledge of mechanics and waves both conceptually and mathematically. Special emphasis will be placed on the qualitative and quantitative understanding of the phenomena and laws that will be relevant later in the field of Nanoscience.

Learning Outcomes

1. CM01 (Competence) Determine the parameters and magnitudes associated with solving problems in the field of general physics.
2. CM02 (Competence) Work in teams to plan and carry out theoretical and practical case studies in the field of general physics.
3. KM01 (Knowledge) Define the characteristics of wave motion and obtain the wave equation.
4. KM02 (Knowledge) State Newton's Laws and their relation to the movement of particles.
5. SM01 (Skill) Express oneself correctly using scientific language, magnitudes and units associated with fundamental physical concepts.

6. SM02 (Skill) Use the theory, principles and methods of general physics to solve simple problems and explain experimental phenomena.
7. SM03 (Skill) Analyse and adequately represent data and observations in the field of physics.
8. SM04 (Skill) Understand how to implement basic techniques, materials and instruments in a general physics laboratory safely.

Content

- Introduction: Measures and Units. Orders of magnitude. Unit systems. Length, mass and time. Fundamental quantities.

- Kinematics: Movement of a particle. Speed. Acceleration. Movement in one dimension: Rectilinear movement and free fall, Movement in two dimensions: Parabolic movement and circular movement.

- Dynamics: Newton's Laws. Linear momentum and conservation of momentum. Forces and types of forces. Inertial and non-inertial reference frame. Fictitious forces.

- Work and energy: Impulse, work, energy and power. Energy conservation. Force fields.

- Systems of particles: Conservation of linear momentum. Centre of masses. Centre of masses reference frame. Kinetic energy. Total energy and conservation. Collisions.

- Rigid solid: Rotation with respect to a fixed axis. Moment of inertia. Kinetic energy of rotation. Pair of forces. Translation, rotation and rolling motion. Angular momentum of a particle. Angular momentum of a system of particles. Conservation of angular momentum. Static equilibrium. Centre of gravity.

- Oscillations: Simple harmonic oscillatory movement. Oscillator energy. The simple pendulum. The physical pendulum. The torsion pendulum. Damped oscillations. Forced oscillations. Resonance frequency.

- Waves: Wave movement. Types of waves. Equation of waves. Harmonic waves. Propagation speed. Wavefront. Polarization. Doppler effect. Superposition principle. Interference. Stationary waves. Harmonic analysis and synthesis. Sound.

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Exercises classes	15	0.6	CM01, KM01, KM02, SM01, SM02, CM01
Laboratory work	9	0.36	CM01, CM02, SM01, SM02, SM03, SM04, CM01
Theory classes	28	1.12	KM02, KM02
Type: Supervised			
Tutoring and problem-solving assistance	9	0.36	CM01, SM01, SM02, CM01
Type: Autonomous			
Preparation of lab reports	9	0.36	CM01, CM02, SM01, SM02, SM03, CM01
Reading lab scripts	3	0.12	CM01, SM03, CM01

Resolution of exercises	40	1.6	CM01, KM01, KM02, SM01, SM02, SM03, CM01
Study of theory concepts	31	1.24	KM01, KM02, SM01, KM01

The course includes theory classes, exercises classes and laboratory work.

In the theory classes, the contents of the subject will be discussed, always encouraging the participation of the student by asking questions.

In the classes of exercises, it is intended that the student participates in an active way either posing doubts or participating in the resolution of exercises and questions.

Some of the sessions of exercises will be of guided problems type, where the students will solve the problems with the help of the teacher and at the end of the class, they will have to deliver individually some questions on the problem solved.

The attendance to the laboratory is compulsory and there will be three sessions of three hours each in which students, in groups of two or three people, will have to make a series of experiments related to the concepts discussed in the classes of theory and exercises. A group report of each of the three sessions performed and an individual delivery of laboratory questions will be required.

The first laboratory work, to be carried out by all groups, will be "Instrumentation: length and mass measurements and error calculation" (P1). The students will do two more laboratory works among the following four:

P2: Free fall

P3: Waves and sound

P4: Energy conservation

P5: Movement of projectiles

The material for theory classes, exercises and laboratory work will be provided through the virtual campus of the subject.

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Assessment

Continous Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Activities to deliver	10	0	0	CM01, CM02, SM01, SM02, SM03
Laboratory reports	20	0	0	CM01, CM02, SM01, SM02, SM03, SM04
Partial exam 1	35	3	0.12	CM01, KM01, KM02, SM01, SM02
Partial exam 2	35	3	0.12	CM01, KM01, KM02, SM01, SM02
Retaking partial exam 1	35	0	0	CM01, KM01, KM02, SM01, SM02

Retaking partial exam 2	35	0	0	CM01, KM01, KM02, SM01, SM02

Continuous assessment

The final mark of the course for continuous evaluation will be obtained from the following percentages:

- 35% : Grade of the first partial exam.

- 35% : Grade of the second partial exam.

- 20% : Grade of the delivered laboratory reports.

- 10% : Grade of the delivered activities.

In order to apply these percentages, the score (out of 10) of each of the partial exams must be equal to or higher than 3.5 and all the laboratory work must have been carried out. In the case that in one or both of the partial exams, the mark is lower than 3.5, the student will have to take the retaking exam of the part that has been failed with a mark lower than 3.5. If a student, even if he/she has passed the subject, wants to improve the mark of the written exams, he/she can take the retaking exam of the part he/she wants to improve and the final mark that will be considered will be the mark obtained in the retaking exam. The mark will be "no avaluable" when the student does not take any exam or only takes one of the two partial exams and does not attend the retaking exam.

Single assessment

Students who have opted for the single assessment mode will have to take a final test consisting of a theory exam in which they will have to answer a series of short questions. Afterwards, they will have to do a problems exam where they will have to solve a series of exercises similar to those that have been worked on in the exercises sessions. When they finish, they will hand in the reports of the three laboratory practices carried out, which are compulsory. These tests will take place on the same day, time and place as the second partial exam of the continuous assessment modality.

The student's mark will be the weighted average of the three previous activities, where the theory exam will account for 32% of the mark, the problems exam for 48% andthe laboratory reports for 20%.

If the mark of the final exam does not reach 3.5 (out of 10) or if the final mark of the subject does not reach 5 (out of 10), the student has another opportunity to pass the subject by means of a retaking exam that will be held on the same day, time and place as the retaking exam of the continuous assessment modality. In this exam, 80% of the grade, corresponding to theory and problems can be recovered. The practical part is not recoverable.

UAB Regulations: To be able to retake partial exams, the student must have previously been evaluated in a set of activities the weight of which is equivalent to a minimum of two-third parts of the total qualification of the subject.

Bibliography

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M. Alonso, E.J. Finn. *Física*. Addison-Wesley Iberoamericana. (1995)

F. W. Sears, M. W. Zemansky, H. D. Young, R. A. Freedman. *Física Universitaria*. Addison-Wesley. 12a edició (2009).

R. P. Feynman, R. B. Leighton, M. Sands, *The Feynman lectures on physics*. Addison-Wesley. 6a impressió (1977).

R. A. Serway, *Física para ciencias e ingenierías*. International Thompson. 7a edició (2008).

Software

No specific software is required.

Groups and Languages

Please note that this information is provisional until 30 November 2025. You can check it through this link. To consult the language you will need to enter the CODE of the subject.

Name	Group	Language	Semester	Turn
(PAUL) Classroom practices	1	Catalan	first semester	afternoon
(PAUL) Classroom practices	2	Spanish	first semester	afternoon
(PLAB) Practical laboratories	1	Catalan/Spanish	first semester	morning-mixed
(PLAB) Practical laboratories	2	Catalan	first semester	morning-mixed
(PLAB) Practical laboratories	3	Catalan	first semester	morning-mixed
(PLAB) Practical laboratories	4	Catalan	first semester	morning-mixed
(TE) Theory	1	Catalan	first semester	afternoon