

**COURSE DATA****DATA SUBJECT****Code:** 34233**Name:** General physics I**Cycle:** Undergraduate Studies**ECTS Credits:** 6**Academic year:** 2026-27**STUDY (S)**

Degree	Center	Acad. year	Period
1105 - Degree in Physics	Facultat de Física	1	First quarter
1928 - Double Degree Program Physics-Mathematics	Facultat de Ciències Matemàtiques	1	First quarter
1929 - Double Degree Program in Physics and Chemistry	Facultat de Física	1	First quarter

SUBJECT-MATTER

Degree	Subject-matter	Character
1105 - Degree in Physics	Physics	BASIC
1928 - Double Degree Program Physics-Mathematics	Primer Curso (Obligatorio)	COMPULSORY
1929 - Double Degree Program in Physics and Chemistry	Primer Curso (Obligatorio)	COMPULSORY

COORDINATION

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SUMMARY

This course aims to provide students with a comprehensive and wide overview of Physics, from a theoretical as well as an experimental or phenomenological point of view, in order to acquire reasoning skills and explain phenomena in terms of basic physical concepts.

The aim, in short, is that students learn to express accurately in the field of science, formulating ideas, concepts and relations between them. They should be capable of reasoning in a scientific way to understand qualitative and quantitative aspects of the world around us, and develop skills in problem solving.



We will develop the basics concepts , emphasizing phenomenological aspects to ensure the background needed in future courses of the program , covered with higher degree of formalism and depth. This will be done considering the historical context of the progress of the various branches of physics and the basic experiments that have led to different concepts and theoretical formulations of the most important applications in science and technology.

"General Physics I" is a 1st year basic course. It is scheduled in the first semester with 6 ECTS credits assigned. In the lectures, both theoretical concepts and problem solving will be addressed. Together with "General Physics II" and "General Physics III", the fundamentals of the Physics subject are fully covered. It needs mathematical tools from algebra, geometry and calculus , also scheduled in the 1st semester, and is complemented with a course (second semester) in which laboratory experiments are carried out.

The topics proposed in the official document of the Physics Degree are: kinematics and dynamics, work and energy, particle systems, rigid body rotation, gravitation and Kepler's laws.

This course teaches the basics of Newtonian mechanics, which are subsequently treated with a greater degree of formalism on the courses "Mechanics I" and "Mechanics II".

PREVIOUS KNOWLEDGE

RELATIONSHIP TO OTHER SUBJECTS OF THE SAME DEGREE

There are no specified enrollment restrictions with other subjects of the curriculum.

OTHER REQUIREMENTS

In order to follow this course, students should have previously studied physics, chemistry and mathematics at a high school level. It is also important that students reinforce and extend the mathematical background in the courses on mathematics to be taken simultaneously with General Physics I in the first semester.

COMPETENCES / LEARNING OUTCOMES

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Apply acquired knowledge to professional activities: know how to solve problems and develop and defend arguments in a clear and structured manner, drawing on that knowledge.

Design laboratory experiments and independently analyse and critically evaluate the experimental data obtained.

1105 - Degree in Physics

Ability to collect and interpret relevant data in order to make judgements.

Basic & applied Research: acquire an understanding of the nature and ways of physics research and of how physics research is applicable to many fields other than physics, e.g. engineering; be able to design



experimental and/or theoretical procedures for: (i) solving current problems in academic or industrial research; (ii) improving the existing results.

Communication Skills (written and oral): Being able to communicate information, ideas, problems and solutions through argumentation and reasoning which are characteristic of the scientific activity, using basic concepts and tools of physics.

Foreign Language skills: Have improved command of English (or other foreign languages of interest) through: use of the basic literature, written and oral communication (scientific and technical English), participation in courses, study abroad via exchange programmes, and recognition of credits at foreign universities or research centres.

Knowledge and understanding of the fundamentals of physics in theoretical and experimental aspects, and the mathematical background needed for its formulation.

Learning ability: be able to enter new fields through independent study, in physics and science and technology in general.

Literature Search: be able to search for and use physical and other technical literature, as well as any other sources of information relevant to research work and technical project development.

Modelling & Problem solving skills: be able to identify the essentials of a process / situation and to set up a working model of the same; be able to perform the required approximations so as to reduce a problem to an approachable one. Critical thinking to construct physical models.

Physics general culture: Be familiar with the most important areas of physics and with those approaches which span many areas in physics, or connections of physics with other sciences.

Prob. solving and computer skills: be able to perform calculations independently, even when a small PC or a large computer is needed, including the development of software programmes.

Problem solving: be able to evaluate clearly the orders of magnitude in situations which are physically different, but show analogies, thus allowing the use of known solutions in new problems .

Students must be able to apply their knowledge to their work or vocation in a professional manner and have acquired the competences required for the preparation and defence of arguments and for problem solving in their field of study.

Students must be able to communicate information, ideas, problems and solutions to both expert and lay audiences.

Students must have acquired knowledge and understanding in a specific field of study, on the basis of general secondary education and at a level that includes mainly knowledge drawn from advanced textbooks, but also some cutting-edge knowledge in their field of study.

Students must have developed the learning skills needed to undertake further study with a high degree of autonomy.

Students must have the ability to gather and interpret relevant data (usually in their field of study) to make judgements that take relevant social, scientific or ethical issues into consideration.

Theoretical understanding of physical phenomena: have a good understanding of the most important



physical theories (logical and mathematical structure, experimental support, described physical phenomena).

To know how to apply the knowledge acquired to professional activity, to know how to solve problems and develop and defend arguments, relying on this knowledge.

DESCRIPTION OF CONTENTS

1. Introduction

Units. Dimensions. Dimensional analysis. Figures and orders of magnitude. Review of basic concepts of vector calculus, derivatives and integrals.

2. Particle Kinematics

Motion in one dimension: position, velocity, acceleration; uniformly accelerated motion. Generalization to three dimensions: position, velocity and acceleration vectors. Projectile motion. Normal and tangential acceleration in two dimensions. Relative motion.

3. Particle dynamics

Newton's laws. Types of forces and gravitational force. Applications and examples: free body diagrams. Static and kinetic friction, drag forces, terminal velocity. Circular motion: centripetal component of the acceleration. Weightlessness.

4. Work and energy

Work done by a force. Kinetic energy. Work-kinetic- energy theorem. Power. Conservative forces. Potential energy. Equilibrium. Mechanical energy: conservation. Conservative and non-conservative forces: Principle of conservation of energy in a system.

5. Systems of particles. Collisions

Center of mass. Equation of motion. Linear momentum: conservation. Kinetic and potential energy of a system of particles. Impulse and average force. Collisions in one dimension. Coefficient of restitution. Collisions in two dimensions. The center of mass reference frame.



6. Rotation of a Rigid Body

Angular velocity and angular acceleration. Torque. Newtons second law for rotation. Rotation around a fixed axis: moment of inertia. Steiner theorem. Calculating moments of inertia.

Applications and examples of the Newtons second law for rotation. Rotational kinetic energy. Work and power. Rolling objects. Angular momentum. The gyroscope. Conservation of angular momentum.

7. The gravitational field

Kepler's laws and their deduction from physical principles. Newton's law of gravitation. Measurement of G: the Cavendish experiment. The gravitational field. Gravitational potential energy: escape velocity, energy and orbits.

WORKLOAD

PRESENCIAL ACTIVITIES

Activity	Hours
Tutorials	15,00
Theory	45,00
Total hours	60,00

NON PRESENCIAL ACTIVITIES

Activity	Hours
Attendance at other activities	0,00
Individual or group project	30,00
Independent study and work	0,00
Preparation of lessons	45,00
Preparation for assessment activities	15,00
Resolution of case studies	0,00
Total hours	90,00

TEACHING METHODOLOGY

DIRECT INSTRUCTION (40%) consisting of two types of classes with different methodological approaches:

a) THEORETICAL-PRACTICAL LECTURES (3 h/week): The subject theoretical contents will be taught including practical examples that illustrate them, with discussions and deductions on the blackboard. Experimental demonstrations of physical phenomena and/or the video projector may also be used, with class outlines and graphic tools (images or videos). Students are expected to take notes during the lectures and will be encouraged and guided to complement and expand these contents with the aid of the recommended textbooks, also to address some specific or monographic aspects that may be pointed out for study without being dealt with directly in class.



b) **PROBLEM SOLVING CLASSES IN SMALL GROUPS (1 h/week)**: based on the resolution of a selection of problems and exercises from the bulletin that is provided at the beginning of the course, and scheduled to be solved by the students before each of these classes. The teaching staff will monitor the work and progress of the students, in addition to resolution of doubts and clarification of conceptual or calculation difficulties. Assessable exercises may be assigned and students may be asked to explain their resolutions of the exercises, justifying adequately the calculations made.

STUDENTS PERSONAL WORK (60%): Study of the theoretical foundations and demonstrations; resolution of problems or conceptual questions with the aid of textbooks. **INDIVIDUAL TUTOR SUPERVISION**: specific queries from the student to the teachers about doubts and difficulties encountered in the study and in solving problems.

EVALUATION

The assessment or evaluation criteria are the following, the same for both examination calls:

1) **Written exam**: with two parts. The first is focused on the understanding of the theoretical-conceptual aspects and the formalism of the subject (theoretical and demonstrative questions, conceptual and numerical questions or simple specific cases) and the second assesses the ability to apply formalism, by solving problems, as well as the critical capacity regarding the results obtained. In both parts the symbolic calculation, correct argumentation and an adequate justification will be assessed.

2) **Continuous assessment** of problems solved by the students, questions proposed and discussed online or during problem solving classes or oral presentation of solved problems.

The final grade will be obtained from the average of these two types: exam (minimum 60%) and continuous assessment (maximum 40%), provided that in the written exam a minimum of 4 out of 10 is obtained. In any case, the final grade will be the maximum value of the exam grade and the average. The total qualification needed to pass the course is 5 out of 10.

NOTE: Whenever the criteria specified by the CAT (Academic Degree Committee) are fulfilled, the course grade will be averaged with those obtained in "General Physics II" and "General Physics III"

REFERENCES

Basic:

- P.A. Tipler, G. Mosca, Física para la ciencia y la tecnología, Volumen 1 y 2. Reverté. 6ª edición, 2010.

Additional:



- P.M. Fishbane, S. Gasiorowicz, S. T. Thornton, Física para ciencias e ingeniería , Vol 1 y 2, Prentice Hall, 1993.
- Gerald Holton & Stephen G. Brush, Introducción a los conceptos y teorías de las ciencias físicas. Ed. Reverté 1987, 2004. 2ª ed. corregida y revisada.
- R.A. Serway y J.W. Jewett, Física, Volumen 1 y 2, Tomson.3ª edición, 2003.
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- M. Alonso y E.J. Finn, Física, Pearson Educación, 2000.
- J.W. Kane, M.M. Sternheim. Física, Editorial Reverté. 1992.
- V. Martínez Sancho. Fonaments de Física, Enciclopedia Catalana.
- J. Aguilar y F. Senent. Cuestiones de Física, Editorial Reverté.