COURSE DATA

Data Subject	
Code	34234
Name	General physics II
Cycle	Grade
ECTS Credits	6.0
Academic year	2023 - 2024

Study (s)

Degree	Center	Acad. year	Period
1105 - Degree in Physics	Faculty of Physics	1	Second term
1928 - D.D. in Physics-Mathematics	Double Degree Program Physics and Mathematics	1	Second term
1929 - D.D. in Physics-Chemistry	Double Degree Program Physics and Chemistry	1	Second term

Subject-matter

Degree	Subject-matter	Character
1105 - Degree in Physics	1 - Physics	Basic Training
1928 - D.D. in Physics-Mathematics	1 - Primer Curso (Obligatorio)	Obligatory
1929 - D.D. in Physics-Chemistry	1 - Primer Curso (Obligatorio)	Obligatory

Coordination

Name	Department
CASES RUIZ, MANUEL RAMON	180 - Atomic, Molecular and Nuclear Physics
VALOR I MICO, ENRIC	345 - Earth Physics and Thermodynamics
ZUÑIGA ROMAN, JUAN	180 - Atomic, Molecular and Nuclear Physics

SUMMARY

"General Physics II" is a subject of basic training of 1er course given in the second quarter with a load of assigned 6 ECTS. It is split in a part of theoretical concepts and another one of resolution of practical exercises related to the theory, both taught in the classroom. This subject is the natural continuation in contents of the "General Physics I" of the first semester, and together with it and also with "General Physics III" establishes the foundations of the Physics subject matter in the degree. This subject needs the mathematical tools of "Algebra and Geometry I" and "Calculus I" developed at the first semester of this

course, and is complemented by the subject "Introduction to experimental Physics", in which experiments are developed in the laboratory.

The proposed descriptors in the document of the grade-level curriculum in Physics establishes the following issues: Simple oscillations, damped and forced (resonance). Basic aspects of wave motion and examples. Deformable solids and fluids. Thermodynamics and kinetic theory of gases. Introduction to the structure of matter: atoms, molecules and solids.

This course is intended to teach the basics of mechanical oscillations, elasticity, thermodynamics and introduction to the structure of matter that subsequently has to be treated with a higher degree of formalism in subjects such as "Oscillations and Waves", "Thermodynamics", "Quantum Physics I and II" or "Solid State Physics".

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

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

Other requirements

To pursue this subject it is desirable that students have previously studied the Physics and Chemistry of 1st course at High School, and the Mathematics II and Physics of 2nd course at High School. They are also used some of the basic knowledge acquired in Physics and Mathematics, completed in the first semester.

OUTCOMES

1105 - Degree in Physics

- Knowledge and understanding of the fundamentals of physics in theoretical and experimental aspects, and the mathematical background needed for its formulation.
- 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.
- Ability to collect and interpret relevant data in order to make judgements.
- 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 .
- Theoretical understanding of physical phenomena: have a good understanding of the most important physical theories (logical and mathematical structure, experimental support, described physical phenomena).
- 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.
- 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.
- 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.
- 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.
- Learning ability: be able to enter new fields through independent study, in physics and science and technology in general.
- 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.
- 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 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 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.
- Students must be able to communicate information, ideas, problems and solutions to both expert and lay audiences.
- Students must have developed the learning skills needed to undertake further study with a high degree of autonomy.

LEARNING OUTCOMES

• Develop the physical intuition.

• Purchase security in the modeling and solving of simple physical problems.

• To know the International System of Units, by assigning them correctly to each one of the physical quantities studied.

•To understand the basic concepts of the oscillatory motion, including the damped oscillations , the forced oscillations and resonance.

• To understand the basic concepts of wave motion, and to apply these concepts to relevant cases, such as sound waves, as well as the treatment of basic aspects of the superposition of waves and standing waves.

• To analyze and know how to solve in practice which are the conditions to get the static balance of objects and the determination of the forces that act on it. To know the deformations and elastic forces that arise when solids are subjected to a stress, identifying in each case the elastic modules involved.

• To understand the basic description of fluids at rest or in motion, through the fundamental laws, and to know how apply them to simple cases.

• To understand the basic principles of thermodynamics, as well as the main concepts related to them : temperature, internal energy, heat, work and entropy. Knowing how to apply these principles to the study of processes of the ideal gas, distinguishing between reversible and irreversible processes. To understand the microscopic interpretation of macroscopic quantities of ideal gas, as well as other basic aspects of the kinetic theory of gases.

• To know the fundamental aspects of the structure of matter, to understand the basic phenomenology associated to the atoms, molecules and solids.

DESCRIPTION OF CONTENTS

1. Static balance and elasticity

Static balance. Equilibrium conditions. Center of gravity. Examples of static balance. Stress and deformation. Elastic Modules.

2. Fluids

Hydrostatic pressure in a fluid. Principle of Pascal. Buoyancy and Archimedes' principle. Surface tension. Ideal fluids in motion: equation of Bernouilli. Viscous Flow: Poiseuille law. Turbulence: Reynolds number.

3. Oscillations

Simple harmonic oscillator. Energy of simple oscillations. Motion close to equilibrium. Some examples of oscillating systems. Damped oscillations. Forced oscillations: resonance.

4. Waves

Simple wave motion. Wave equation. Harmonic waves. Three-dimensional waves. Doppler Effect. Shock waves. Overlapping waves of the same frequency. Sound beats. Standing waves on strings and sound.

5. Introduction to Thermodynamics

Thermodynamic systems. Temperature and the Zeroth law of Thermodynamics. Thermometers and temperature scales. Ideal Gases. Thermal equation of state. Thermal coefficients. Solids and liquids. Phase Diagram. Equation of van der Waals. Vapor pressure. Relative humidity.

6. First Law of Thermodynamics

Mechanisms of interaction between system and surroundings. Thermodynamic processes. Mechanical work. Clapeyron Diagram. Work in adiabatic processes. Heat. Mechanisms of heat transfer. First Law of Thermodynamics. Heat. Capacity. Relationship of Mayer. Joule Experiment: mechanical equivalent of heat. Calorimetry. Latent Heat. Quasistatic processes of an ideal gas.

7. Second Law of Thermodynamics

Need of a second law. Thermal machines, refrigerators and heat pump. The different statements of the second law and their equivalence. Carnots machine. Entropy. Reversible and irreversible processes. Carnot Theorem. Entropy of the ideal gas. The thermodynamic definition of temperature. Calculation of variation of entropy in irreversible processes. Entropy and disorder. Entropy and probability.

8. Kinetic theory of gases

Introduction: model of ideal gas. Molecular interpretation of pressure and temperature. Equipartition Theorem. Internal Energy of the ideal gas. Distribution of molecular speeds. Heat capacities of solids and of di- and polyatomic gases.

9. Atoms, molecules and solids

Atomic spectra. Bohr's model of the hydrogen atom. Quantum description: quantum numbers. The spin of the electron. Pauli exclusion principle. Multielectronic atoms. Atomic spectroscopy. Molecular bond. Bonds in solids. Band theory. Metals, insulators and semiconductors. Theory of free electrons in metals.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	45,00	100
Tutorials	15,00	100
Development of individual work	30,00	0
Preparation of evaluation activities	15,00	0
Preparing lectures	45,00	0
TOTAL	**150,00**	

TEACHING METHODOLOGY

1.- Direct Instruction (40 %):

The methodology will consist of two types of classes with different methodological approaches:

a) Theoretical-practical classes (3 h/week). In the theoretical-practical lectures the content of the subject will be taught including practical examples that illustrate the main concepts. It will be indicated which chapters of the basic bibliography correspond to the subject matter given in class. This last will conform the matter to be evaluated in the examinations. During the lectures, the video projector will be used together with discussions and deductions on the

chalkboard. We will also use graphical tools that include images, videos, and animations to illustrate some of the phenomena explained, as well as experimental demonstrations. Although most of the contents of the program will be addressed directly
in these classes, some specific aspects or particular cases may be listed for individual study out of the class without dealing them directly. In fact, students will be encouraged and guided in the expansion of these contents through the recommended bibliography, as well as the possibility of expansion of knowledge in future subjects of the degree.

b) Group tutoring sessions or work in small groups (1 h/week). They are classes of problems in small groups that will be based on a collection of problems and selected exercises to facilitate the understanding of the fundamentals of matter, and scheduled to be solved by the students before each one of these classes. In them, the teachers will make a follow-up of the work and progress of the students, in addition to solve the doubts raised by the students and to clarify aspects of the conceptual difficulties or calculations. In these classes, exercises may be assigned to students who will be asked to explain their resolution, justifying the calculations properly.

2.- Student's personal work (60%):

- Study of the theoretical basis.

- Resolution of problems, conceptual questions and eventual scheduled tasks.

- Individual tutorials: Students ask questions to the lecturers regarding doubts and difficulties encountered while studying and solving problems.

EVALUATION

The assessment system is as follows:

1) Written examinations (EE): one part will evaluate the understanding of the theoretical aspects and formalism of the subject, both through theoretical questions as via conceptual issues and numeric or special cases. Another part will assess the ability of application of the formalism, through the resolution of problems, as well as the ability to be critical with respect to the results obtained. Proper argumentations and adequate justifications will be important in both cases. The theoretical part will have a value of 6 points, and the part of problems a value of 4 points on the total score (10).

2) Continuous assessment (AC): the rating of this part (on a maximum of 10 points) will be obtained with the valuation of work and problems presented by the students, issues and proposals discussed in the classroom, oral presentation of solved problems or any other method that involves an interaction between teachers and students.

The written examinations will have a weight in the final rating of 70% and continuous assessment will have a weight of 30%. However, if the grade on the examination is higher than the weighted rating, will prevail the mark of the examination. Therefore, the final grade for the course (F) will be, for the two calls:

F = MAX {EE; (0,7*EE+0,3*AC)}

whenever a minimum of **4 points** in the written examination is obtained. Otherwise, the final mark will be equal to the written examination grade.

To pass the subject it is necessary that the final grade is equal to or greater than 5 points.

NB: It is possible to pass the subject via compensation with other subjects of the same branch, if the criteria for compensation are fulfilled.

REFERENCES

Basic

- P.A. Tipler, G. Mosca, Física para la ciencia y la tecnología, Vols. 1, 2 y Física Moderna. Reverté, Barcelona. 6ª edición, 2010.
- P.A. Tipler, G. Mosca, Física per a la ciència i la tecnologia, Vols. 1, 2. Reverté, Barcelona. 6ª edición, 2011.

Additional

- T.A. Moore, Física. Seis ideas fundamentales, Vols. 1 y 2. McGraw-Hill, 2005.
- P.M. Fishbane, S. Gasiorowicz, S. T. Thornton, Física para ciencias e ingeniería, Vols. 1 y 2, Prentice Hall, 1993 .
- R.A. Serway y J.W. Jewett, Física, Vols. 1 y 2, Tomson.3ª edición., 2003.
- R.A. Serway, Physics for Scientists and Engineers, Saunders. 3ª edición, 1990.
- D.E. Roller y R. Blum, Física. Mecánica, ondas y termodinámica (Vol. 1), Reverté, 1983.
- R. Wolfson, J.M. Pasachoff, Physics, Addison-Wesley, 3ª edición, 1999.
- M. Alonso y E.J. Finn, Física, Pearson Educación, 2000.
- V. Martínez Sancho. Fonaments de Física, Vols. 1 y 2, Enciclopédia Catalana, Barcelona, 1991.
- J. Aguilar y F. Senent. Cuestiones de Física, Editorial Reverté.