VNIVERSITAT DE VALÈNCIA

Course Guide
34235 General physics III

COURSE DATA

Data Subject	
Code	34235
Name	General physics III
Cycle	Grade
ECTS Credits	6.0
Academic year	2022 - 2023

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
CERDA DURAN, PABLO	16 - Astronomy and Astrophysics
GUIRADO PUERTA, JOSE CARLOS	16 - Astronomy and Astrophysics
SILVA VAZQUEZ, FERNANDO	280 - Optics and Optometry and Vision Sciences

SUMMARY

This course aims to provide students with a broad overview of physics, from a theoretical point of view to experimental and phenomenological one, in order that they acquire a way to reason and to explain the phenomena in terms of basic physical concepts.

It intends to learn to express them with the precision required in the realm of science, formulating ideas, concepts and relationships between them; they are able to reason, both qualitative and quantitative, in scientific terms; to understand aspects of the world around us; to develop skills in problem solving.

Also ensure that the conceptual background of the students can successfully address future courses of study. It will develop the basics of themes that are part of the matter, insisting on phenomenological aspects and taking into account that the student will deliver other subjects tackled with a greater degree of formalism and depth.

All this without forgetting the historical context of the progress of the different branches of physics or basic experiments that have given rise to different concepts and theoretical formulations or most relevant applications in science and technology.

"Physics III" is a subject with theoretical concepts and resolution of practical exercises related to the theory, both taught in the classroom. This course is the natural continuation of the subject "Physics I" in the first semester and establishes with this and "Physics II" the fundamentals of the physical matter in grade. It needs mathematical tools from the subjects algebra, geometry and calculous of 1st course and has as a complement in a couse in the second semester where experiments are developed in the laboratory.

Descriptors proposed in the document of the Plan of studies of the degree in physics established the following points: electrostatics, Magnetism, DC and AC current, electromagnetic induction, Maxwell's equations in integral form and electromagnetic waves. Properties of light: Reflection and Refraction. Polarization, Geometrical Optics and optical instruments. Interference and Diffraction.

In this course we aim to teach the basic concepts of electromagnetism and optics, to be subsequently treated with a greater degree of formalism in the subjects "Electromagnetism I", "Electromagnetism II", "Optics I" and "Optics 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

To study this subject it is convenient that the students have previously completed subjects of physics and chemistry the 1st year of high school and mathematics II and physics the 2nd year of high school. Also used some of the basic knowledge acquired in physics and mathematics, completed the first quarter.

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 physical intuition.

• Acquire security in modelling and solving simple physical problems.

• Know the units of the International System, by assigning them correctly to each of the studied physical magnitudes.

• Knowledge of the concepts and basic laws of electromagnetism through the integral form of Maxwell's equations. Understand the basics of electromagnetic waves. Learn the basic concepts of DC and AC current solving simple circuits of one or two meshes.

• Knowledge of the concepts and basic laws of Optics: reflection, refraction, polarization, geometrical optics and physical optics.

• Develop physical intuition.

• Acquire security in modelling and solving simple physical problems.

• Know the units of the International System, by assigning them correctly to each of the studied physical magnitudes.

• Knowledge of the concepts and basic laws of electromagnetism through the integral form of Maxwell's equations. Understand the basics of electromagnetic waves. Learn the basic concepts of DC and AC current solving simple circuits of one or two meshes.

• Knowledge of the concepts and basic laws of Optics: reflection, refraction, polarization, geometrical optics and physical optics.

DESCRIPTION OF CONTENTS

1. Electric Field

Electric interaction: electric charge. Force between charges: Coulomb's law. Electric field. Field lines. The electric field flow: Gauss theorem. Electrostatic potential. Equipotential surfaces. Conductive materials. Capacity. Capacitors. Electrostatic energy. Electric dipole. Dielectric materials.

2. Direct Current

Electrical current and resistance. Ohm's law. Combinations of resistors. Energy in electric circuits: Power. Kirchhoff rules. RC circuits: charging and discharging a capacitor.

3. Magnetic Field

Introduction to magnetic phenomena. Force exerted by a magnetic field. Movement of charges in magnetic field: examples. Action of a magnetic field on a current loop. Sources of the magnetic field: Biot and Savart law, examples. Force between wires: definition of ampere. Ampere's theorem. Magnetic flux: Gauss law in magnetism. Magnetism in matter: dia-, para- and ferromagnetism.

4. Electromagnetic Induction

Electromagnetic induction. Faraday-Lenz law: examples. Induced electric camp. Induction and mutual induction. Magnetic energy. RL, LC and RLC circuits.

5. Altern current

Generators and Transformers of alternating current. Elements of a circuit of alternating current. Impedances. Power in circuits of alternating current.

6. Electromagnetics waves

Generalized Ampere Law. Maxwell Equations. Electromagnetic waves. Electromagnetic spectrum. Electromagnetic waves properties. Propagation in dielectric media (refraction index). Light as an electromagnetic wave

7. Polarita

Polarization

Polarization of electromagnetic waves. Dicroism (Malus Law). Polarization by reflection and refraction (Brewster Angle). Polarization by birefringence.

8. Geometrical Optics

Light rays. Reflection and refraction (Snells law). Image Formation. Spherical mirrors. Spherical Dioptri. Lenses. Compound systems. Cardinal Elements. Optical Instruments: Human Eye, magnifying glass, microscope, and telescopes.

9. Interferences and diffraction

Interference by a wave front division, Young experiment. Interference by an amplitude division, plates and interferometers. Fresnel and Fraunhoffer diffraction. Resolution, Rayleigh criterion. Diffraction grating.

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.-Lectures (40%):

1.1.- General lectures: conceptual and formal aspects of the matter are explained, and the resolution of problems are performed such an application of theoretical concepts. They are based mainly in the master class through dialogue and the use of tools (experimental demonstrations, animations or video, graphic representation of solutions, projections, presentations, etc.).

1.2.- Work sessions in small groups: focused on the work of the student and their active participation: resolution of doubts that have arisen to the face of theoretical concepts and problem solving, reinforcement in aspects of greatest difficulty, questionnaires of conceptual, experimental shows relevant to cases studied, and associated with a continuous evaluation of the student.

2. Student personal work (60%):

-Study of the theoretical matters.

-Resolution of problems, test types questions, and additional work (individually or in Group).

-Interpretation and conclusion of the results of the work. Communication of the personal work.

-Individual tutoring: specific inquiries from the student to the teacher about doubts and difficulties on the study.

EVALUATION

The evaluation will consist of two parts, both in 1st and 2nd call:

Exam: It will be 60% of the final grade. One part will assess the understanding of the theoretical aspects and the formalism of the subject, using theoretical questions, or conceptual and numerical questions (6 points out of 10). Another part will assess the implementation capacities of formalism, by solving problems, as well as the critical capacity with respect to the results. A proper argumentation and adequate justification will be assessed (4 out of 10 points). To approve the call, you must obtain at least a score of 3.5 points out of 10.

Continuous assessment: It will be 40% of the final grade. work and problems presented by students, proposed and discussed in the classroom, oral presentation and any other method which assumes an interaction between teachers and students.

The final grade in each call must be more than 5 points out of 10 to pass the subject.

Both in the 1st and in the 2nd call, the exam grade may be chosen if it is higher than the previous weighted average.

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. Reverté, Barcelona. 6ª edición, 2010.
- P.A. Tipler, G. Mosca, Física per a la ciència i la tecnologia. Reverté, Barcelona. 6ª edició, 2011

Additional

- P.M. Fishbane, S. Gasiorowicz, S. T. Thornton, Física para ciencias e ingenieria , Vol 1 y 2, Prentice Hall, 1993
- R.A. Serway y J.W. Jewett, Física, Volumen 1 y 2, Tomson.3ª edición, 2003
- R.A. Serway, Physics for Scientists and Engineers, Saunders. 3ª edición, 1990
- R. Wolfson, J.M. Pasachoff, Physics, Addison-Wesley, 3ª edición, 1999.
- 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, Enciclopédia Catalana.
- J. Aguilar y F. Senent. Cuestiones de Física, Editorial Reverté.