COURSE DATA

Data Subject	
Code	34250
Name	Mechanics laboratory
Cycle	Grade
ECTS Credits	5.0
Academic year	2022 - 2023

Study (s)

Degree	Center	Acad. year	Period
1105 - Degree in Physics	Faculty of Physics	2	Second term
1928 - D.D. in Physics-Mathematics	Double Degree Program Physics and Mathematics	3	First term
1929 - D.D. in Physics-Chemistry	Double Degree Program Physics and Chemistry	2	Second term

Subject-matter

Degree	Subject-matter	Character
1105 - Degree in Physics	10 - Experimental physics laboratory	Obligatory
1928 - D.D. in Physics-Mathematics	3 - Tercer Curso (Obligatorio)	Obligatory
1929 - D.D. in Physics-Chemistry	2 - Segundo Curso (Obligatorio)	Obligatory

Coordination

Name	Department
CERDA DURAN, PABLO	16 - Astronomy and Astrophysics
GUIRADO PUERTA, JOSE CARLOS	16 - Astronomy and Astrophysics
TORRES FORNE, ALEJANDRO	16 - Astronomy and Astrophysics

SUMMARY

The Mechanics Laboratory subject is compulsory. Its contents are taught during the first semester of the double Physics and Mathematics (DGFM), second semester of the second year of the Degree in Physics (GF) and the double Degree in Physics and Chemistry (DGFQ) through 5 ECTS credits. It is related to the subject Mechanics and Waves, whose contents will be taught simultaneously in the second year of both grades through the subjects "Mechanics" and "Oscillations and Waves".

It is an experimental subject that illustrates in a practical way the theoretical contents of this subject. It requires the use of the knowledge acquired in the subject Introduction to "Physics Experimental" (GF), "Basic Physics Laboratory" (DGFQ) or "General Physics Lab" (DGFM) taught in the first year, as well as study skills statistics of the data, skill acquired in the subject "Mathematical Methods" or "Numerical and Statistical Methods", also in the second year, which broadens and deepens the part of the statistical treatment of the experimental data. In this subject, the experimental analysis of several physical laws regarding the dynamics of systems, kinematics and waves is carried out, favoring the methodological aspects of laboratory work and developing a critical attitude towards the results obtained. This training continues in more advanced courses when other experimental laboratories of Electromagnetism, Optics and Quantum Physics are addressed.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

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

Other requirements

Before facing this course, students have already acquired knowledge on the development of experimental work in the laboratory and the treatment of the acquired data. That's why this course stresses, in particular, in the critical analysis of the results, the synthesis of the issues and their understanding as well as in the development of physical arguments and intuition.

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 .
- Have become familiar with most important experimental methods and be able to perform experiments independently, estimate uncertainties, as well as to describe, analyse and critically evaluate experimental data according to the physical models involved. Know how to use basic instrumentation.

- 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 from the observation of experimental results.
-Determine relevant variables in the analysis of a natural phenomenon.
-Distinguish between real phenomenon and physical model.
-Distinguish a possible result from an erroneous result. Analyze the possible causes of the latter.
-Decide which experimental data are relevant and how many evidences should be taken to describe a physical phenomenon.
-How to present the experimental data describing a physical phenomenon.

-Develop deductive reasoning and experimentally test the results of certain assumptions.
-Develop teamwork.
-To acquire skill in the use of measuring instruments.
-Learn to use software applications and data processing equipment to analyse data.
-Develop a laboratory notebook.
-Develop reports.

DESCRIPTION OF CONTENTS

1. Agenda of lab activities

1. Conservation of momentum. Dynamic of collisions.
2. Coupled oscillations. Oscillation modes in one dimension.
3. Standing waves in strings with different boundary conditions.
4. The simple and compound pendulum.
5. Analysis of gyroscopic precession and nutation.
6. Kundt tube: formation of harmonics in a closed and open tube.
7. Torsion balance: measurement of gravitational constant.
8. Measurement of the speed of light.

WORKLOAD

ACTIVITY	Hours	% To be attended
Laboratory practices	50,00	100
Study and independent work	75,00	0
TOTAL	**125,00**	

TEACHING METHODOLOGY

The subject has two very different parts: 1) Data collection in the laboratory, 2) Analysis of the results as individual guided non-presential work.

The course consists of 8 practical sessions that combine data measurements and analysis, as well as two back-up sessions to solve doubts, repeat measurements, etc. In both types of sessions, the student will be assisted by the teacher. Each session is attended by groups of about 16 students, who are distributed in pairs for data collection. Each member of the couple will have to participate equally in the development of the practice. The analysis, results and interpretation of the data, together with the critical evaluation of the practice and the conclusions, will have to be reflected individually in a report. At the beginning of the next laboratory session, the student will have to deliver the report of the previous session to the teacher. Any absence or delay must be adequately justified. The recovery of sessions will only be carried out with justification and in the sessions established for this reason at the beginning of the course. It is not allowed to attend or recover session at the times corresponding to other subgroups.

EVALUATION

The evaluation consists of the following parts:

1) *Continuous evaluation based on the preparation of reports.*

The students will release individual reports of the practices indicated by the teacher. There will be a limit of approximately 4 pages for each report. For its elaboration, the guidelines indicated in the Laboratory Guide for the first cycle of the Degree in Physics will be followed (see bibliography).

2) *Oral communication and presentation of an extended report of the results of one of the practices*. The results of a practice, determined by the teacher, will be presented in an extended report (limit of 20 pages) and will be presented orally. The student will have a time of 15 minutes to make this presentation, followed by a turn of questions for another 15 minutes.

3) *Practical test.*

The professor may carry out a practical test in the laboratory consisting of carrying out one (or part) of the practices, as well as the resolution of questions and/or problems related to the theoretical contents.

The weight of each part of the evaluation will be determined by the teacher at the beginning of the course.

REFERENCES

Basic

- Guía de laboratorio del Grado en Física, Universitat de València (2010).
- Guiones de Prácticas del Laboratorio de Mecánica (http://pizarra.uv.es).
- J.B. Marion, Dinámica clásica de partículas y sistemas, Ed. Reverte, 1975.

Additional

- C. Kittel, N. D. Knight, M. A. Ruderman, Mecánica. Berkeley Physics Course, Vol. I, Ed. Reverté, 1973.
- LIDE, D.R. (2001). Handbook of Chemistry and Physics. 82nd edition (2001). CRC
- Press, Inc. London.
- SÁNCHEZ DEL RIO, C (1989): Análisis de errores. Eudema, Madrid 1989.
- TAYLOR, J R. (1997) An Introduction to Error Analysis. 2nd ed., University Science Books, Sausalito,

California
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- American Journal of Physics, http://scitation.aip.org/ajp/