VNIVERSITAT DE VALÈNCIA

Course Guide
34250 Mechanics laboratory

COURSE DATA

Data Subject	
Code	34250
Name	Mechanics laboratory
Cycle	Grade
ECTS Credits	5.0
Academic year	2021 - 2022

Study (s)

Degree	Center	Acad. year	Period
1105 - Degree in Physics	Faculty of Physics	2	Second term
1929 - Double Degree Program in Physics and 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
1929 - Double Degree Program in Physics and Chemistry	2 - Segundo Curso (Obligatorio)	Obligatory

Coordination

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

SUMMARY

The subject of Mechanics and Waves Laboratory is mandatory and belongs, together with the Laboratory of Thermodynamics, which are also courses in Year 2, the field of Experimental Physics Laboratory. Its contents are held during the second half of the second course of the Degree in Physics and the Double Degree in Physics and Chemistry through 5 ECTS. Matter is related to Mechanics and Waves, whose contents are held simultaneously in the second degree courses across subjects Mechanics I, Mechanics II, and Oscillations and Waves.

This is an experimental subject in a practical way to illustrate the theoretical content of this field. Requires the use of the knowledge acquired in the course Introduction to Experimental Physics, taught at first in regard to development work in the laboratory and the statistical analysis of data acquired, as well as taught in the course "Numerical Methods and statistics", also the second year, which broadens and

deepens the statistical treatment of experimental data. This subject performed the experimental analysis of various physical laws about the system dynamics, kinematics and wave, favoring the methodological aspects of laboratory work and develop a critical attitude towards the results. This training continues in the third grade when dealing with other experimental laboratories Electromagnetism, Optics and Quantum 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

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.

COMPETENCES (RD 1393/2007) // LEARNING OUTCOMES (RD 822/2021)

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 (RD 1393/2007) // NO CONTENT (RD 822/2021)

-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

Contact teaching 40%

Theoretical and practical classes: These are aspects of measurement instrumentation and techniques specific to each laboratory as well as monographic themes provide a culture of experimental physics on topics of interest, current or relevant technology.

Laboratory sessions in small groups, in which students conduct experimental work in groups and individually, taking measurements in experimental devices and the recording of data and preliminary analysis.

Student's personal work 60%

- Preparation of the experimental sessions and study of theoretical aspects.

- Working staff needed for the study and interpretation of the observed phenomenology and data processing, basic statistics, results, interpretations, conclusions and communication.

In the same way and with laboratory materials are developed for theoretical training.

EVALUATION

The assessment consists of the following parts:

1) Continuous assessment based on interaction with students.
Evaluation of the attitude and demonstrated skills in laboratory sessions, including, if requested, the quality of laboratory notebooks,

2) Continuous assessment based on lab reports.
Students submit individual reports of the practices indicated by the teacher. There will be a limit of, approx., 4 pages for each report. For elaborating the reports, we recommend to follow the guidelines stressed in the Guide for Laboratory (see bibliography).

3) Oral presentation and extended lab report of one of the modules.
Oral presentation, along with an extended report (max. 20 pages), of the background and results of one of the lab modules, the latter suggested by the teacher. The students will have 15 minutes for this presentation, followed by a Q&A period of another 15 minutes.

4) Practical test in the laboratory.
The teacher can arrange individual practical tests in the lab to further evaluate the student's ability to perform individual practices and/or to solve related theoretical issues

The weight assigned to each part of the assessment will be determined by the professor 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
- Física re-creativa. Experimentos de física usando nuevas tecnologías. Ed. Prentice Práctica. Salvador Gil, Eduardo Rodríguez. http://www.fisicarecreativa.com/
- The Journal of Undergraduate Research in Physcs http://www.jurp.org/
- The Physics Teacher http://scitation.aip.org/tpt/

- European Journal of Physics http://www.iop.org/EJ/journal/EJP
- American Journal of Physics, http://scitation.aip.org/ajp/

ADDENDUM COVID-19

This addendum will only be activated if the health situation requires so and with the prior agreement of the Governing Council

In case that health situation requires blended teaching, the teaching model approved by the Academic Degree Committee on July 23, 2020 will be adopted.
For lectures this model consist of 50% student attendance in the classroom, while the rest of students attend the class in streaming broadcast. Two groups will be set with alternate days attendance to the classroom in order to guarantee 50% of teaching hours attendance for all students.
The rest of the teaching activities (laboratories, computer rooms, tutorials) will have a 100% attendance.
If a total reduction in attendance is necessary, classes will be broadcast by synchronous videoconference at their regular schedule, along the period determined by the Health Authority.