COURSE DATA

Data Subject	
Code	36595
Name	Basic Physics Laboratory
Cycle	Grade
ECTS Credits	3.5
Academic year	2023 - 2024

Study (s)

Degree	Center	Acad. year	Period
1929 - D.D. in Physics-Chemistry	Double Degree Program Physics and Chemistry	1	Second term

Subject-matter

Degree	Subject-matter	Character
1929 - D.D. in Physics-Chemistry	1 - Primer Curso (Obligatorio)	Obligatory

Coordination

Name	Department
HERNANDEZ LUCAS, MARIA JESUS	345 - Earth Physics and Thermodynamics

SUMMARY

This course is an adjustment of the course “Introduction to Practical Physics”, a basic training course in the first year of the Degree in Physics. It is complemented by Physics I (first semester), II and III (second semester).

This is a basic subject in at least two aspects: the first one is the consolidation and experimental realization of the abstract concepts introduced in the lectures; the second one is the achievement of correct practice in laboratory work (taking data and analyzing it), which leads to the statistical treatment and analysis of uncertainties. Another fundamental aim of this course is to familiarize the student with handling measurement devices and managing quantities, units and uncertainties.

Curriculum keywords:

Laboratory work is based on simple experiments in different branches of physics, chosen for their experimental and conceptual relevance. Introduction to data analysis: direct measurements, determination and propagation of uncertainties, statistical analysis, linear fit, data registration, presentation and analysis of data, basic instrumentation, references and scientific communication of results

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

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

Other requirements

OUTCOMES

LEARNING OUTCOMES

- Knowing the basic processes, techniques and measurement tools used in the different fields of physics.

- Applying the scientific method to the experimental work performed in the lab.

- Learning to design and perform a simple experiment, relating the concepts learned in the Physics I, II and III with the laboratory work.

- To acquire skills in the use of measuring instruments. Learning to read scales and establish uncertainty intervals for the measurements. To learn how to determine the necessary number of measurements depending of their deviation.

- Interpreting the measurements obtained in the laboratory and making the relevant analysis to obtain the final results and the desired physical quantities.

- To express the physical quantities correctly and evaluate their uncertainties. To distinguish between systematic errors and random errors. Applying error propagation and determine the accuracy of the results.

- Learning how to make tables and graphs, with information explained in a clear and concise way.

- Learning probability concepts and especially Gaussian distribution.

- Fitting data to lineal models and obtaining physical magnitudes from the parameters calculated.

- Being able to analyse the adequacy of the mathematical fits to the experimental data.

- Developing physical intuition, making preliminary estimations of quantities from the measurements to distinguish what is relevant.

- Distinguishing erroneous results and analyze their possible causes.

- Knowing how to interpret experimental results, on the basis of physics laws.

- Preparing report on the process of measurement, data analysis and interpretation of results.

- Using software applications, data processing equipment and data analysis.

DESCRIPTION OF CONTENTS

1. THEORY

- Direct measurements and uncertainties estimation: Absolute and relative uncertainties.
- Significant digits.
- Statistical analysis of uncertainties. Type A and Type B uncertainties.
- Mean value and variance of a distribution.
- Propagation of uncertainties.
- Linear interpolation.
- Least squares fits.
- Communication of results. Scientific reports.

2. LABORATORY

P1. Measurement of fundamental quantities. Density of solids and mathematical pendulum
P2. Verification of Ohm's Law. Combination of resistances.
P3. Density and viscosity of liquids
P4. Movement analysis using sonar
P5. Specific heat of metals
P6. Geometrical optics. Imaging
P7. Electromagnetic induction. Transformers
P8. Emission spectra of different elements

WORKLOAD

ACTIVITY	Hours	% To be attended
Laboratory practices	24,00	100
Theory classes	11,00	100
Development of group work	30,00	0
Development of individual work	12,00	0
Preparation of evaluation activities	4,50	0
Preparing lectures	6,00	0
TOTAL	**87,50**	

TEACHING METHODOLOGY

The course has two parts with a distinct methodology:

1) Lectures

2) Laboratory.

Lectures:

The lectures are structured in sessions that take place during the first weeks of the course.

- The teacher explains the different topics on data analysis and scientific communication interacting with students.

- Students will solve a series of exercises and will perform some activities related to scientific communication.

Laboratory work

In each lab session (3 h) students are grouped in pairs and guided by one teacher. Attendance to these sessions is mandatory and a necessary condition for passing the course. The students must attend the lab having previously read the script of each experiment to be performed in each session (previously known). At the beginning of the session the teacher will monitor the understanding of that script and he will guide students on conceptual and technical aspects necessary to record experimental data.

Each pair of students will have a logbook where he must record data, with tables and graphs, and any relevant comments on the implementation of the experiment. Students will be supervised during the session by the teacher, helping with correcting errors and work habits.

EVALUATION

Attendance to all the lab sessions is mandatory and a necessary condition for passing the course.

The minimum score to average is 4/10 in the activities of each part (lectures and laboratory)

LECTURES: 30%

Some exercises and and activities performed by the students will be considered, related to data analysis and scientific communication.

LABORATORY: 70%

Experimental development will be checked and assessed at the end of each lab session.

Each pair of students must submit a brief report of each experiment with measurement data, the corresponding analysis (uncertainties, graphics, etc.), together with the results and conclusions.

Additionally, each pair of students must submit two complete report following the structure of a scientific paper: abstract, introduction, material and methods, results and discussion, conclusions and references.

REFERENCES

Basic

- John R. Taylor. Introducción al análisis de errores: el estudio de las incertidumbres en las mediciones físicas. Editorial Reverté, Barcelona, 2014.
- G.L. Squires.Practical Physics, Third edition, Cambridge University Press, 1998
- P.R. Bevington and D. K. Robinson.Data Reduction and Error Analysis for the Physical Sciences, McGraw-Hill International Editions Physics Series, Second Edition 1994
- Carlos Sánchez del Río. Análisis de errores, EUDEMA UNIVERSIDAD: Textos de Apoyo, 1989