Bachelor in Physics
(Academic Year 2025-26)

Physics Laboratory I		Code	800497	Year	1st	Sem.	2nd
Module	Basic Core	**Topic**	Physics			**Character**	Obligatory

	Total	Theory	Exercises
ECTS Credits	6	1	5
Semester hours	70	12	58

Learning Objectives (according to the Degree's Verification Document)

▪ Carry out laboratory measurements following established protocols that involve calibration, data collection and mathematical treatment of data, including the estimation of systematic and random uncertainties, and the management of orders of magnitude and units.

● Learn to prepare reports related to the measurement processes and the analysis of results.

● Consolidate the understanding of the core areas of Physics through the observation, characterization and interpretation of phenomena and the realization of quantitative determinations in predesigned experiments.

Brief description of contents

General Physics Laboratory. Nature and extent of physical phenomena. Units, Data analysis. Uncertainty evaluation. Basic notions of Statistics.

Prerequisites

General physics at the Baccalaureate level.

It is recommended to have completed the subject *Computer Lab*.

Related Subjects

General physics II. Physics Laboratory II and III.

Coordinator	Daniel Sánchez Parcerisa		**Dept.**	EMFTEL
	Room	03.218.A	**E-mail**	dsparcerisa@ucm.es

Theory – Schedule and Teaching Staff					No. of Sessions	8
Group	Lecture Room	Day	Time	Professor (12 h)		Dept.
B	7	Fr (1)	13:00-14:30	Daniel Sánchez Parcerisa		EMFTEL

(1) There will be a total of 8 theory session along the year

Office hours				
Group	Professor	Schedule	E-mail	Location
B	Daniel Sánchez Parcerisa	M: 10:00 - 13:00	dsparcerisa@ucm.es	03.258.0

Laboratory Teaching Staff				
Group	**Data Analysis Laboratory – Professor (6h)**		**Dpt.**	**e-mail**
LB	Daniel Sánchez Parcerisa Natalia Calvo Fernández		EMFTEL FTA	dsparcerisa@ucm.es nataliac@ucm.es
Group	**Laboratory - Professor**		**Dpt.**	**e-mail**
LB	Daniel Sánchez Parcerisa Natalia Calvo Fernández Pablo Zurita Gotor		EMFTEL FTA FTA	dsparcerisa@ucm.es nataliac@ucm.es pzurita@ucm.es

Data Analysis Laboratory- Schedule				No. of sessions:	**6**
Group	**Day**	**Hours**	**Dates**	**Location**	
LB	Fr	13:00 - 14:30	23/1, 6/2, 20/2, 27/2, 8/5	Computer Rooms A2 and A3	

Laboratory Schedule				No. of sessions:	**13**
Group	**Day**	**Hours**	**Location**	**Remarks**	
LB	Th	15:00-18:30	General Physics Laboratory basement Physics Faculty	Students should deliver a written report of the practices in approximately 50% of the assignments. In the rest of them, it will suffice to fill a form with the results and uncertainties during the Lab session. Part of each session will be devoted to small group discussions of the results obtained and reports delivered in the previous session. If needed sessions will be organized to make for missed ones.	

Syllabus
It comprises a total of 8 sessions of 1.5 hours, grouped into five topics: • **Data treatment.** Linear regression. Weighted mean. Linear interpolation. Preparation of reports. • **Descriptive statistics:** Discrete and continuous data. Frequency. Accumulated frequency. Histograms • **Random variable.** Concept. Probability density. Mean and variance. • **Probability distributions**. Discrete and continuous distributions. Uniform distribution, Normal distribution, Student's t. Estimation of parameters.

Laboratory experiments (Indicative)	Sessions
Introduction. Data analysis. Units. Types of measures. Error and uncertainty.	1
Mechanics: Pendulum. Torsion pendulum. Surface tension. Hooke's law	3
Thermodynamics. Mechanical equivalent of heat. Enthalpy of melting ice	5
Electricity and magnetism. Wheatstone bridge. Characteristic curve of a lamp. Oscilloscope operation. Alternating current: RC circuit. Measurement of magnetic fields.	2
Optics. Determination of refractive indexes. Power of lenses.	1
Structure of matter. Measurement of the charge / mass ratio of the electron.	1
Data analysis. Linear regression. Histograms. Graphics Data analysis module, Quizzes. (Computer classroom). Six sessions of 1.5 hours.	6

Bibliography
Basic

Class notes, available on the web.

Experimental Methods. An introduction to the analysis of Data. L. Kirkup. J. Wiley & Sons. 1994.

Probability & Statistics for Engineers and Scientists. R. Walpole et al. Prentice Hall

Complementary

Practical Physics. G.L. Squires. Ed. Cambridge University Press, 2001.

Curso y ejercicios de estadística, Quesada, Isidoro & López. Ed. Alhambra. 1989.

Estadística Básica para Estudiantes de Ciencias, J. Gorgas, et al. (available online).

Online Resources

The subject is registered in the Virtual Campus.

There is also a website at http://fisicas.ucm.es/lab-fis-gen

Extra links are available on the web site and virtual campus.

https://www.phyphox.org	Physics experiments with mobile phones
https://www.ucm.es/theoscarlab	Videos and tutorials of Physics experiments

Methodology

The subject consists of theory classes, laboratory, and data analysis sessions.

The theory classes will consist of expositions of the instructor, with projection of slides and realization of exercises.

Guided experiences will be carried out, with a prior script, during laboratory sessions (3.5 hours each) or catch-up sessions. Throughout each lab practice, students will have a tutor who will introduce it and answer their questions. During the experiment, a form will be filled with the measurements and calculations made. Additionally, in approximately half of the cases, a written report will be delivered in the following session. The forms and reports will be corrected and evaluated by the teachers and discussed with the students during the laboratory sessions.

The "data analysis" sessions aim at students being able to use this tool in their calculations and reports. They will be held in the Computer Room and consist of 4 sessions of 1.5 hours each.

Evaluation Criteria

Exams	Weight:	40%

Theoretical-practical exam at the end of the semester.

Other activities	Weight:	60%

Laboratory and data analysis experiments. Online quizzes.

For each laboratory experiment, a report of the measures taken will be delivered. In approximately 50% of the cases, it will be a complete report, including a description of the method used, estimation of the associated uncertainties, and a discussion of the results obtained. In the rest of the cases, only the measurements and results will be presented.

Final Mark

It is mandatory to assist to all the lab sessions and deliver the reports and filled forms.

The final grade will be the weighted mean of the two previous values, with a minimum score of 4.0 out of 10 demanded in both the assignments and the exam.

If needed, the marks of both activities will be kept for the extraordinary call, which will also offer the possibility of being evaluated of the exercises not performed during the course.