

**COURSE DATA****DATA SUBJECT****Code:** 34253**Name:** Optics laboratory**Cycle:** Undergraduate Studies**ECTS Credits:** 5**Academic year:** 2026-27**STUDY (S)**

Degree	Center	Acad. year	Period
1105 - Degree in Physics	Facultat de Física	3	Annual
1928 - Double Degree Program Physics-Mathematics	Facultat de Física	4	Annual
1929 - Double Degree Program in Physics and Chemistry	Facultat de Química	4	Annual

SUBJECT-MATTER

Degree	Subject-matter	Character
1105 - Degree in Physics	Experimental physics laboratory	COMPULSORY
1928 - Double Degree Program Physics-Mathematics	Cuarto Curso (Obligatorio)	COMPULSORY
1929 - Double Degree Program in Physics and Chemistry	Cuarto Curso (Obligatorio)	COMPULSORY

COORDINATION

SILVA VAZQUEZ FERNANDO

SUMMARY

"Optics Laboratory" is a compulsory full year duration subject in the third year of the Bachelor Degree in Physics and in the fourth year of the Double Degrees in Physics-Chemistry and Physics-Mathematics. In the current curriculum it has been assigned 1.0 theoretical credits and 4.0 practical credits, the later dedicated to laboratory work. This subject complements the matter "Optics", that has an annual basis and it is delivered to the same year. Its contents range from the basic refraction and reflection phenomena described by means of the Geometrical Optics model, to polarization, interference and diffraction experiences, that constitute the paradigm of Electromagnetic Optics.

PREVIOUS KNOWLEDGE**RELATIONSHIP TO OTHER SUBJECTS OF THE SAME DEGREE**



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

OTHER REQUIREMENTS

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

Regarding theoretical aspects, it is assumed that the student knows the basic propagation model provided by Geometrical Optics and its application to the calculation of light trajectories in elementary systems as diopters, lenses, prisms and mirrors. It is also assumed that the student knows the elementary aspects of the wave model of light.

Regarding practical skills, it is assumed that the student knows the handling of basic measurement instruments like voltmeters and amperimeters.

COMPETENCES / LEARNING OUTCOMES

1105 - Degree in Physics

Ability to collect and interpret relevant data in order to make judgements.

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.

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.

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.

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.

Knowledge and understanding of the fundamentals of physics in theoretical and experimental aspects, and the mathematical background needed for its formulation.

Learning ability: be able to enter new fields through independent study, in physics and science and technology in general.

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.

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.



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 .

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 be able to communicate information, ideas, problems and solutions to both expert and lay audiences.

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 have developed the learning skills needed to undertake further study with a high degree of autonomy.

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.

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.

DESCRIPTION OF CONTENTS

1. Theory

TOPIC 1. Experiments in Optics

TOPIC 2. Introduction to Instrumental Optics

- Classification of optical instruments
- General characteristics of optical instruments
- The eye as receiver of the information provided by the optical instruments

TOPIC 3. The magnifying glass or simple microscope

- Optical-geometric description. Visual magnification. Visual camp

TOPIC 4. The compound microscope

- Structure of the microscope. Visual magnification. Working distance
- Visual camp. Depth of focus. Field diaphragm and reticles
- Numerical aperture

TOPIC 5. Telescopic systems

- The non-focal condition
- Astronomical telescopes
- Terrestrial telescopes. Inverter systems
- Galileo's telescope
- Reflective telescopes



2. Experiments

- The microscope. Applications to metrology
- Telescopic systems
- Measurement of the refractive index gradient in a layered medium
- Linearly polarized light experiences: Malus law and Brewster angle
- Characterization of polarized light
- Wavefront division Interference: Young's Double Slit
- Amplitude division Interference: Michelson's interferometer. Measurement of air refractive index
- Introduction to diffraction

WORKLOAD

PRESENCIAL ACTIVITIES

Activity	Hours
Theory	10,00
Laboratory	40,00
Total hours	50,00

NON PRESENCIAL ACTIVITIES

Activity	Hours
Attendance at other activities	0,00
Individual or group project	30,00
Independent study and work	20,00
Preparation of lessons	10,00
Preparation for assessment activities	15,00
Resolution of case studies	0,00
Total hours	75,00

TEACHING METHODOLOGY

Presence-based teaching 40%:

Theoretical/practical classes. They cover some aspects of measurement instrumentation and techniques that are specific to each laboratory, as well as monographic subjects providing a general knowledge in experimental physics on topics of interest, in vogue or technologically relevant.

Laboratory sessions in small groups. Students conduct experimental work in groups and individually, taking measurements in experimental setups, recording data, and performing a preliminary analysis of the results.

Student's personal work 60%:

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



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

The corresponding theoretical matters are taught in the same academic year.

EVALUATION

The evaluation of the subject will correspond to the continuous evaluation of the student's work:

- a) 30% will correspond to the evaluation of the theoretical contents, with an exam at the end of the period of theoretical classes or other non-presential evaluation elements.
- b) 35% will correspond to the evaluation of the work carried out during the development of the practices, valuing the method followed, the results achieved and their corresponding errors.
- c) The other 35% will correspond to the evaluation of two oral presentations of practices, valuing the transmission and discussion of experiences and results.

If it is obtained less than 5 points out of 10 in the continuous evaluation or all the corresponding practices have not been completed, this evaluation will be replaced by an alternative individual laboratory exam that will consist in the development of part of practices worked, taking into account both the results sheet that will be delivered at the end and the oral answers to the teacher's questions about aspects of the experience and theoretical aspects developed in the theoretical part of the subject.

To pass the course, you must obtain at least 5 points out of 10.

In the second call, the outline of the previous alternative laboratory exam will be repeated, and 5 points out of 10 must be obtained to pass the course.

REFERENCES

- M. Martínez Corral, W.D. Furlan, A. Pons Martí y G. Saavedra, *Instrumentos ópticos y optométricos. Teoría y prácticas* (Universitat de València, 1998).
- Guiones de prácticas de *Técnicas Experimentales en Óptica*.