



COURSE DATA

Data Subject

Code	34253
Name	Optics laboratory
Cycle	Grade
ECTS Credits	5.0
Academic year	2020 - 2021

Study (s)

Degree	Center	Acad. year	Period
1105 - Degree in Physics	Faculty of Physics	3	Annual

Subject-matter

Degree	Subject-matter	Character
1105 - Degree in Physics	10 - Experimental physics laboratory	Obligatory

Coordination

Name	Department
SILVA VAZQUEZ, FERNANDO	280 - Optics and Optometry and Vision Sciences

SUMMARY

"Optics Laboratory" is a compulsory four-month duration subject in the third year of the *Bachelor Degree in Physics*. In the current curriculum it has been assigned 1.5 theoretical credits and 4.5 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

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.
- Capacity to communicate information, ideas, problems and solutions to a specialist and a general audience.
- Developing learning skills so as to undertake further studies with a high degree of autonomy.
- 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.
- 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.
- Resolución de problemas y destrezas informáticas: Ser capaz de interpretar cálculos de forma independiente, incluso cuando sea necesario un pequeño PC o un gran ordenador, incluyendo el desarrollo de programas de software. En el contexto de esta materia, dominio de, al menos, un programa de análisis de datos de carácter científico.
- Investigación básica y aplicada: Adquirir una comprensión de la naturaleza de la investigación Física, de las formas en que se lleva a cabo, y de cómo la investigación en Física es aplicable a muchos campos diferentes, por ejemplo la ingeniería; habilidad para diseñar procedimientos experimentales.



- Destrezas generales y específicas en lenguas extranjeras: Mejorar el dominio del inglés y, específicamente, del inglés científico-técnico a través del acceso a la bibliografía básica o a la presentación de trabajos en este idioma.
- Búsqueda de bibliografía: Ser capaz de buscar y utilizar bibliografía en Física y otra bibliografía técnica, así como cualquier fuente de información relevante para trabajos experimentales.
- Ser capaz de proseguir con el estudio de otras materias de la física gracias al bagaje adquirido en el contexto de esta materia.
- Cultura General en Física: Haberse familiarizado con las áreas más importantes de la mecánica en relación con la Física en general, y con enfoques que abarcan y relacionan diferentes áreas de la Física.

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

In this subject the students should acquire the following skills:

- To learn the basic measurement procedures, techniques and instruments in Optics.
- To acquaint with the application of the scientific methodology in solving experimental problems.
- To design and implement experiments by linking the practical situation in the laboratory to the contents of the matter "Optics".
- To get used to the handling of optical instruments
- To use physical intuition in optical experiments by estimating magnitudes from measurements for discriminating the relevant from the accessory issues.

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

ACTIVITY	Hours	% To be attended
Laboratory practices	40,00	100
Theory classes	10,00	100
Preparation of evaluation activities	38,00	0
Preparing lectures	5,00	0
Preparation of practical classes and problem	32,00	0
TOTAL	125,00	

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

Basic

- 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.

ADDENDUM COVID-19

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

The hybrid teaching model implemented and the percentage of attendance will be determined by the CAT of the degree based on the available material resources and the existing health conditions and regulations.