COURSE DATA

Data Subject	
Code	34253
Name	Optics 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	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

OUTCOMES

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

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

TEACHING METHODOLOGY:

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 and 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.