COURSE DATA

Data Subject	
Code	34253
Name	Optics laboratory
Cycle	Grade
ECTS Credits	5.0
Academic year	2019 - 2020

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
SAAVEDRA TORTOSA, GENARO	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.
- 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

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

LESSON 1. Experiments in Optics
General scheme of experiment in Optics. Experimental error estimation in a typical optical experiment.

LESSON 2. Introduction to Instrumental Optics
Introduction. Classification of optical instruments. General features of optical instruments. The eye as a receptor of the information provided by optical instruments

LESSON 3. The magnifying glass.
Introduction. Visual magnification. Normalized values of visual magnification. Field of view. Luminosity. Resolving power.

LESSON 4. The compound microscope
Introduction. Architecture of a compound microscope. Visual magnification. Working distance. Field of view. Depth of focus. Field stops and reticles. Numerical aperture. Luminosity. Resolving power.

LESSON 5. Telescopic systems
Introduction. Afocality. Astronomic telescope. Terrestrial telescope. Inverting systems. Galileos telescope. Reflecting telescopes.

2. Experiments

EXPERIMENT 1. Optical Instruments
a) The microscope. Metrological applications
b) Telescopic systems

EXPERIMENT 2. Measurement of the refractive index gradient in a stratified medium

EXPERIMENT 3. Polarization
a) Experiments with linearly polarized light. Malus law. Brewsters angle
b) Characterization of a polarized light

EXPERIMENT 4. Interference by wavefront division: Youngs fringes
a) Youngs double slit
b) Fresnels biprism

EXPERIMENT 5. Interference by amplitude division: Michelsons interferometer. Measurement of the refractive index of air

EXPERIMENT 6. Grating spectroscopy

EXPERIMENT 7. 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 assessment system for this subject will account for the following contributions:

A) Written examination with questions regarding the theoretical contents of the subject (30 % of the final mark).

B) Assessment of the work performed at the laboratory (70% of the final mark). This contribution can be obtained in two different ways:

Continuous assessment. If the student has attended every laboratory session, this contribution will be obtained as the average of two inputs:

- At the end of each session, the teacher will revise and evaluate the experimental work developed by some teams (pairs) in the class. This assessment will focus on the methodology, the obtained results and the experimental error estimation.

- Additionally, two oral presentations (maximum 15 min. each) of the experimental results achieved in some selected sessions will be evaluated. Presentations will be given in pairs.

Single assessment. If the final mark after “continuous assessment” is lower than 5/10 or the student did not attend all laboratory sessions, this contribution will be evaluated by means of a single practical exam. This individual evaluation will consist in realizing some part of one of the experiments carried out by the student along the academic year. In this assessment, both the data sheets (including a description of the measuring technique and a critical review of the results) and the oral answers to some practical questions will be considered.

The final mark will be obtained after a weighted sum of these contributions. To pass the course the final mark should be greater than or equal to 5/10.

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

1. Contenidos

Los contenidos teóricos se impartieron al 100%

La finalización del periodo presencial afectó a 3 sesiones de laboratorio (de las 10 previstas), 3 de prácticas y 1 de exposición evaluada.

Esta finalización afecta pues en un 30% de reducción a los contenidos prácticos, pero se considera que todos los estudiantes han practicado los elementos básicos considerados en el apartado Resultado del Aprendizaje.

2. Volumen de trabajo y planificación temporal de la docencia

El cierre del laboratorio con el fin de la docencia presencial significa la eliminación de 12 h de docencia presencial en Prácticas de Laboratorio que incrementan hasta las 40 h la Preparación de Actividades de Evaluación y hasta las 42 h la Preparación de Clases Practicas al tener para asumir los conocimientos no practicados de forma presencial

3. Metodología docente

No hay cambios en la metodología docente. Ya se ha impartido el 100% de la teoría y respecto a posibles trabajos de evaluación adicionales, equivaldrían a la preparación por parte del estudiante de las diferentes experiencias que se han dejado de dar.

4. Evaluación

Se mantiene la evaluación prevista, ya que prácticamente toda se ha podido efectuar en periodo presencial. Únicamente se reducirá de 2 a 1 las exposiciones orales de las parejas de estudiantes al tratarse de una actividad presencial.

Si fuera necesario por falta de elementos de evaluación del trabajo de laboratorio se podrá pedir al estudiante un trabajo evaluable sobre alguna de las prácticas que haya dejado de dar.

La evaluación puntual del trabajo de laboratorio, si fuera necesaria, no se realizará presencialmente en el laboratorio sino con un examen oral por videoconferencia individualizada durante 1 h. sobre cuestiones relacionadas con las prácticas realizadas.

5. Bibliografía

Sin cambios.