COURSE DATA

Data Subject	
Code	34292
Name	Physical optics
Cycle	Grade
ECTS Credits	6.0
Academic year	2023 - 2024

Study (s)

Degree	Center	Acad. year	Period
1207 - Degree in Optics and Optometry	Faculty of Physics	3	First term

Subject-matter

Degree	Subject-matter	Character
1207 - Degree in Optics and Optometry	8 - Optics	Obligatory

Coordination

Name	Department
GARCIA MONREAL, FRANCISCO JAVIER	280 - Optics and Optometry and Vision Sciences

SUMMARY

This course is intended for the students to acquire a basic understanding of the subject known as Physical Optics and basically revolves around the electromagnetic wave theory of light. First we study the phenomena characteristic of the wave nature of light such as interference and diffraction. Later, in the context of electromagnetic theory of light, deals with the study of polarization of light and its propagation in material homogeneous, isotropic and anisotropic media. Finally, the course ends with an introduction to corpuscular aspects of light, and the basic processes of interaction between light and matter.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

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

Other requirements

The student must have knowledge of Geometrical Optics and Physics

OUTCOMES

1207 - Degree in Optics and Optometry

- Knowing how to apply the knowledge acquired to professional activity, knowing how to solve problems and develop and defend arguments.
- Being able to gather and interpret relevant data to make judgments.
- Being able to transmit information, ideas, problems and solutions to both a specialized and non-specialized audience.
- Development of learning skills necessary to undertake further studies with a high degree of autonomy.
- To know the characteristic phenomena of the wave nature of light, such as interference, diffraction and polarization.
- To know the propagation of light in isotropic media, light-matter interaction, light interferences, diffraction phenomena, the properties of monolayers and multilayers, and the principles of lasers and their applications.

LEARNING OUTCOMES

To know the general aspects of the wave nature of light
To Know the phenomena of interference and diffraction with application to optical systems in optometry, such as ophthalmic lenses and the human eye.
To Know the phenomenon of polarization, with application to optical systems in optometry, such as measuring instruments and quality control in optometry
To know the propagation of light in isotropic media, the basis of light-matter interaction, the properties of the behavior of light on the surfaces of separation between media and its application in optometry

DESCRIPTION OF CONTENTS

1. Light as a wave

Wave motion: review of basic concepts. Monochromatic waves. Electromagnetic waves. Electromagnetic spectrum. Irradiance of electromagnetic waves. Superposition of harmonic waves

2. Interferences

Interference conditions. Interference wavefront division: Young's fringes. Other devices interference wavefront division. Division of amplitude interference. Applications of interferences

3. Diffraction

Introduction. Fresnel and Fraunhofer diffraction . Diffraction by rectangular apertures. Diffraction gratings. Diffraction by a circular aperture. Resolving power of optical instruments. Diffractive lenses

4. Polarization

Ellipse of polarization. Particular cases. Polarizers. Malus Law. Retarders. Quarter wave and half-wave plates. Natural light and partially polarized light. Degree of polarization

5. Optical properties of homogeneous materials

Reflection and refraction at dielectric. Fresnel formulas. Polarization by reflection and refraction. Uniaxial anisotropic media. Propagation of a monochromatic plane wave. Double refraction and polarization dichroism. Retarders. Polarization dispersion

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	30,00	100
Tutorials	15,00	100
Laboratory practices	15,00	100
Development of individual work	20,00	0
Study and independent work	30,00	0
Preparing lectures	20,00	0
Preparation of practical classes and problem	20,00	0
TOTAL	**150,00**	

TEACHING METHODOLOGY

Theoretical and practical classes: addresses conceptual and formal aspects of the subject. They are based mainly on lectures and using dialogic teaching tools as experimental demonstrations, animations or videos, presentations projection, etc..

Protected classes work: These sessions are focused on student work and active participation of an individual or group in resolving questions arising from the theoretical and practical classes and will also

serve to reinforce concepts more difficult. Besides being classes attached to problem solving for the exercise of the tools presented in the theoretical and practical classes. In this type of class may discuss complementary theoretical aspects which the group will seek interactivity.

Laboratory Practice Sessions: In practice students do experimental work, taking measurements, and proceeding to the registration of data and analysis. They are made in teams of two students. Each student must know how to perform and individually tailor a lab notebook, which includes both the experimental results obtained directly in the practices as those derived from them.

EVALUATION

The evaluation of the course will take into account both the theoretical and practical contents of the course.

Theory and tutored work will score 75% of the final grade. This will be distributed as a 55% of written exam and a 20% of continuous evaluation. The written exam will be composed of both theoretical and practical questions that may have different difficulty and contribution to the grade. The continuous evaluation will consist of the rendering, throughout the term, of exercises and/or questions to be developed by the student.

The laboratory grade will represent the remaining 25% of the final grade. The learning obtained with the practices carried out will be evaluated; in particular, a practical exam will be carried out in the laboratory and the written report of one of the practices carried out during the course could be additionally evaluated if necessary.

A grade higher than 4 is required both in the Theory and Tutored Work part and in the laboratory part.

In the second call, the exams of both the Theory/Tutelated Works and the Laboratory will be carried out. If a grade equal or higher than 5 has been obtained in the theory or laboratory part, the student will be allowed to keep this grade until the second call. To take one of the exams of second call implies not to keep the previous grade, even if the exam is not handed in.

In the second call, the grade will be the highest obtained when considering (a) only the exams or (b) the exams together with the continuous evaluation.

REFERENCES

Basic

- 10.1 Referencias Básicas

Referencia b1: E. Hecht. Óptica. Addison Wesley Iberoamericana (2000).
Referencia b2: P.A. Tipler. Física para la ciencia y la tecnología. Reverté (2000).
Referencia b3: P. M. Mejías y R. Martínez-Herrero. 100 Problemas de Óptica. Alianza (1996).
Referencia b4: E. Hecht. Teoría y problemas de óptica. McGraw-Hill (1992).
Referencia b5: F. Carreño y M. A. Antón. Óptica Física. problemas y ejercicios resueltos. Pearson

Educación (2001).

Additional

- 10.2 Referencias Complementarias

Referencia c1: A. H. Tunnacliffe and J. G. Hirst. Optics. Association of Dispensing Opticians (1998)
Referencia c2: L. S. Pedrotti and F. L. Pedrotti. Optics and Vision. Prentice-Hall International (1998)
Referencia c3: F. L. Pedrotti and L. S. Pedrotti. Introduction to Optics. Prentice-Hall International (1996)