COURSE DATA

DATA SUBJECT

Code: 34292
Name: Physical optics
Cycle: Undergraduate Studies
ECTS Credits: 6
Academic year: 2025-26

STUDY (S)

Degree	Center	Acad. year	Period
1207 - Degree in Optics and Optometry	Facultat de Física	3	First quarter

SUBJECT-MATTER

Degree	Subject-matter	Character
1207 - Degree in Optics and Optometry	Optics	COMPULSORY

COORDINATION

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SUMMARY

This course aims to provide students with a basic understanding of the subject known as Physical Optics, which is fundamentally structured around the electromagnetic wave theory of light. First, the characteristic phenomena of the wave nature of light, such as interference and diffraction, are studied. Then, within the framework of electromagnetic theory, the course covers the study of light polarization and its propagation in homogeneous materials, both isotropic and anisotropic. Finally, an introduction is given to the particle¿like aspects of light and to the basic processes of light¿matter interaction.

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

COMPETENCES / LEARNING OUTCOMES

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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.

Knowing how to apply the knowledge acquired to professional activity, knowing how to solve problems and develop and defend arguments.

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.

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. **Interference**
   Conditions for interference. Interference by division of wavefront: Young's fringes. Other devices for wavefront division. Interference by amplitude division. Applications of interference.

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

4. **Polarization**
   Polarization ellipse. Special cases. Polarizers. Malus' law. Retarders. Quarter-wave and half-wave plates.

Natural and partially polarized light. Degree of polarization.

5. **Optical properties of homogeneous materials**
Reflection and refraction in dielectrics. Fresnel equations. Polarization by reflection and refraction. Uniaxial anisotropic media. Propagation of a monochromatic plane wave. Polarization by birefringence and dichroism. Retarders. Polarization by scattering.

WORKLOAD

PRESENCIAL ACTIVITIES

Activity	Hours
Tutorials	15,00
Theory	30,00
Laboratory	15,00
Total hours	**60,00**

NON PRESENCIAL ACTIVITIES

Activity	Hours
Attendance at other activities	0,00
Individual or group project	50,00
Independent study and work	30,00
Preparation of lessons	0,00
Preparation for assessment activities	10,00
Resolution of case studies	0,00
Total hours	**90,00**

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 references:

- Hecht, E. *Óptica*. Addison Wesley Iberoamericana, 2000. ISBN 978-0201579656
- Hecht, E. *Teoría y problemas de óptica*. McGraw-Hill, 1992. ISBN 978-8448100653
- Carreño, F. y Antón, M. A. *Óptica física. Problemas y ejercicios resueltos*. Pearson Educación, 2001. ISBN 978-8420532425

Complementary references:

- Tipler, P. A. *Física para la ciencia y la tecnología*. Reverté, 2000. ISBN 978-8429141956

- Mejías, P. M. y Martínez-Herrero, R. *100 problemas de óptica*. Alianza Editorial, 1996. ISBN 978-8420628821
- Tunnacliffe, A. H. y Hirst, J. G. *Optics*. Association of Dispensing Opticians, 1998. ISBN 978-0952314515
- Pedrotti, L. S. y Pedrotti, F. L. *Optics and Vision*. Prentice-Hall International, 1998. ISBN 978-0132615129
- Pedrotti, F. L. y Pedrotti, L. S. *Introduction to Optics*. Prentice-Hall International, 1996. ISBN 978-0131499331