VNIVERSITAT DE VALÈNCIA

**Course Guide**
**34292 Physical optics**

# COURSE DATA

## DATA SUBJECT

**Code:** 34292
**Name:** Physical optics
**Cycle:** Undergraduate Studies
**ECTS Credits:** 6
**Academic year:** 2026-27

## 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

GARCIA MONREAL FRANCISCO JAVIER

# SUMMARY

This course aims to provide students with a basic understanding of Physical Optics, a subject mainly structured around the electromagnetic wave theory of light. First, the course studies the characteristic phenomena of the wave nature of light, such as interference and diffraction. Subsequently, within the framework of electromagnetic theory, it addresses the study of light polarization and its propagation in homogeneous material media, both isotropic and anisotropic. Finally, it introduces the particle-like aspects of light, as well as 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

## COMPETENCES / LEARNING OUTCOMES

### 1207 - Degree in Optics and Optometry

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: the conceptual and formal aspects of the subject will be addressed. These classes will be mainly based on interactive lectures and on the use of teaching resources such as experimental demonstrations, animations or videos, slide presentations and other supporting materials.

Tutored work classes: these sessions will focus on students' work and active participation, either individually or in groups, in solving questions arising from the theoretical and practical classes. They will also serve to reinforce the most difficult concepts. In addition, they will be aimed at solving problems through the application of the tools presented in the theoretical and practical classes. Complementary theoretical aspects may also be addressed in these sessions, promoting group interaction.

Laboratory practical sessions: in the practical sessions, students will carry out experimental work, perform measurements and record and analyse data. The practical sessions will be carried out in teams of two students. Students must know the procedure for carrying out the practical sessions and prepare an individual laboratory notebook, including both the experimental results obtained directly during the sessions and the results derived from them.

## EVALUATION

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

The final grade will be obtained from the following components:

1. Written examination on theory and tutored work: 55% of the final grade. The examination will include theoretical and practical questions, which may differ in difficulty and in their contribution to the grade.
2. Continuous assessment of theory and tutored work: 20% of the final grade. This will consist of exercises and/or questions to be completed by students throughout the semester.
3. Laboratory assessment: 25% of the final grade. The learning acquired in the laboratory practical sessions will be assessed by means of a practical laboratory examination.

To pass the course, students must obtain a grade equal to or higher than 4.0 out of 10 in both the theory and tutored work component and the laboratory component. The final grade will only be calculated when this minimum requirement is met in both components.

In the second examination period, examinations will be held for both the theory/tutored work component and the laboratory component. If students have obtained a grade equal to or higher than 5.0 in either the theoretical component or the laboratory component in the first examination period, they may keep that grade until the second examination period. Sitting one of the examinations in the second examination period means waiving the previous grade for that component, even if the examination is not submitted.

The written examination on theory and tutored work and the practical laboratory examination are recoverable activities in the second examination period. Continuous assessment is not recoverable, but in the second examination period it will only be taken into account when it improves the student's final grade. Therefore, in the second examination period, the grade will be the highest obtained by considering: a) only the examinations, or b) the examinations together with the continuous assessment.

## 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