COURSE DATA

DATA SUBJECT

Code: 34294
Name: Physiological 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	1	Second quarter

SUBJECT-MATTER

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

COORDINATION

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SUMMARY

The subject of Physiological Optics is responsible for explaining from a theoretical point of view, the fundamentals of optometry.

This subject needs basic knowledge of ocular anatomy, as well as treatment of optical systems, knowledge already achieved in the subjects of human and ocular anatomy and the subject of geometric optics.

At the beginning, a correlation is made between the knowledge gained in geometric optics and the new reformulation of all this knowledge so that it can be applied in a simple way to the optical part of the visual system.

Once the reformulation is done, various models of the visual system will be analyzed, which will help us to be able to study different behaviors of the visual system. In addition, the concept of the emmetropic eye will be introduced, as that eye to which every optical system is intended to resemble.

The concept of visual acuity, which is fundamental in the life of any optometrist, will also be discussed. In daily practice, visual acuity is a measure that allows us to have an estimate of the patient's visual quality. It

will look at how to measure and calculate it, both theoretically and experimentally.

When an eye is no longer emmetropic, it is because it is ametropic. Patients with ametropia have problems in their daily lives. In addition, if they are presbyopic, they present additional problems in near vision. In this subject we will name spherical and cylindrical ametropia and, through a mathematical treatment, we will try to understand the symptoms of these patients. The last topics will address how, from an optometric point of view, we can compensate for these ametropias, and what the consequences are for doing so.

PREVIOUS KNOWLEDGE

RELATIONSHIP TO OTHER SUBJECTS OF THE SAME DEGREE

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

OTHER REQUIREMENTS

Geometric optics: provides the mathematical tools of the subject.
Human and ocular anatomy: it provides the anatomical knowledge with which it is going to work.

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 have and to understand the fundamentals of Optometry for its correct clinical and healthcare application.

To know and to understand the principles of compensation through ophthalmic lenses and other techniques.

To know the basic models of vision.

To know the ocular parameters and models.

To recognize the eye as an optical system.

To understand the factors that limit the quality of the retinal image.

DESCRIPTION OF CONTENTS

1. Geometric optics applied to the eye

We will make an adaptation of the paraxial equations seen in the subject of Geometric Optics in the eye. Proximities and powers, main power and equivalent power will be calculated. The formulas of step or effectiveness and the formulas of the couplings of systems will also be reformulated.

2. Theoretical eye

We will apply all this knowledge to define the human eye as an optical system. The approaches needed to modelize human eye will be discussed, as well as some of the existing theoretical eye models, such as Legrand's theoretical eye, the simplified theoretical eye, and the reduced theoretical eye.

3. The emmetropic eye

We will explain concept of emmetropic eye, working on the concepts of remote point, retinal image of a point and a large focused and out-of-focus object, sharpness, depth of field, and catopic and entoptic images.

4. Accommodation and presbyopia

The concept of accommodation amplitude and clear vision interval (IVN) will be addressed. However, we will talk about eye modifications during accommodation, and how these changes affect the theoretical eye, the size of the retinal image, the pseudo-image, and the blur circle. It will study the decrease in the amplitude of accommodation with age, called presbyopia, how to compensate for it, and how IVN compensation changes.

5. Spherical ametropia

A definition, classification and formulation of spherical ametropias will be made. We will learn about the concepts of axial and refractive ametropia, and how this ametropia affects IVNs, and combined with accommodation.

6. Compensation of ametropias

We will study how to compensate patients with spherical ametropias, and how this compensation affects concepts such as the pupil diameter, optical magnification, retinal image size, and accommodation amplitude. The concept of spherical ametropy and presbyopia compensation, and compensation tolerance will also be combined

7. Astigmatism

We will learn the astigmatism concept. We will study its anatomical origin, definitions and classifications, the vision of these eyes, the sizes of the retinal images, the accommodation and the appropriate optical compensationsthat we must use in these patients.

8. Visual acuity.

We wil study the concept of visual acuity (VA) as a measure of the optical quality of the eye. The limits of spatial vision, the resolving power of the eye, various definitions of VA, VA tasks and optotypes will be explored. We relate these concepts with the distribution of the photoreceptors in the retina, the visual field and the aberrations in the eye.

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	10,00
Independent study and work	20,00
Preparation of lessons	20,00
Preparation for assessment activities	30,00
Resolution of case studies	10,00
Total hours	**90,00**

TEACHING METHODOLOGY

Theoretical-practical classes Conceptual and formal aspects of this subject are addressed. They are based on the master class dialogue and the use of teaching tools as experimental demonstrations, animations or videos, presentations, etc. Exercises of practical application of the theoretical contents will also be developed. In some particular cases, the use of the computer room could be planned.

Seminars: This part of the course is subject to continuous assessment and is non-recoverable. These sessions are focused on the student's work and their active participation individually or in groups in resolving doubts arising from the theoretical-practical classes and they will also serve to reinforce concepts of greater difficulty. In addition, these classes are intended for problem solving because the tools

presented in the theoretical-practical classes are exercised.

Laboratory: This part of the subject is recoverable continuous assessment. It is proposed to the student to work on an optical bench making different eye simulations. It is intended to recognize the ametropia of each proposed eye and to analyze a possible optical compensation; students will also learn to determine clear vision intervals with and without the compensating lens.

EVALUATION

Evaluation System for This Subject

A) **Theoretical Assessment**: Students will be evaluated through exercises with theoretical questions to verify their understanding of fundamental concepts, as well as theoretical-practical questions to assess their ability to apply studied techniques and models to real situations. The student's critical thinking skills, argumentation, and justifications will always be considered. This evaluation may include true/false questions, practical applications of theory, and multiple-choice questions where incorrect answers may reduce the score of correctly answered questions. This section accounts for **70%** of the final grade. To average with other parts of the course, students must obtain a minimum score of **4 out of 10**.

B) **Laboratory Assessment:** Students' skills, adaptability, and ability to handle real-life situations will be evaluated. This continuous assessment is recoverable and represents **20%** of the final grade. To average with other parts of the course, students must obtain a minimum score of **4 out of 10**.

C) **Seminar Assessment** This evaluation is based on students' participation in problem-solving and submission of exercises throughout the course. Only assignments submitted through the virtual classroom within the established deadline will be considered. This continuous assessment is non-recoverable and represents **10%** of the final grade, without requiring a minimum score to average with the other sections of the course.

In the retake of the exam of this subject, the grade obtained in the seminar component will be retained, as it is a continuous, non-recoverable assessment. Regarding the theoretical and laboratory components, if the student obtained a grade equal to or greater than 4 and less than 5 in either of them during the first exam, they may keep that grade for the second session and decide whether or not to retake that part. It will not be permitted to retake any component¿whether theoretical or laboratory¿in which a grade equal to or greater than 5 was obtained. Conversely, it will be mandatory to retake any component in which the grade was below 4 out of 10.

REFERENCES

- Referencia b1: L¿ull humà com a sistema òptic, Camps V, Coloma P, Verdú FM, Viqueira V, de Fez D. Publicacions de la Universitat d¿Alacant. Edició 2011. ISBN:978-84-9717-147-2
- Referencia b2: Óptica Fisiológica: modelo paraxial y compensación óptica del ojo, Martínez-Verdú, Viqueira, de Fez. Publicacions de la Universitat d¿Alacant. Edició 2004. ISBN:8479087757