VNIVERSITAT DE VALÈNCIA

Course Guide
34294 Physiological optics

COURSE DATA

Data Subject	
Code	34294
Name	Physiological optics
Cycle	Grade
ECTS Credits	6.0
Academic year	2022 - 2023

Study (s)

Degree	Center	Acad. year	Period
1207 - Degree in Optics and Optometry	Faculty of Physics	1	Second term

Subject-matter

Degree	Subject-matter	Character
1207 - Degree in Optics and Optometry	9 - Physiological optics	Obligatory

Coordination

Name	Department
DIEZ AJENJO, MARIA AMPARO	280 - Optics and Optometry and Vision Sciences
ESTEVE TABOADA, JOSE JUAN	280 - Optics and Optometry and Vision Sciences

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.

OUTCOMES

1207 - Degree in Optics and Optometry

- To have and to understand the fundamentals of Optometry for its correct clinical and healthcare application.
- 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 recognize the eye as an optical system.
- To know the ocular parameters and models.
- To understand the factors that limit the quality of the retinal image.
- To know and to understand the principles of compensation through ophthalmic lenses and other techniques.

- To know the basic models of vision.

LEARNING OUTCOMES

- Distinguish perfectly the different ametropia that a healthy eye can have

- Know how to correct them using compensating lenses

- Be able to solve any type of calculation with the eye: size of an image, entrance pupil, etc.

- To be able to determine the Visual Acuity of an eye to know if its visual capacity is normal or not.

- Know in what conditions the previous AV determinations must be made to be correct.

- Have the ability to analyze, interpret and treat the particularities of each eye that is examined

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

ACTIVITY	Hours	% To be attended
Theory classes	30,00	100
Tutorials	15,00	100
Laboratory practices	15,00	100
Development of group work	10,00	0
Study and independent work	20,00	0
Resolution of case studies	10,00	0
TOTAL	**100,00**	

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 recoverable with continuous assessment. 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

The evaluation system of this subject will be based on:

A) Theoretical evaluation, through exercises of theoretical questions that allow to verify the assimilation of theoretical foundations of the subject and theoretical-practical issues where the students' ability to carry out real applications of the studied techniques and models is evaluated. The critical capacity of the student will be evaluated, as well as the argumentation and justifications proposed. To carry out this evaluation, questions of true / false type, questions of practical application of the theory and even questions of test type can be used where the wrong answer of any of the questions will subtract part of the questions answered correctly. The written evaluation represents 70% of the final grade and, to make it average with the other evaluation modalities, it will be necessary to obtain a minimum of 4 points out of 10.

B) Laboratory evaluation, through the evaluation of the skill and ability of the student, and also the ability to adapt to the different cases that may arise in real life. The practical evaluation is a retrievable continuous assessment, represents 20% of the final grade of the subject and it will be necessary to obtain a minimum score of 4 points out of 10 to make it average with the rest of the evaluation modalities.

C) Seminars evaluation, established from the student's participation in the resolution and delivery of exercises during the course. This evaluation is continuous and retrievable, represents 10% of the total grade of the subject and no minimum grade will be necessary to do the average with the other evaluation modalities.

REFERENCES

Basic

- Referencia b1: Lull humà com a sistema òptic, Camps V, Coloma P, Verdú FM, Viqueira V, de Fez D. Publicacions de la Universitat dAlacant. 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 dAlacant. Edició 2004. ISBN:8479087757