

370507 - OPTIVISUAL - Visual Optics

Coordinating unit: 370 - FOOT - Terrassa School of Optics and Optometry
Teaching unit: 731 - OO - Department of Optics and Optometry
Academic year: 2019
Degree: BACHELOR'S DEGREE IN OPTICS AND OPTOMETRY (Syllabus 2009). (Teaching unit Compulsory)
ECTS credits: 6 Teaching languages: Catalan

Teaching staff

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Degree competences to which the subject contributes

Specific:

1. Technical english applied to optics and optometry
2. Understanding the mechanism of imaging and information processing in the visual system.
3. Being able to take, treat, represent and interpret experimental data. "Use basic laboratory equipment and techniques"
4. Knowing how to do clinical examinations and interpret the results
5. Evaluate the process of formation of the optical image in the retina and the transmission and information processing in the brain
6. Know interpret functional and health test results of the visual system.
7. Value the effects (perceptual changes) caused by the glasses, optical aids and protection elements in the visual system.

Generical:

8. Extract the main points of a text or any source of information (oral or written)
9. Synthesize and organize information to convey it effectively orally and / or written
10. Display information orally and in writing of reasonably and coherent.
11. Define the general objectives and to carry out a specific group
12. Assessing the acquisition of the course objectives.
13. Locate new information and the interpretation of it in its context.
14. Value the methods used to achieve the objectives.
15. Working with evidence, methodology and rigour.

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Teaching methodology

On the one hand the controlled learning hours consist of lectures (large group) in which the teachers make a brief introduction to the general learning objectives related to the basic concepts of matter. Through practical exercises we try to motivate and engage students to participate actively in their learning. It uses support material in the form of detailed syllabus by ATENEA: learning objectives for content, concepts, examples, programming and evaluation activities of learning and literature. On the other hand, can also consist of classes of problems (which works, generally in groups of 3 to 4 members), by solving exercises and numerical problems related to the specific learning objectives of each content of the course. In these sessions is to incorporate some problems generic skills such as teamwork competition.

The last type of controlled learning hours is to realize seven laboratory practices, which are made in couples. And can develop basic instrument skills in a laboratory and initiate the students in the application of scientific method in solving problems. The small group is subdivided into seven subgroups. Assigned to draw one of the 7 practices each subgroup, which we call sub-charge. This must prepare (with the help of the teacher and the script of practice) the practice in terms of theoretical, experimental method and material used. At the beginning of the laboratory session the subgroup will charge you a brief overview of the development of practice. The subgroup should also be able to resolve the doubts that may arise to their companions. The subgroup will be commissioned to develop a full practice, containing all the experimental results of their companions. The note of the report will count together with the development of the explanation of the practice in the laboratory, giving the fraction of EL rating. We must also consider other hours of independent learning such as those dedicated to the reading-oriented, solving proposed questionnaires or self-study of the contents through the virtual campus Atenea.

Learning objectives of the subject

- To understand the process of image formation and the properties of the optical systems.
- To recognize the eye as optical system.
- To understand and to handle the basic laboratory equipment and techniques.
- To know the parameters and the models of eye.
- To understand the factors that limit the quality of the retinal image.
- To be able to perform psychophysical tests to determine levels of visual perception.
- To knowing the properties and functions of the several elements of the visual system.
- To understand the principles and to have the ability to measure, to interpret and to treat abnormalities of binocular vision and accommodative.
- To be able to measure and to interpret the data obtained in the psychophysical assessment of visual perception.

Study load

Total learning time: 154h	Hours large group:	0h	0.00%
	Hours medium group:	48h	31.17%
	Hours small group:	12h	7.79%
	Guided activities:	10h	6.49%
	Self study:	84h	54.55%

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Content

<p>1. Introduction to Visual Optics</p>	<p>Learning time: 6h Practical classes: 3h Laboratory classes: 1h Guided activities: 0h Self study : 2h</p>
<p>Description: In this content is worked:</p> <p>The concept of visual optics and the situation within the context of the degree Geometrical optics applied to the eye: vergence notation.</p>	
<p>2. Model of the optical system of the eye. Training Images</p>	<p>Learning time: 42h Practical classes: 15h Laboratory classes: 4h Guided activities: 0h Self study : 23h</p>
<p>Description: This content is worked:</p> <p>EYE THEORY: Optical constants of the eye. Approaches in Theoretical model of the Eye: focusing system and paraxial approximation. Optics of the cornea. Optical lens. The complete theoretical eye. Diaphragm opening and pupils of the eye. Visual field. The Eye Theoretical Concessions. Axes and angles of the eye.</p> <p>Related activities: It carried out activities 1 and 2.</p> <p>Specific objectives: IMAGES formed by the eye: types of images formed by the eye. Image diòptriques. Retinal Image. Specific purpose. Circle of blur. Large object. Retinal Image Size. Level of sharpness / blurring of the retinal image. Depth of field and depth of focus. Catadiòptriques Images: images of Purkinje.</p> <p>Visual acuity: visual discrimination tasks. Type of visual acuity. Calculation optotips. Factors affecting visual acuity (A.V.). Peripheral visual acuity. Kinetic visual acuity.</p>	

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<p>3. Optics of the accommodating</p>	<p>Learning time: 23h Practical classes: 8h Laboratory classes: 2h Guided activities: 0h Self study : 13h</p>
<p>Description: his content is worked:</p> <p>THE ACCOMMODATION: Concept and definition. Amplitude of accommodation and travel. Modifications to accommodate the eye. The theoretical eye accommodated. Image Size retinal in the eye accommodated. Accommodated accommodative stimulus and response.</p> <p>Presbyopia: Concept and definition. Variations of accommodation with age. Neutralization of presbyopia. Zones of sharp vision. Influence of depth of field. Calculation of special additions.</p> <p>Related activities: It carries out activities 3.</p>	

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<p>4. Optics of refractive error and its neutralization</p>	<p>Learning time: 65h Practical classes: 21h Laboratory classes: 6h Guided activities: 0h Self study : 38h</p>
<p>Description: This content is worked:</p> <p>THE spherical refractive error: Concept of refractive error. Formula optics of refractive error. Types of refractive error. Axial and refractive refractive error. Deviation of axial length on the status of refractive error. Amplitude of accommodation and tour of the eye refractive error. Hyperopia and accommodation. Myopia by inadequate stimulation. Retinal Image Size. Grade of blurring of the retinal image. Relationship between visual acuity and refractive error.</p> <p>Neutralization perspective of refractive error: Principle and value of the neutralization. Influence of distance from the vertex. System-eye lens. The pupil of the eye refractive error neutralized. Tolerance of optical neutralization. Accommodation of the eye refractive error neutralized. Neutralization of the eye refractive error Presbyterian. Retinal Image Size. Comparison with the eye refractive error without neutralizing. Increased slow. Comparison with the eye emmetrop. Relative increase of the lens.</p> <p>Aphakic THE EYE: The theoretical aphakic eye. Refraction of the eye aphakic. Optical neutralization of aphakia. The theoretical Pseudophakic eye.</p> <p>Astigmatism: Definition and causes of astigmatism. Astigmatism of the cornea. Total Eye Astigmatism. The Eye Theoretical Astigmàtic. Classification of astigmatism: examples. Retinal image of an object off. Conoid of Sturm. Size of a large retinal image. Comparison with the eye emmetrop. Astigmàtic accommodation of the eye.</p> <p>OPTICAL neutralization of astigmatism: Principle and value of the neutralization. Retinal Image Size. Comparison with the eye astigmàtic not neutralized. Comparison with the eye emmetrop. Astigmatism in near vision.</p> <p>Related activities: It carried out activities 4,5 and 6.</p>	
<p>5. Optical quality of the retinal image.</p>	<p>Learning time: 14h Theory classes: 0h Practical classes: 4h Laboratory classes: 2h Guided activities: 0h Self study : 8h</p>
<p>Description: This content is worked: Specifications on the optical quality of the retinal image. Blur. Monochromatic aberrations. Chromatic aberration. Intraocular Circulation. Diffraction.</p> <p>Related activities: It carries out activities 7.</p>	



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Planning of activities

<p>1. LABORATORY. FIELD OF VIEW (CONTENT 2)</p>	<p>Hours: 2h Laboratory classes: 2h</p>
<p>Description: Practice should be done in the laboratory, in pairs, with a duration of 2 hours. The laboratory should carry out the experimental part, as a self-directed learning is planned that the students do after reading the script and answer the questionnaire to identify relevant targets from the viewpoint of results of learning to be achieved after the experiment. Later, the teacher makes an oral test, using questions prior to testing to identify learning prelaboratori. The practice is done in the Laboratory of Physiological Optics, TR8 building, floor -2</p> <p>Support materials: All materials for the realization of the experiment is available in the laboratory. Written with the questionnaire and detailed notes of the theme available (PowerPoint) to Atenea.</p> <p>Descriptions of the assignments due and their relation to the assessment: Register by the teachers check the students' independent learning and work in the laboratory and questionnaire results of the experiment at the end of the session. It becomes fixed and the corresponding feedback to the teacher the next session. Part of 10% of the final deliverables for the Laboratory (EL).</p> <p>Specific objectives: At the end of practice the student or student should be able to:</p> <ul style="list-style-type: none"> · Familiar with the tools and methods for measuring the visual field. · Understand the variables that come into play in each of the two measuring instruments. <p>Obtain a field isoptera central and peripheral field and represent them in a diagram perimeter.</p>	
<p>2. LABORATORY. VISUAL ACUITY (CONTENT 2)</p>	<p>Hours: 2h Laboratory classes: 2h</p>
<p>Description: Practice should be done in the laboratory, in pairs, with a duration of 2 hours. The laboratory should carry out the experimental part, as a self-directed learning is planned that the students do after reading the script and answer the questionnaire to identify relevant targets from the viewpoint of results of learning to be achieved after the experiment. Later, the teacher makes an oral test, using questions prior to testing to identify learning prelaboratori. The practice is done in the Laboratory of Physiological Optics, TR8 building, floor -2.</p> <p>Support materials: All materials for the realization of the experiment in the laboratory Written with the questionnaire and detailed notes of the theme available (PowerPoint) to Atenea.</p> <p>Descriptions of the assignments due and their relation to the assessment: Register by the teachers check the students' independent learning and work in the laboratory and questionnaire results of the experiment at the end of the session. It becomes fixed and the corresponding feedback to the teacher the next session. Part of 10% of the final deliverables for the Laboratory (EL).</p> <p>Specific objectives: At the end of practice the student or student should be able to:</p> <p>Calculate · visual acuity for different screening criteria</p> <ul style="list-style-type: none"> · Determine the influence of visual acuity on clinical factors such as type of test, contrast and eccentricity. · Recognising the different types of notation and know how to move from one to another. · Mastering the use of letters optotips at different distances from the calibration 	

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3. LABORATORY. PRESBYOPIA. AREAS OF VIEW OF A PRESBYTERIAN (CONTENT 3)	Hours: 2h Laboratory classes: 2h
<p>Description: Practice should be done in the laboratory, in pairs, with a duration of 2 hours. The laboratory should carry out the experimental part, as a self-directed learning is planned that the students do after reading the script and answer the questionnaire to identify relevant targets from the viewpoint of results of learning to be achieved after the experiment. Later, the teacher makes an oral test, using questions prior to testing to identify learning prelaboratori. The practice is done in the Laboratory of Physiological Optics, TR8 building, floor -2.</p> <p>Support materials: All materials for the realization of the experiment in the laboratory Written with the questionnaire and detailed notes of the theme available (PowerPoint) to Atenea.</p> <p>Descriptions of the assignments due and their relation to the assessment: Register by the teachers check the students' independent learning and work in the laboratory and questionnaire results of the experiment at the end of the session. It becomes fixed and the corresponding feedback to the teacher the next session. Part of 10% of the final deliverables for the Laboratory (EL).</p> <p>Specific objectives: At the end of practice the student or student should be able to: · Determine the variation of the different zones of vision in one eye emmetrop Presbyterian, for different values of the amplitude of accommodation, simulating the condition of presbyopia eye on an optical bench.</p>	
4. LABORATORY. SPHERICAL REFRACTIVE ERROR. MYOPIA. (CONTENT 4)	Hours: 2h Laboratory classes: 2h
<p>Description: Practice should be done in the laboratory, in pairs, with a duration of 2 hours. The laboratory should carry out the experimental part, as a self-directed learning is planned that the students do after reading the script and answer the questionnaire to identify relevant targets from the viewpoint of results of learning to be achieved after the experiment. Later, the teacher makes an oral test, using questions prior to testing to identify learning prelaboratori. The practice is done in the Laboratory of Physiological Optics, TR8 building, floor -2.</p> <p>Support materials: All materials for the realization of the experiment in the laboratory Written with the questionnaire and detailed notes of the theme available (PowerPoint) to Atenea.</p> <p>Descriptions of the assignments due and their relation to the assessment: Register by the teachers check the students' independent learning and work in the laboratory and questionnaire results of the experiment at the end of the session. It becomes fixed and the corresponding feedback to the teacher the next session. Part of 10% of the final deliverables for the Laboratory (EL).</p> <p>Specific objectives: At the end of practice the student or student should be able to: · To study the differences and similarities between axial myopia and refractive, and various aspects of the neutralization and the accommodation of the myopic, using a model eye on simulated optical bench.</p>	

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<p>5. LABORATORY. SPHERICAL REFRACTIVE ERROR. HYPEROPIA (CONTENT 4)</p>	<p>Hours: 2h Laboratory classes: 2h</p>
<p>Description: Practice should be done in the laboratory, in pairs, with a duration of 2 hours. The laboratory should carry out the experimental part, as a self-directed learning is planned that the students do after reading the script and answer the questionnaire to identify relevant targets from the viewpoint of results of learning to be achieved after the experiment. Later, the teacher makes an oral test, using questions prior to testing to identify learning prelaboratori. The practice is done in the Laboratory of Physiological Optics, TR8 building, floor -2.</p> <p>Support materials: All materials for the realization of the experiment in the laboratory Written with the questionnaire and detailed notes of the theme available (PowerPoint) to Atenea.</p> <p>Descriptions of the assignments due and their relation to the assessment: Register by the teachers check the students' independent learning and work in the laboratory and questionnaire results of the experiment at the end of the session. It becomes fixed and the corresponding feedback to the teacher the next session. Part of 10% of the final deliverables for the Laboratory (EL).</p> <p>Specific objectives: At the end of practice the student or student should be able to:</p> <ul style="list-style-type: none"> · To study the differences between the axial and refractive hyperopia, and various aspects of the accommodation and the neutralization of hyperopia using a model eye on simulated optical bench. 	
<p>6. LABORATORY. ASTIGMATISM (CONTENT 4)</p>	<p>Hours: 2h Laboratory classes: 2h</p>
<p>Description: Practice should be done in the laboratory, in pairs, with a duration of 2 hours. The laboratory should carry out the experimental part, as a self-directed learning is planned that students do after reading the script and answer the questionnaire to identify relevant targets from the viewpoint of results of learning to be achieved after the experiment. Later, the teacher makes an oral test, using questions prior to testing to identify learning prelaboratori. The practice is done in the Laboratory of Physiological Optics, TR8 building, floor -2.</p> <p>Support materials: All materials for the realization of the experiment in the laboratory Written with the questionnaire and detailed notes of the theme available (PowerPoint) to Atenea.</p> <p>Descriptions of the assignments due and their relation to the assessment: Register by the teachers check the students' independent learning and work in the laboratory and questionnaire results of the experiment at the end of the session. It becomes fixed and the corresponding feedback to the teacher the next session. Part of 10% of the final deliverables for the Laboratory (EL).</p> <p>Specific objectives: At the end of practice the student or student should be able to:</p> <ul style="list-style-type: none"> · To study the formation of images of various objects to one eye astigmatic, using a model eye on simulated optical bench. · Understanding the ray tracing in one eye astigmatic. · Understanding the neutralization of the negative cylinder astigmatic eye. 	

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7. LABORATORY. ABERRATIONS (CONTENT 5)	Hours: 2h Laboratory classes: 2h
<p>Description: Practice should be done in the laboratory, in pairs, with a duration of 2 hours. The laboratory should carry out the experimental part, as a self-directed learning is planned that students do after reading the script and answer the questionnaire to identify relevant targets from the viewpoint of results of learning to be achieved after the experiment. Later, the teacher makes an oral test, using questions prior to testing to identify learning prelaboratori. The practice is done in the Laboratory of Physiological Optics, TR8 building, floor -2.</p> <p>Support materials: All materials for the realization of the experiment in the laboratory Written with the questionnaire and detailed notes of the theme available (PowerPoint) to Atenea</p> <p>Descriptions of the assignments due and their relation to the assessment: Register by the teachers check the students' independent learning and work in the laboratory and questionnaire results of the experiment at the end of the session. It becomes fixed and the corresponding feedback to the teacher the next session. Part of 10% of the final deliverables for the Laboratory (EL).</p> <p>Specific objectives: At the end of practice the student or student should be able to: · Analyse the spherical and chromatic aberrations in a longitudinal and transverse theoretical model eye. Check · expression variation of aberrations according to several variables by fitting curve made with Excel. · Familiar with optical design software Beam4.</p>	
8. TEST PART 1 (PAC1)	Hours: 1h Practical classes: 1h
<p>Description: Proof of a single classroom hour with 1 or 2 exercises on a theoretical and practical concepts of the absolute minimum of the course.</p> <p>Support materials: Statements, form and calculator to perform the test.</p> <p>Descriptions of the assignments due and their relation to the assessment: Resolution of the test. Represents 35% of the final grade for the course.</p> <p>Specific objectives: After the test, the student or student should be able to: · To achieve the specific objectives of the contents 1, 2 y 3.</p>	
9. TEST PART 2 (pac2)	Hours: 2h Practical classes: 2h
<p>Description: Individual test in the classroom two hours with the contents of the course. Theoretical concepts of the course the absolute minimum resolution of 3 or 4 issues related to the learning of all course content.</p> <p>Support materials: Statements, form and calculator to perform the test.</p>	

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Descriptions of the assignments due and their relation to the assessment:
Resolution of the test. Represents 35% of the final grade for the course.

Specific objectives:

- After the test, the student or student should be able to:
- Achieve the specific objectives of the contents 1,2,3,4 and 5.

10. PRACTICE TEST (PAL)

Hours: 1h
Practical classes: 1h

Description:

Test of a single classroom hour on the concepts and practical situations worked in the laboratory.

Support materials:

Statements, form and calculator to perform the test.

Descriptions of the assignments due and their relation to the assessment:

Resolution of the test. Represents 20% of the final grade for the course.

Specific objectives:

- After the test, the student or student should be able to:
- Achieve the objectives of the laboratory course.

11. Classroom exercises (EA)

Hours: 2h
Practical classes: 2h

Qualification system

The final mark is the weighted sum of the following qualifications:

$$QF=0.35*PAC1+0.35*PAC2+0.2*PAL+0.1*EA$$

- QF: Final mark
PAC1: First test of continuous assessment
PAC2: Second test of continuous assessment where will be possible to improve de mark of PAC1
PAL: Laboratory test
EA: Classroom exercises and attendance

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Regulations for carrying out activities

In case that PAC1's mark is < 4 , it will be able to be recovered in the day of PAC2.

- Attendance to lectures is mandatory because it is taken into account in the 10% of the final mark. So, attendance is monitored each day of class.
- If any of the laboratory activities is not done, it will be considered as non-rated and discounting from the total practical mark (PAL) the 16.67% per each session not attended.
- In case of having pass the theoretical part but not passing the final mark (QF) due to a low PAL performance, this last part cannot be recovered. It will be needed to increase the mark in the theoretical part at the end of semester.

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Basic:

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