Universidad Zaragoza

# 26807 - Optical and Optometric Instruments

## Syllabus Information

**Academic Year:** 2018/19
**Subject:** 26807 - Optical and Optometric Instruments
**Faculty / School:** 100 - Facultad de Ciencias
**Degree:** 297 - Degree in Optics and Optometry
**ECTS:** 12.0
**Year:** 2
**Semester:** Annual
**Subject Type:** Compulsory
**Module:** ---

## 1.General information

### 1.1.Aims of the course

### 1.2.Context and importance of this course in the degree

### 1.3.Recommendations to take this course

## 2.Learning goals

### 2.1.Competences

### 2.2.Learning goals

### 2.3.Importance of learning goals

## 3.Assessment (1st and 2nd call)

### 3.1.Assessment tasks (description of tasks, marking system and assessment criteria)

## 4.Methodology, learning tasks, syllabus and resources

### 4.1.Methodological overview

**The learning process that is designed for this subject is based on the following:**

Theoretical sessions that consist mainly in both theoretical and problem-participatory lectures in which student participation will be promoted, valuing it as continuous assessment.

Laboratory sessions will consist of the realization, in pairs, internship and practical optical bench simulation with ray tracing programs. In order that when students arrive at the laboratory already have a previous idea of ??the work to be done previously will have a script of practices where the theoretical concepts necessary for the realization of the same and the goals to be achieved are listed, and an explanation of the experimental devices and activities during practice.

Continuous learning will be stimulated by tasks proposed sessions both theory and practice, the students will hand through the moodle platform. In addition it is intended to stimulate autonomous student learning through the development of a job or project to be presented at the end of the course.

### 4.2.Learning tasks

1. Acquisition of basic knowledge of Geometrical Optics, Aberrations and Instruments (7 ECTS).

Methodology:

Participatory lectures in large group.
Tutorials (small groups and / or individual)
Peer education through the discussion forum of the subject.
Self-learning: I watch videos and program management for ray tracing.

1. Troubleshooting and analysis of practical cases (1 ECTS)

Methodology:
Learning based on cases analyzed in small groups.
Learning based on analysis and problem solving.

1. Acquisition of practical knowledge, skills and abilities in conceptual design, use and analysis instruments (3 ECTS)

Methodology:
Laboratory practice in small groups.

1. Design, development and analysis instruments through raytracing software (1 ECTS).

Methodology:
Guided practices real raytracing
Simulation of systems in ray tracing programs.
Group work with oral presentation thereof.
Individual work through exercises in moodle.

### 4.3.Syllabus

Theoretical contents:
1. Perfect optical systems
2. Photometry
3. Key features of optical instruments
4. The camera
5. Projection systems
6. Loupes and eye
7. Telescopes
8. Microscopes
9. Optic matrix
10. Ray tracing
10.1. Description of rays in space. Cosines directors.
10.2. Refraction at a spherical surface. snell's law of refraction in vector form.
10.3. Spot diagram.
11. Wave aberration beam and aberration.
11.1. Monochromatic aberrations. Transverse aberration of beam and wave aberration.
11.2. Chromatic aberrations.
11.3. Effect of aberrations in optical parameters. Correction.
11.4. Expression of the aberration function of zernike polynomials.
12. Subsidiary instruments laboratory.
12.1. Lensmeter
12.2. Radiometer
13. Instruments for determining the state refractive eye.

13.1. Retinoscope
13.2. Optometer
14: Instruments for corneal study
14.1. Biomicroscope
14.2. Keratometer
14.3. Topography
15: Internal instruments for study of eye
15.1. Ophthalmoscope
15.2. Aberrometer
15.3. Biometer.
15.4. OCT

Lab practices:
Practice 1: Chromatic aberration in ophthalmic lenses
Practice 2: Projection systems
Practice 3: Magnifiers and microscopes
Practice 4: Telescopes
Practice 5: Lensmeter
Practice 6: Optometers
Practice 7: Keratometer
Practice 8: Composition of cylindrical lenses and Jackson cross cylinders
Practice 9: Calibrating optometric instruments

Ray tracing software practices:
Practice 1: Introduction to Oslo software
Practice 2: Paraxial approximation and raytracing in an optical system
Practice 3: Spot diagram on axis.
Practice 4: Spot diagram and off-axis behavior
Practice 5: Seidel coefficients and chromatic aberration.
Practice 6: Design of optical systems

### 4.4.Course planning and calendar

**Schedule sessions and presentation of works**

The calendar of classroom sessions is set by the Faculty of Science.

The date of realization of each of the lab sessions will be published at the beginning of the school year by the Grade Coordinator and can be consulted by enrolled students in the web of the subject.

### 4.5.Bibliography and recommended resources


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| **BB** | Arasa Martí, J. Instrumentos ópticos y optométricos: problemas UPC. 1995 |
| **BB** | Boj Giménez, Pedro J.. Instrumentos oftálmicos y optométricos / Pedro J. Boj Giménez, Angel García Muñoz, José I Alicante : Universidad, 1993 |
| **BB** | Henson, David B.. Optometric instrumentation / David B. Henson . - 2nd ed. Oxford : Butterworth-Heinemann, 1996 |

**BB** Instrumentos ópticos y optométricos : teoría y prácticas / Manuel Martínez Corral ... [et al.] València : Universitat de