Universidad Zaragoza

Academic Year/course: 2024/25

26807 - Optical and Optometric Instruments

Syllabus Information

Academic year: 2024/25
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

The aim of this subject is to apply the knowledge of Geometric Optics acquired during the first year subject "Optics Visual I", for the description and analysis of different optical and optometric instruments. Other contents, such as photometry or the study of aberrations and tools, such as real ray tracing programs, which will allow the analysis of the image quality given by these instruments, will also be studied

These approaches and objectives are aligned with the following Sustainable Development Goals (SDGs) of the United Nations Agenda 2030 (https://www.un.org/sustainabledevelopment/es/), in such a way that the acquisition of the learning results of the subject provides training and competence to contribute to some extent to their achievement.

2. Learning results

- Know the concept, practical manifestation and most important consequences of optical aberrations in instruments and vision.
- Determine the causes of the optical limitations of the most significant optical instruments and of the human eye.
- Calculate the paraxial constants of any type of optical system (including the eye) according to material characteristics and geometrical arrangement by means of matrix formulation and ray tracing programs.
- Know the existing optometric instruments on the market for a given task as well as the most relevant differences between them.
- Evaluate the accuracy, precision and measuring range of different optometric instruments.
- Interpret the technical characteristics of the different optical and optometric instruments on the market.
- Photometric characterization of optical and optometric instruments.

3. Syllabus

THEORY

TOPIC 1. PERFECT OPTICAL SYSTEMS

TOPIC 2. PHOTOMETRY

TOPIC 3. FUNDAMENTAL CHARACTERISTICS OF OPTICAL INSTRUMENTS

TOPIC 4. THE CAMERA

TOPIC 5. PROJECTION SYSTEMS

TOPIC 6. MAGNIFIERS AND EYEPIECES

TOPIC 7. TELESCOPES

TOPIC 8. MICROSCOPES

TOPIC 9. MATRIX OPTICS

TOPIC 10. ACTUAL RAY TRACING

TOPIC 11. WAVE ABERRATION AND BEAM ABERRATION
TOPIC 12. AUXILIARY LABORATORY INSTRUMENTS
TOPIC 13. INSTRUMENTS FOR THE DETERMINATION OF THE REFRACTIVE STATE OF THE EYE
TOPIC 14. INSTRUMENTS FOR CORNEAL STUDY
TOPIC 15. INSTRUMENTS FOR THE INTERNAL STUDY OF THE EYE

LABORATORY PRACTICES
Practice 1: Chromatic aberration in ophthalmic lenses
Practice 2: Projection systems
Practice 3: Magnifiers and microscopes
Practice 4: Telescopes
Practice 5: Frontophocometer
Practice 6: Optometers
Practice 7: Keratometers
Practice 8: Composition of Jackson cylindrical lenses and cross cylinders
Practice 9: Calibration of optometric instruments

PRACTICES WITH RAY TRACING PROGRAMS
Practice 1: Introduction to Oslo management
Practice 2: Paraxial approximation and real ray tracing in an optical system
Practice 3: Shaft impact diagram
Practice 4: Impact diagram and off-axis behaviour
Practice 5: Seidel coefficients and chromatic aberration
Practice 6: Design of optical systems

4. Academic activities

Master classes: 69 hours
Theoretical sessions in which the contents of the subject are explained.

Problems and cases: 10 hours
Problem solving and case studies of each topic.

Laboratory Practices: 27 hours
Acquisition of practical knowledge, skills and abilities in the conceptual design, use and analysis of instruments.

Computerized practices: 14 hours
Design, development and analysis of instruments by actual ray tracing

Teaching assignments: 48 hours
Both the evaluable teaching assignments and the preparation of laboratory practice reports are included.

Personal study. 120 hours

Assessment tests. 12 hours

5. Assessment system

Continuous evaluation. For the student who regularly attends the practical laboratory and simulation sessions of real ray tracing (the student must attend 8 out of 9 laboratory practices and 5 out of 6 simulation sessions of real ray tracing).

- Evaluation of theoretical contents and problems through two exams (65%).

First midterm exam: 50%

Second midterm exam: 50%

In order to average both exams, a grade of at least 4 points must be obtained in each of them.

- The Oslo practices will be evaluated by means of an objective computer test at the end of the practices (15%). Evaluation of laboratory practices by means of a theoretical and/or practical exam (20%).

Final exam. For students who do not regularly attend the learning activities planned by the teacher (master classes, practical sessions and proposed assignments).

- Evaluation of theoretical contents and problems by means of one or more exams (65%).
- Evaluation by means of theoretical-practical exam of the contents of design and analysis of optical and optometric instruments by means of simulation programs (15%)
- Evaluation of laboratory practices through a practice exam (20%).

In both cases it is necessary to have at least a 5 in the theory part and a minimum grade of 4 points in each of the two remaining parts to average the different parts. If this does not happen, and the average grade is a “pass”, the grade that will be recorded in the minutes will be that of the failed part.

6. Sustainable Development Goals

3 - Good Health & Well-Being
4 - Quality Education
9 - Industry, Innovation and Infrastructure