COURSE DATA

DATA SUBJECT

Code: 34293
Name: Optical and optometric instruments
Cycle: Undergraduate Studies
ECTS Credits: 12
Academic year: 2026-27

STUDY (S)

Degree	Center	Acad. year	Period
1207 - Degree in Optics and Optometry	Facultat de Física	2	Annual

SUBJECT-MATTER

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

COORDINATION

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SUMMARY

The subject of optical Instruments integrates Opticians and Optometrists in Matter Optics Optometry Degree. This is an annual course, compulsory, whose contents are essential for the development of the profession of Optical optometrist, as it lays down the laws and mechanisms of formation of images in the instruments used in optometric practice. It presents theoretical aspects (6 ECTS credits) of supervised work in small groups (3 ECTS), practical laboratory apectos (3 ECTS). The contents of this course are related to many other's Degree in Optometry. Its development is based on geometrical optics in establishing the laws of image formation in optical systems and the physiological optics are studied in the human visual system characteristics and the imaging system. The subject is related to physical optics, especially in regard to resolving power of the instruments and the use of polarizing elements. Moreover, the instruments studied are useful for other materials as OPTOMETRY Required, Contact Lenses and Ophthalmic Optics or subject CLINICAL EXAMINATION METHODS. In addition, the subject has projected the following subjects Module Optional:, recording and processing of medical images, COMPUTER-AIDED DESIGN OPTICAL LOW VISION, orthoptics and vision therapy, CURRENT ISSUES OF OPTICS AND OPTOMETRY.

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PREVIOUS KNOWLEDGE

RELATIONSHIP TO OTHER SUBJECTS OF THE SAME DEGREE

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

OTHER REQUIREMENTS

The student must know and master the principles of geometrical optics and physiological optics

COMPETENCES / LEARNING OUTCOMES

1207 - Degree in Optics and Optometry

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 know and to calculate the parameters that characterize the image-forming elements.

To know the aberrations of optical systems.

To know the characteristic phenomena of the wave nature of light, such as interference, diffraction and polarization.

To know the elementary principles and characteristics of the optometric instruments.

To know the fundamentals of radiometric and photometric laws.

To know the principle of image formation and the properties of optical systems.

To know the principles, description and characteristics of the fundamental optical instruments, as well as the instruments used in optometric and ophthalmological practice.

To know the propagation of light in isotropic media, light-matter interaction, light interferences, diffraction phenomena, the properties of monolayers and multilayers, and the principles of lasers and their applications.

DESCRIPTION OF CONTENTS

1. INTRODUCTION TO INSTRUMENTAL OPTICS

1.1.- General Introduction
1.2.- Classification of Optical Instruments
1.3.- The Eye as a Receptor of Information Provided by Optical Instruments

2. GENERAL CHARACTERISTICS OF OPTICAL INSTRUMENTS

2.1.- Basic Relations of Geometric Optics. Conjugation Equations
2.2.- Optical-Geometric Characteristics. Lateral Magnification and Visual Magnification. Ray Limitation and Field of View. Axial Field: Depth of Field and Depth of Focus
2.3.- Photometric Characteristics. Basic Magnitudes and Relations of Photometry. Illumination and Apparent Luminance of an Image. Luminosity of an Optical Instrument
2.4.- Separating Power of Optical Instruments

3. THE MAGNIFYING GLASS

3.1.- Introduction
3.2. -Visual magnification.
3.3.- Equivalent viewing distance and equivalent power.
3.4.- Standardized values ¿¿of visual magnification.
3.5.- Field of view.
3.6.- Depth of focus.
3.7.- Luminosity.
3.8.- Separating power.

4. THE MICROSCOPE

4.1.- Introduction. Microscope structure.
4.2.- Visual magnification.
4.3.- Depth of focus.
4.4.- Field diaphragm and reticles.
4.5.- Eyepieces.
4.6.- Numerical aperture of the objective.
4.7.- Luminosity.
4.8.- Separating power.
4.9.- Microscope objectives.

5. TELESCOPIC SYSTEMS

5.1. Introduction. The afocal condition.
5.2. Astronomical telescope.
5.3. Inverting system.
5.4. Galileo telescope.
5.5. Reflecting telescopes.
5.6. Trade name: Examples.

6. OPTICAL INSTRUMENTATION FOR LOW VISION.

6.1. Introduction: Concept of Low Vision.
6.2. Conventional optical aids for near vision.
6.3. Conventional optical aids for intermediate vision.
6.4. Non-conventional optical aids.

7. OPHTHALMIC LENS CHARACTERIZATION INSTRUMENTS.

7.1. Introduction.
7.2. The frontofocometer: Elements and operating principle. Precision and sources of error in measurements. Design features.
7.3.- The diasporameter (Risley prisms).
7.4.- Instruments for measuring radii of curvature: Sagimeter and spherometer.

8. THE RETINOSCOPE

8.1.- Introduction.
8.2.- Fundamentals: Illumination system and observation system.
8.3.- Determination of ocular refraction: Neutralization and ametropia. Relative speed of movements.
8.4.- Factors influencing measurement accuracy.
8.5.- Design features.

9. THE OPHTHALMOSCOPE

9.1.- Introduction.
9.2.- Direct ophthalmoscope. Observed fields and magnification.
9.3.- Indirect ophthalmoscope. Observed fields and magnification.
9.4.- Design characteristics of commercial models.

10. OPTOMETERS AND AUTOREFRACTOMETERS.

10.1.- Introduction.
10.2.- Simple optometer.
10.3.- Badal's optometer.
10.4.- Galileo's telescope as an optometer.
10.5.- Manual objective optometers.
10.6.- Automatic objective optometers: Autorefractometers. Sources of measurement error. Design characteristics of commercial models.

11. THE KERATOMETER AND THE CORNEAL TOPOGRAPHER.

11.1.- Introduction. Operating principle.
11.2.- Helmholtz keratometer.
11.3.- Javal keratometer.
11.4.- Sources of measurement error.
11.5.- Corneal topographers.

12. INSTRUMENTS USED IN SUBJECTIVE REFRACTION.

12.1.- Introduction.
12.2.- Optotype projector. Technical characteristics: Test, filters, and diaphragms. Working conditions. Test box and test glasses.
12.3.- The phoropter: Design features, accessories. Advantages and disadvantages compared to the test box.

13. THE OCULAR BIOMICROSCOPE (SLIT LAMP)

13.1.- Introduction. Fundamentals.
13.2.- Köhler illumination system. Observation system: Binocular microscope.
13.3.- Design characteristics of slit lamps.
13.4.- The pachymeter. Operating principle. Coupling to the slit lamp.

14. TONOMETERS

14.1. Introduction. Measurement of intraocular pressure (IOP).
14.2. Contact tonometers: Design features. Goldmann tonometer.
14.3. Air tonometer: Operating principle.
14.4. Comparative study.

15. LABORATORY PRACTICES

1. THE MAGNIFYING GLASS (I AND II).
2. THE MICROSCOPE (I, II, and III).
3. THE TELESCOSCOPE.
4. THE FRONT-FOCOMETER.
5. THE RETINOSCOPE. FUNDAMENTALS.
6. THE RETINOSCOPE. SOURCES OF ERROR IN RETINOSCOPY.
7. OPHTHALMOSCOPES.
8.- OPTOMETERS.

WORKLOAD

PRESENCIAL ACTIVITIES

Activity	Hours
Tutorials	30,00
Theory	60,00
Laboratory	30,00
Total hours	**120,00**

NON PRESENCIAL ACTIVITIES

Activity	Hours
Attendance at other activities	0,00
Individual or group project	75,00
Independent study and work	95,00
Preparation of lessons	0,00
Preparation for assessment activities	10,00
Resolution of case studies	0,00
Total hours	**180,00**

TEACHING METHODOLOGY

Teaching methodology

The course will consist of three types of classes with different methodology:
(i) Theoretical and practical classes
(ii) The types of jobs safeguarded
(iii) Laboratory sessions in small groups

Theoretical and practical classes (2 hours per week): It covers the conceptual and formal aspects of the subject. They are based mainly on lectures and using dialogic teaching tools as experimental demonstrations, animations or videos, presentations projection, etc.. Exercises also develop practical application of theoretical content.
Classes protected work (1 hour per week): In addition to the theoretical and practical classes or laboratory sessions, seminars have been included in small groups. These sessions are focused on student work and active participation of an individual or group in the resolution of questions arising from the theoretical and practical classes and will also serve to reinforce concepts more difficult. Besides being classes for problem solving for the exercise of the tools presented in the theoretical and practical classes. In this type of class may discuss complementary theoretical aspects which the group will seek interactivity through oral presentations.
Works protected classes are associated to a continuous assessment component, which values the student's progress in the field.
Laboratory practical sessions in small groups (12 practices 2.5 hours): In practice students do experimental work, taking measurements, and proceeded to record the data and analysis. Are conducted in small groups of up to 16 students are divided into pairs in 8 jobs.
Attendance at laboratory classes is mandatory.

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EVALUATION

The course is assessed using two different types of grades.
1) Written exams (50% of the course grade) consisting of a series of theoretical and practical questions related to the different program topics. Two partial exams will be given in the first sitting, while a single exam will be given in the second sitting.
2) Continuous assessment in seminars with supervised assignments (25% of the final grade) includes problem-solving, either in class or outside of class, and oral presentations of assigned work.
3) Laboratory exercises (the remaining 25% of the final grade) will be obtained by answering questions

about the exercises and submitting the results sheets obtained in the laboratory.

This assessment scheme will be applied in both sittings of the course. In both sittings, to pass the course, students must obtain a grade of at least four out of ten in each of the three sections (theory, supervised assignments, and laboratory). In addition, in the first sitting, students must obtain a minimum grade of three out of ten in each of the written partial exams.

REFERENCES

Basic

- M. Martínez Corral, W. Furlan, A. Pons y G. Saavedra, Instrumentos Ópticos y Optométricos. Teoría y Prácticas. Universitat de València (1998).
- J. Antó i N. Tomás, Òptica Instrumental, Universitat Politècnica de Catalunya, Barcelona (1994).
- D. Henson. Optometric Instrumentation. Butterworth & Heinemann (1996).).

Complementary

- J. Arasa, M. Arjona I N. Tomás, Instrumentos Ópticos y Optométricos. Problemas, Universitat Politècnica de Catalunya, Barcelona (1995).
- A. H. Tunnacliffe and J.G. Hirst, Optics, Association of Dispensing Opticians (1998).
- G. Smith y D. Atchinson, The eye and visual optical instruments, Cambrigde University, Cambrigde (1997).
- W. Furlan, J. García Monreal y L. Muñoz Escrivá. Fundamentos de Optometría. Refracción ocular. Universitat de València (2ª edición, 2009).