UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

SYLLABUS DEL CORSO

Storia degli Strumenti Ottici

2627-3-E3002Q051

Aims

The objectives fall within the area of "Professional training" and refer to the following Dublin Descriptors:

1 – Knowledge and understanding

- Acquire knowledge of the key stages in the historical development of optics and optometry
- Acquire knowledge of the foundations of physical optics, starting from interference and diffraction introduced in the 19th century up to quantum theory in the early 20th century
- Acquire knowledge of the historical development of the instruments used in the optometric field since the 19th century

2 – Applying knowledge and understanding

- Acquire skills in the use of certain instruments commonly used in optometric practice
- Acquire basic statistical skills for processing experimental data
- Acquire skills in applying the scientific method, which is essential both for understanding the topics covered and for applying them to professional practice
- Acquire the ability to understand the principles of physical optics underlying instruments and devices used in optometric practice, as well as those underlying the visual system

3 – Making judgements

- Develop the ability to reflect independently on the course content in order to acquire autonomous judgement

4 – Communication skills

- Acquire communication skills related to the course content, both in terms of historical aspects and the historical evolution of the field, as well as the concepts of physical optics developed from the 19th century

onwards

5 – Learning skills

- Develop the ability to reflect independently on the course content in order to acquire learning skills with a view to future developments in the field

Contents

The course concerns the history of optics and the concepts of physical optics developed in the last centuries, from the first lenses to spectacles, from the optics of the Seventeenth century to quantum optics, including the evolution of the main instrumentation applied in the field of optics and optometry.

Detailed program

E-learning activities:
• Introduction to statistics
• The evidence-based approach to the optometric examination
• Exercises

In-person and e-learning lectures concerning the following four parts of the program:

PART 1
• The Layard lens
• History of glass
• History of the invention of spectacles
• History of contact lenses
• Alhazen, Rucellai, Maurolico, and Della Porta: from the Middle Ages to the Renaissance

PART 2
• Galileo, Kepler, Newton, and the telescope: the seventeenth century and the Scientific Revolution
• Snell, Descartes, and Fermat: the law of refraction
• Rømer: measurement of the speed of light
• Grimaldi, Huygens, and Newton: wave and corpuscular theories of light

PART 3
• Malus, Fresnel, Arago, and Rayleigh: polarization
• Young and Fresnel: interference and diffraction
• Gauss, Brewster, Maxwell, Hertz, Michelson, Planck, Einstein, and de Broglie: nineteenth-century optics up to the quantum theory of the early twentieth century
• Fraunhofer, Planck, Stefan, Boltzmann, Wien, Edison, Volta, Davy, Einstein, and Maiman: spectral lines, thermal radiation, spontaneous and stimulated emission, different light sources, and their emission spectra

PART 4
• Hooke, Donders, and Snellen: measurement of visual acuity, lens power, and refraction
• Weber and Michelson: contrast sensitivity
• Scheiner, Porterfield, Paremt, Burow, Badal, and Young: the optometer
• von Helmholtz, Placido, Stokes, Donders, and Scheimpflug: from the keratometer and corneal topographer to modern ocular tomography

• Galileo, Rayleigh, Strehl, Donders, and Gullstrand: the microscope, resolving power, and the slit lamp
• Hartmann–Shack and Tscherning: ocular aberrometry

Laboratory:
Laboratory activities on eye-imaging techniques and the measurement of ocular parameters used in optometry, together with data-analysis exercises.
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Prerequisites

Concepts of mathematics and physics of the first year of the Degree in Optics and optometry

Teaching form

The course corresponds to a total of 6 ECTS credits, of which 4 ECTS credits are devoted to the topics divided into the four parts listed in the detailed syllabus, 1 ECTS credit to e-learning exercises, and 1 ECTS credit to laboratory activities. Attendance at the laboratory activities is compulsory.
More specifically, the course includes the following:
• 24 hours of in-person lectures;
• 8 hours of online lectures;
• 12 hours of e-learning exercises;
• 12 hours of in-person interactive laboratory activities, with compulsory attendance.

Textbook and teaching resource

- notes on the e-learning page of the University
- F.W. Sears, Ottica, CEA, chapters 7-12
- notes on the laboratory activities on the e-learning page of the University

Semester

first semester

Assessment method

The test consists of a written test and an oral test.

The purpose of the written test is the extensive verification of the preparation on the exam program.

The purpose of the oral exam is to verify the ability to autonomously thinking and discussion on the topics of the program.

During the semester, five in-itinere written tests (multiple choice questions, brief exercises, graphic constructions or similar requests) will be proposed, each one part of the program (four parts of the program and introduction on statistics), on dates communicated by the lecturer through the e-learning platform.
Alternatively, students will be able to carry out the written exam on the day of the official exam sessions. The written part of the exam on the day of the official exam will be divided into five parts so that those who have passed only one, two, three, or four partial tests in itinere or in previous exams can carry out only the part(s) missing or with previous negative result.

To access the oral, students will need to:

· Be in compliance with the mandatory attendance hours of the laboratory activities (at most, three hours of absence, including late arrivals or early exits); students who do not attend the minimum of laboratory hours will not be able to take the exam, if not attending the laboratory hours in another academic year.

· Obtain the sufficiency in the written exams of all the five parts of the program (in the in-itinere exams or during the written official exams).

The oral exam will cover the program of the course.

The exam can be done in English. For the written exam, the student must expressly request it to the lecturer at least one week in advance of the exam date.

Office hours

by appointment to be agreed via email

Sustainable Development Goals

GOOD HEALTH AND WELL-BEING