Universidad Zaragoza

Academic Year/course: 2023/24

69728 - Optical technologies in biomedicine

Syllabus Information

Academic year: 2023/24
Subject: 69728 - Optical technologies in biomedicine
Faculty / School: 110 - Escuela de Ingeniería y Arquitectura
Degree: 633 - Master's Degree in Biomedical Engineering
ECTS: 3.0
Year: 1
Semester: Second semester
Subject type: Optional
Module:

1. General information

The objective of the subject is for the student to know and understand a range of optical techniques to measure various physical quantities and to be able to use them to obtain relevant information in some biomedical applications, taking into account the particularities of each application, as well as the possibilities and limitations of these techniques. It focuses on techniques that use the interaction between light and materials to modify or obtain information about those materials.

The training provided by this subject (theoretical and practical) contributes to SDG - 3 Health and Wellness, as it enables the student to contribute to the development and application of various technologies aimed at the prevention and treatment of different diseases and health problems.

2. Learning results

- To be able to choose the most appropriate optical technique in some biomedical applications, knowing the physical quantity to be measured, the expected range of values and the desired spatial and temporal resolution.
- To be able to explain the operation and typical biomedical applications of the optical techniques studied.
- To be able to apply some of the techniques to practical cases.

3. Syllabus

1. Fundamentals of optics. Reflection, refraction and image formation. Superposition of light waves: polarization and interference. Consistency. Diffraction. Diffusion. Lasers.
2. Moiré techniques for topography surveys. Measurement of shapes. Applications.
3. Laser speckle techniques for the study of mechanical properties of materials (tissues, prosthesis, ...). Measurement of deformations, shape, etc. Applications.
4. Velocimetry techniques for the study of biological flows. Particle image velocimetry. Digital holography. Applications.
5. Microscopy techniques. Compound microscope. Confocal microscopy. Holographic microscopy. Applications.
6. Optical tomography. Diffuse optical tomography (DOT). Optical coherence tomography (OCT). Optical diffractional tomography (ODT). Applications.

4. Academic activities

- Classroom and laboratory activities: lectures (24 hours) and laboratory practices (6 hours).
- Activities outside the classroom and laboratory: study and personal work (40 hours).
- Assessment tests (4 hours)

5. Assessment system

The student must demonstrate that they has achieved the intended learning results through the following assessment activities:

- **Written exam (50%):** the test consists of a series of theoretical and practical questions. The student must obtain a minimum total grade of 4 out of 10 points.
- **Laboratory practices (30%):** the student will prepare a report of each of the practices carried out. The practical sessions´ grade will be the average of the grades obtained in the reports.
- **Subject work (20%):** the evaluation of the work will take into account the ability to summarise and assimilate shown in the report presented.

Students who do not pass the subject or do not opt for the previous assessment system, will be entitled to take a global test in each of the established calls for exams, on the dates and times determined by EINA.