Universidad Zaragoza

Year : 2019/20

69328 - Optical technologies in biomedicine

Syllabus Information

Academic Year: 2019/20
Subject: 69328 - Optical technologies in biomedicine
Faculty / School: 110 -

Degree: 547 - Master's in Biomedical Engineering

ECTS: 3.0
Year: 1
Semester: Second semester
Subject Type: Optional
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 methodology followed in this course is oriented towards achievement of the learning objectives. A wide range of teaching and learning tasks are implemented, such as lectures where the main contents are presented and discussed; laboratory sessions, assignments, and autonomous work.

Students are expected to participate actively in the class throughout the semester.

4.2.Learning tasks

The course includes the following learning tasks:

- **A01 Lectures** (22 hours). This activity will take place in the classroom. The teacher will present the main course contents such as several non intrusive optical measurement techniques, which provide information on the mechanical properties of biological materials, and some representative applications. The course materials (slides and texts) for each topic are given to the students in advance.
- **A03 Laboratory sessions** (6 hours). The laboratory practice will take place in the laboratories of the Applied Physics Department at the Sciences Faculty, at dates and time agreed with the students. They are activities carried out in specific spaces with specialized equipment. There are 3 two-hour sessions. In the first session, Moiré techniques are used for measuring the shape of a knee prosthesis. In the second session, speckle pattern

interferometry techniques are used for measuring the deformation of an elastic material. In the third session, particle image velocimetry is used to measure the flow in an in vitro aneurysm model. The lab tasks are done in pairs and students are given in advance the instructions to follow in each session. Each team is required to submit a written report for each session. The assessment of these reports is one of the assessment activities, which are detailed in the Assessment Section.

- **A05 Assignments.** There will be one assignment, to be done individually. It will be a written report on a topic chosen by the student, with the approval of the teacher, and related to the course contents. The report will consist on a brief summary of a research or popular science paper, along with the student personal opinion on the subject covered in the paper. The assessment of this report is one of the assessment activities, which are detailed in the Assessment Section.
- **A06 Tutorials.** Students may ask doubts or review and discuss the materials and topics presented in both theory and practice sessions.

  A08 Assessment. A set of written tests and submission of reports, which will be used for evaluating the student progress, as detailed in the corresponding Assessment Section.

4.3.Syllabus

The course will address the following topics:

1. Fundamentals of Optics.

Reflection, refraction and imaging. Superposition of light waves: polarization and interferences. Coherence. Diffraction. Diffusion. Lasers: types and properties.

2. Moiré techniques for topography studies.

The moiré effect. Analysis of moiré patterns. Shape measurements. Applications.

3. Laser speckle techniques for studying the mechanical properties of materials (tissue, prosthesis, ...)

Speckle and its properties. Methods for speckle comparison. Defect detection. Strain measurement. Applications.

4. Velocimetry techniques for studying biological flows.

Particle image velocimetry. Digital holography. Applications.

5. Microscopy techniques.

Compound microscope. Confocal microscope. Holographic microscopy. Applications.

6. Optical Tomography.

Diffuse optical tomography (DOT). Optical coherence tomography (OCT). Optical diffraction tomography (ODT). Applications.

7. Therapeutic uses of lasers.

Light-matter interaction. Optical tweezers. Laser scalpel. Laser ablation. Applications.

4.4.Course planning and calendar

Further information concerning the timetable, classroom, office hours, assessment dates and other details regarding this course, will be provided on the first day of class or please refer to the EINA website.

4.5.Bibliography and recommended resources

http://biblos.unizar.es/br/br_citas.php?codigo=69328&year=2019