69328 - Optic technologies in biomedicine

Información del Plan Docente

Academic Year	2016/17
Academic center	110 - Escuela de Ingeniería y Arquitectura
Degree	547 - Master's in Biomedical Engineering
ECTS	3.0
Course	1
Period	Second semester
Subject Type	Optional
Module	---

1.Basic info

1.1.Recommendations to take this course

1.2.Activities and key dates for the course

2.Initiation

2.1.Learning outcomes that define the subject

2.2.Introduction

3.Context and competences

3.1.Goals

3.2.Context and meaning of the subject in the degree

3.3.Competences

3.4.Importance of learning outcomes

4.Evaluation

5.Activities and resources

5.1.General methodological presentation

The learning methodology is structured in three levels: theoretical classes where the main subject contents are presented and discussed and where the student participation is encouraged; laboratory sessions; and assignments on topics related to the course contents. The proposed methodology seeks to promote the continued work of the student.

5.2.Learning activities

The learning process designed for this subject is based on the following training activities:
A01 Theory lectures actively involving the students (20 hours). This activity will take place in the classroom. The

teacher will present the main course contents. Several non intrusive optical measurement techniques, which provide information on the mechanical properties of biological materials, and some representative applications are presented. The course materials (slides and texts) for each lesson are given to the students well 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 times to be agreed with the enrolled students.
They are activities carried out in specific spaces with specialized equipment. There are three 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 work is done by two-student teams, who are given in advance the script of the activities to be carried out in each session. Each team is required to submit a written report for each session. The assessment of these reports is one of the evaluation activities, which are detailed in the corresponding section.

A05 Assignments. There will be one assignment, to be performed individually. It will consist on 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 by the paper. The assessment of this report is one of the evaluation activities, which are detailed in the corresponding section.

A06 Tutoring. Personalized attention to students with the aim of reviewing and discussing the materials and topics presented in both theory and practice classes.
A08 Evaluation. A set of written tests and submission of reports, which will be used for evaluating the student progress, as detailed in the corresponding assessment activities section.

5.3.Program

The program offered to the students for helping them achieve the expected skills includes the following lessons:
Fundamentals of Optics.
Reflection, refraction and imaging.
Superposition of light waves: polarization and interferences.
Coherence.
Diffraction.
Diffusion.
Lasers: types and properties.

Moiré techniques for topography studies.
The moiré effect.
Analysis of moiré patterns.
Shape measurements.
Applications.

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.

Velocimetry techniques for studying biological flows.
Particle image velocimetry.
Digital holography.

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Applications.

Microscopy techniques.
Compound microscope.
Confocal microscope.
Holographic microscopy.

Applications.

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

Applications.

Therapeutic uses of lasers.
Light-matter interaction.
Optical tweezers.
Laser scalpel.
Laser ablation.
Applications.

5.4.Planning and scheduling

The course schedule for the theory and practice classes is defined by the academic calendar established by the Escuela de Ingenieria y Arquitectura. The specific dates and times for the laboratory sessions will be agreed with the enrolled students. The schedule for submission of assignments shall be announced at the beginning of the course.

5.5.Bibliography and recomended resources

BB	Casas Peláez, Justiniano. Optica / Justiniano Casas . - 7ª ed. Zaragoza : [El Autor], 1994
BB	Kafri, O. The physics of moiré metrology / O. Kafri, I. Glatt John Wiley & Sons Ltd., 1990.
BB	Particle image velocimetry : a practical guide / Markus Raffel, Christian E. Willert, Steve T. Wereley, Jürgen Kompenhans . - 2nd ed. Berlin [etc.] : Springer, cop. 2007
BB	Sirohi, R.S . Optical methods of measurement-wholefield techniques / R. S. Sirohi, F. S. Chau Marcel Dekker, 1999.
BB	Sirohi, R.S . Speckle metrology / R. S. Sirohi, ed . Marcel Dekker, 1993.
BB	Splinter, R.. An introduction to biomedical optics / R. Splinter, B. A. Hooper CRC Press, 2006.
BB	Williams, D.C. Optical Methods in Engineering Metrology / D. C. Williams, ed

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. Chapman & Hall, 1993.