Universidad Zaragoza

Year : 2019/20

69307 - Materials and surface treatments for prosthesis and implants

Syllabus Information

Academic Year: 2019/20
Subject: 69307 - Materials and surface treatments for prosthesis and implants
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, problem-solving, lab sessions, visits, case studies, tutorials and assessment tasks.

4.2.Learning tasks

The course includes the following learning tasks:

- **A01 Lectures** (36 hours). Classroom presentations comprising the main contents of the course which are the most relevant techniques for surface modification and characterization of materials in the field of Biomedical Engineering.
- **A02 Problem-solving** (8 hours). Simple examples and exercises including quantitative calculations will be solved by the students in class sessions.
- **A03 Lab sessions.** Material selection processes and basic techniques for surface modification or characterization of biomaterials will be shown in 2-hour lab sessions (4 hours). The students will prepare an essay describing the experiments done and the obtained results (5 hours).
- **A04 Laboratory visits.** This activity includes visiting advanced characterization laboratories (such as PVD, XPS,

AFM, etc.) available at INA and ICMA institutes (2 hours). The students will prepare an essay describing the techniques shown (2 hours).

- **A05 Case study** (15 hours). The students will select a research article published in a scientific journal on some specific surface technique, material or application in the field of Biomedical Engineering. They will prepare a written report under the teachers' supervision and they will present their results in a defense session including either oral or poster presentation.
- **A06 Tutorials.** Individual or group sessions with the aim of discussing the materials and topics presented in both theoretical and practical classes.
- **A08 Assessment**. 2 hours written exam + 3 hours defense and discussion.

4.3.Syllabus

The course will address the following topics:

Topic 1. Introduction

- 1.1. Surface Engineering
- 1.2. Types of biomaterials. Interaction with the biological environment
- 1.3. Examples of biomedical applications. The importance of surfaces

Topic 2. Surface treatments

- 2.1. Plasma-based technologies
- 2.2. Ion implantation
- 2.3. Laser surface modification
- 2.4. Thermochemical treatments
- 2.5. Mechanical treatments

Topic 3. Coatings

- 3.1. Plasma polymerization
- 3.2. Vapor deposition: PVD and CVD
- 3.3. Thermal spray
- 3.4. Sol-gel
- 3.5. Electrochemical coatings

Topic 4. Surface characterization techniques

- 4.1. Composition (XPS, AES, SIMS, EDS)
- 4.2. Microstructure (electron microscopy, AFM)
- 4.3. Roughness (profilometry, AFM)
- 4.4. Coating thickness (Calotest, ellipsometry)
- 4.5. Mechanical properties (hardness, elastic modulus, tribology)

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 and the Moodle platform.

4.5.Bibliography and recommended resources

http://biblos.unizar.es/br/br_citas.php?codigo=69307&year=2019