Universidad Zaragoza

Academic Year/course: 2021/22

68957 - Engineering applied to the design of prostheses and implants

Syllabus Information

Academic Year: 2021/22
Subject: 68957 - Engineering applied to the design of prostheses and implants
Faculty / School: 326 - Escuela Universitaria Politécnica de Teruel
Degree: 614 - Master's in Innovation and Entrepreneurship in Health and Wellbeing Technologies
ECTS: 3.0
Year: 1
Semester: Second semester
Subject Type: Optional
Module:

1. General information

1.1. Aims of the course

The objective of the course is to train student in different aspects of Engineering, applied to the design of prostheses and implants.

At the end of his learning, he must be able to propose the design of a prosthesis or implant. To do this, they must be able to understand its mechanical behavior by proposing a mathematical simulation model.

These approaches and objectives are aligned with some of the Sustainable Development Goals, SDG, of the 2030 Agenda (https://www.un.org/sustainabledevelopment/es/) and certain specific goals, in such a way that the acquisition of the Learning outcomes of the subject provides training and competence to the student to contribute to a certain extent to their achievement:

? Goal 3: Ensure healthy lives and promote well-being for all at all ages.

Target 3.4 By 2030, reduce by one third premature mortality from non-communicable diseases through prevention and treatment and promote mental health and well-being.

Target 3.d Strengthen the capacity of all countries, in particular developing countries, for early warning, risk reduction and management of national and global health risks.

? Goal 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

Target 4.4 By 2030, substantially increase the number of youth and adults who have relevant skills, including technical and vocational skills, for employment, decent jobs and entrepreneurship.

? Goal 8: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.

Target 8.6 By 2020, substantially reduce the proportion of youth not in employment, education or training.

? Goal 9: Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation.

Target 9.5 Enhance scientific research, upgrade the technological capabilities of industrial sectors in all countries, in particular developing countries, including, by 2030, encouraging innovation and substantially increasing the number of research and development workers per 1 million people and public and private research and development spending.

1.2. Context and importance of this course in the degree

By means of the knowledge acquired in this subject, the student will obtain the necessary competences and capacities to be able to propose the design of a prosthesis or implant of the locomotor system, as well as the biomechanical comparison between different devices, taking into account the principles of functionality and mechanical optimization.

1.3. Recommendations to take this course

Previous basic knowledge of Statics, Strenght of Materials and Finite Elements is required. These contents, in the case of not having been acquired by the student, can be seen within the subject of "Complementary training in Industrial Technologies".

2. Learning goals

2.1. Competences

Specific competences:

- Being able to make decisions considering technical, social and economic responsibilities in the field of health and wellness, in an integral and interdisciplinary way.
- Being able to analyze biomedical data and extract relevant information from them for solving problems in the field of Health and Wellbeing Technologies.
- Being able to carry out a technological modeling of a real element or scenario in the field of Health and Wellbeing Technologies, being able to connect it with models from other disciplines.
- Being able to carry out, present and defend before a university court an original and innovative project or work that solves a real problem in the field of Health and Well-being Technologies in which the skills acquired in the teaching are synthesized and integrated.

2.2. Learning goals

- Possess the Biomechanical knowledge necessary to understand the behavior of different organs of the locomotor system that may be replaced by a prosthesis.
- Know the biomechanical behavior of the different types of biomaterials currently used in the design of prostheses and implants.
- Know the different types of implants and prostheses currently used in the musculoskeletal system, and be able to discern which of the different existing types is the most suitable for the optimal restoration of physiological functionality for a specific pathology.
- Being able to propose the design of a new prosthesis or implant, applicable to the locomotor system, as well as to compare different existing designs, evaluating the advantages and disadvantages of each one and proposing improvements in their design.
- Be able to use an advanced computational tool, based on the Finite Element Method, to design and simulate the biomechanical behavior of prostheses and implants of the locomotor system.

2.3. Importance of learning goals

The learning results are designed to provide the student with the knowledge and tools necessary to address problems related to the design of prosthetics and implants of the locomotor system.

3. Assessment (1st and 2nd call)

3.1. Assessment tasks (description of tasks, marking system and assessment criteria)

The students must demonstrate that they have achieved the expected learning outcomes through the following assessment activities.

The final qualification for the course in the first call is divided as follows:

- Assignments. 70% of the final qualification. This note will be achieved through the development of a series of practical works to be carried out throughout the course. The evaluation will be based on the written reports submitted. If such practical work is not delivered in its entirety, or if its average grade is less than 5 out of 10, the student must deliver the part suspended or not delivered, duly completed, on the day of the final exam that appears in the official announcement.
- Theoretical and practical tests. 30% of the final qualification. It is a test carried out on the dates set by the center. A minimum grade of 4 out of 10 must be obtained to pass the final exam.

For the second call, the evaluation will consist of the same parts as in the first call.

4. Methodology, learning tasks, syllabus and resources

4.1. Methodological overview

The teaching methodology is structured in four levels:

- Theoretical documentation where the main subject contents are presented and discussed.

- Practice sessions where examples and concrete cases are presented throughout the course.
- Computer lab sessions where the theoretical concepts are applied.
- Development of a practical task based on a real application.

4.2. Learning tasks

- Practice sessions (T2). Examples and concrete cases are presented throughout the course that complement the theoretical knowledge.
- Computer lab sessions (T3). The aim is to familiarise students with another of the basic tools of the subject, such as calculus and numerical simulation. The fundamental objective of these sessions is for the student to be able to interpret the results obtained by means of the computer, being able to discern if these are suitable or not.
- Development of a practical task (T6). It aims to develop the formula of project-based learning to reinforce the rest of the teaching activities and, together with laboratory and computation sessions, allow the student to acquire autonomous work and critical thinking.
- Autonomous work and study (T7). The student's autonomous work of the theoretical part and problem solving. The student's continuous work will be encouraged by the homogeneous distribution of the various learning activities throughout the course. Tutorials are included here, such as direct attention to the student, identification of learning problems, orientation in the subject, support to exercises and work.
- Assessments (T8). In addition to the grading function, assessment is also a learning tool with which the student checks the degree of understanding and assimilation achieved.

4.3. Syllabus

The course will address different topics, including concepts such as:

- Biomechanics oriented to the design of prostheses and implants.
- Biomaterials currently used in the design of prostheses and implants.
- Typologies of most common prostheses for the locomotor system: upper limb, lower limb and spine.
- Application of the Finite Element method to the design of prostheses and implants.

4.4. Course planning and calendar

The course calendar is defined by the University of Zaragoza. 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 EUPT website (https://eupt.unizar.es/).

In addition, a detailed schedule of activities (computer lab sesión, deadlines, ...) will be available on the website of this course (http://moodle.unizar.es/).

Every professor fixes their office hours.

4.5. Bibliography and recommended resources

The bibliography recommended by the teaching staff will be available in the library of the University of Zaragoza http://psfunizar10.unizar.es/br13/eBuscar.php?tipo=a