

69712 - Nano-biomedicine: Fundamentals and applications

Syllabus Information

Academic year: 2024/25

Subject: 69712 - Nano-biomedicine: Fundamentals and applications

Faculty / School: 110 - Escuela de Ingeniería y Arquitectura

Degree: 633 - Master's Degree in Biomedical Engineering

ECTS: 3.0

Year:

Semester: Second semester

Subject type: Optional

Module:

1. General information

The main objective of the subject is to show how nanotechnology is contributing to the development of advanced therapies and new diagnostic systems, as well as to the improvement of existing ones. Current examples of the use of nanomaterials in the improvement of the quality of patient care will be shown. This allows to progress towards personalized medicine, offering innovative products in various pathologies including cancer, cardiovascular diseases, rare diseases, infectious diseases, etc. A distinction will be made between those nanotechnological approaches applied in **therapy** (e.g., localized drug delivery, vaccine development, etc.) and those applied in **diagnostics** with special emphasis on the use of nanobiosensors to detect biomarkers that could indicate the potential presence of a disease.

2. Learning results

Upon completion of this subject, the student will be able to:

Write a scientifically valid report developing one of the examples described during the term on materials and devices currently used in nanoscience or nanotechnology applied to therapy or diagnostics. The work required to pass the subject is so demanding that a merely informative work with no scientific value is not acceptable.

By passing this subject, the student acquires a basic knowledge in the field of biomedical applications of nanoscience. It starts with the learning on how to synthesize these nanomaterials, characterize and apply them in therapy and diagnosis.

Manage the basic terminology of the field of nanomedicine, understand the concepts and relate them with each other.

See the importance and role of nanobiomedicine in the global context of biomedical applications

The student can broaden the range of possibilities that their training offers after completing the master's degree by "discovering" the multidisciplinary possibilities that nanoscience offers. They may also apply their training to the pharmaceutical, biotechnology, chemical, health and other industries.

The importance of the learning results designed for this subject lies in being able to demonstrate basic knowledge in one of the fields of greatest current projection in the field of bioengineering, biomaterials, personalized medicine and biomedical applications.

Students will be able to understand that nanotechnology employs nano-scale materials, which, due to their size, interact with biological systems at the molecular level and can revolutionize the treatment of diseases by stimulating, responding to, and interacting with specific sites to induce physiological responses while minimizing the side effects of conventional therapies.

3. Syllabus

Topic 1. Generalities of nanoscience, historical evolution and manipulation of materials at the atomic scale.

Topic 2. Synthesis and characterization of nanoparticles and nanostructured materials.

Topic 3. Biochemistry applied to nanomedicine. Structure and function of biomolecules: DNA probes, enzymes, antibodies, etc.

Topic 4. Strategies and key aspects for recognition element immobilization including nucleic acids, enzymes and antibodies.

Topic 5. Introduction to the therapeutic and diagnostic applications of nanobiomedicine.

Topic 6. Future and social, ethical and environmental implications of these technologies. Nanotoxicology.

4. Academic activities

The presentation of the theoretical contents as lectures and the tutored practical work will be the main activities.

The teacher will propose to each student a topic related to the matter covered in the subject, as close as possible to their personal interests, taking into account, if applicable, their professional tasks, the thesis project, master's thesis, etc. that they are developing in order to relate these personal interests to the subject.

This course is English Language Friendly, which means that: the course syllabus is also available in English; the study and class materials are in English; the faculty is willing to conduct office hours in English; and students are allowed to take their assessments in English

5. Assessment system

There are two examination modalities:

Continuous assessment:

This system consists of a scientific review paper (50% of the final grade) and an exam with multiple choice, true or false, short development, multiple choice, etc. questions (50% of the final grade)

To average both evaluation activities it will be necessary to obtain at least 4 points out of 10 in each of them.

Regarding the paper: the student (individually or in groups, according to their preference) must be able to prepare a scientifically valid report (in Spanish or English, according to their preference) developing a scientific review article.

The work required to pass the subject is so demanding that a merely informative work with no scientific value is not acceptable. The paper will have a defined structure, which will be detailed during the presentation of the subject and will include the title, abstract, review of the state of the art, conclusions and personal opinion.

On the other hand, students will also have the option of a single assessment test in the first and second call, which will consist of 10 multiple-choice, true or false, short development, multiple choice, etc. questions.

6. Sustainable Development Goals

2 - Zero Hunger

3 - Good Health & Well-Being

6 - Clean Water and Sanitation