Universidad Zaragoza

Academic Year/course: 2024/25

60038 - Nanoscience and nanotechnology

Syllabus Information

Academic year: 2024/25
Subject: 60038 - Nanoscience and nanotechnology
Faculty / School: 100 - Facultad de Ciencias
Degree: 538 - Master's in Physics and Physical Technologies
589 - Master's in Physics and Physical Technologies
ECTS: 5.0
Year: 1
Semester: Second semester
Subject type: Optional
Module:

1. General information

The main objective of this subject is to help the student learn how systems with nanometric dimensions can be prepared by physical methods, in addition to the most common techniques for the characterization of nanomaterials. For this purpose, state-of-the-art equipment belonging to the University of Zaragoza and the Institute of Nanoscience and Materials of Aragon (INMA) will be used.

2. Learning results

- Maturity to distinguish between the different approaches, tools and techniques used in nanoscience and nanotechnology.
- Describe different applications in each of the different fields of nanotechnology.
- Differences between different methods of growth, fabrication and characterization of nanosystems.
- Name the most important research topics in nanoscience.
- Explain the different steps required for each application in terms of preparation and fabrication of nanosystems as well as their characterization.
- Calculate the interaction between an AFM tip and a surface.
- Evaluate the X-ray reflectivity of a film as a function of its thickness and roughness.
- Calculate the tunnel current between an STM tip and a surface.
- Estimate the growth rate of a material in the FEBID technique.
- Calculate the response of a magnetic biosensor.

3. Syllabus

- **Block 1: Introduction**: Basic concepts of nanoscience and nanotechnology and precise description of the subject.
- **Block 2: Nanostructure preparation**: vacuum and thin film growth technologies. Artificial fabrication methods: optical, electron and ion beam lithography, local probe lithography, nanoimprinting. Self-assembly and self-organization. Manufacture of nanoparticles. Functionalization of nanoparticles.
- **Block 3: Characterization techniques in nanoscience**: local probe microscopy, scanning and transmission electron microscopy. Characterization techniques for thin films, surfaces and interfaces. Physical characterization techniques of nanoparticles for biomedical applications.
- **Block 4: nanoscience and nanotechnology applications**.

4. Academic activities

Master classes:35 hours**.**

Theoretical sessions in which the contents of the subject are explained.

Laboratory practices:15 hours**.**

Five practical work sessions will be organized using the existing research equipment at the INMA and the Advanced Microscopy Laboratory facilities at the Río Ebro Campus. Teachers and technicians will help students use the tools and guide them in writing the report.

Personal study:72 hours

Teaching assignments: 22 hours**.**

The writing of laboratory practice reports is included.

Assessment tests: 6 hours.

5. Assessment system

- Through **continuous assessment**:

- Intermediate tests (50% of the grade)**.**

They will consist of two or three tests to be taken in class after each of the three main sections of the subject. The final grade will reflect the quality of the solutions given to the tests.

- Laboratory practices **(**50% of the grade)**.**

Brief report of each of the five practical laboratory sessions including the objective and results obtained. The final grade will reflect the quality of the reports.

- Through **global assessment**:

- Final assessment test **(**100% of the grade)**.**

It will contain 50% of questions on the main concepts covered in the theoretical part of the subject and 50% of questions related to experimental aspects of the five practical sessions developed during the subject.

6. Sustainable Development Goals

3 - Good Health & Well-Being
7 - Affordable and Clean Energy
9 - Industry, Innovation and Infrastructure