Universidad Zaragoza

Academic Year/course: 2023/24

66100 - Fundamental Properties of Nanostructured Materials

Syllabus Information

Academic year: 2023/24
Subject: 66100 - Fundamental Properties of Nanostructured Materials
Faculty / School: 100 - Facultad de Ciencias
Degree: 539 - Master's in Nanostructured Materials for Nanotechnology Applications
ECTS: 6.0
Year: 1
Semester: First semester
Subject type: Compulsory
Module:

1. General information

The main aim of this course is to provide students with a sound theoretical and methodological background that will allow them to understand the fundamentals of the chemistry, physics, materials science, biochemistry, engineering, bioengineering and ecotoxicity behind the properties of nanomaterials. Throughout this module, students will acquire skills to interrelate structure, composition, architecture and physical, chemical properties of nanomaterials. This knowledge will guide students in the following modules of the Master.

These approaches and objectives are aligned with the achievement of SDG 9. Industry, innovation and infrastructures of the Agenda 2030. More specifically, they will create action to enhance research, foster innovation and upgrade industrial technologies.

2. Learning results

- Understanding the state of art of Nanoscience and Nanotechnology, assessing its multidisciplinary nature as well as the social, economic and legal implications.
- Understanding the conceptual differences between macro and nano systems, obtaining the necessary theoretical knowledge to acquire understanding of the nanoscale.
- Identifying materials and compounds of significant relevance at the nanoscale.
- Understanding the importance of the surface effects and the new forces that appear on the nanoscale and their influence on the properties of nanoscopic systems.
- Assessing properties of particular interest in nano-structured materials.
- Students are expected to know the possible effects of nanomaterials on health, environment and sustainability.

3. Syllabus

- Nanomaterials vs. macroscopic materials Physical Chemistry at the Nanoscale Physical Chemistry of Surfaces
- Introduction to Supramolecular Chemistry and Self-Assembly
- Optical, electric, magnetic, and mechanical properties of nanomaterials
- Nanoscopic organic materials (nanotubes, fullerenes, dendrimers, block copolymers...). 2D Nanomaterials
- Nanobiomaterials. Biomacromolecules.
- Nanoporous materials (zeolites and related, MOFs and mesoporous silica): structure, properties and emerging applications
- Eco-nanotoxicology

4. Academic activities

- **Lectures**. Lecture notes and a set of problems (and their corresponding solutions) will be available for the students. Each topic area making up the programme for the course will be presented, analysed and discussed by the lecturer through lectures of 50 minutes. The lecturers will provide the students with notes, handouts or summaries of class content prior to the beginning of the class (preferably via Moodle) along with the recommended reading for more in-depth understanding of the topic. Additionally, open forum activities on the basic concepts and their application, comparison with real developments, problem-solving and practical case studies are included in this module.

- **Assignments**. At the end of every topic, each student will complete the Q&As that the lecturers give them over the course. The Q&As are to be completed individually by students and sent electronically or handed in to the lecturers. In some cases, the Q&As will be presented and openly debated during class. Here, the students must also show their oral communication skills. Students will receive a reply from the lecturers as a result of the Q&As and there will be a discussion on the areas of discrepancy in the answers. For some topics, the assignments will be carried out in small groups or in pairs, and the students will elaborate an oral exposition for the presentation to the class.
- **Autonomous work**. Students are expected to spend about 90 hours to study theory, solve problems, prepare sessions and assignments and take exams.

5. Assessment system

For students choosing **Continuous Assessment** (attendance to at least 80% of this module lectures is required)

1.- Written exam (50% of the final result for the module). This written exam consists of: a) Theory questions including: (i) topic(s) to be explained and (ii) short answer and/or multiple choice questions; b)Problem solving and exercises where data treatment ability, chemical-physical property assessment, differentiation between macro- and nanoscale, use of appropriate SI units, etc. will be assessed.

2.- Individual Assessments including exercises, problem and question solving of matters seen in class and seminars, oral expositions where the students need to show knowledge of the topic and oral communication skills (50% of the final result of the module).

For students that did not pass the ongoing assessment or wish to increase their mark **Global Assessment** comprising a written test (50%) and an oral test (50%) before a board of three lecturers from the subject area.

A minimum qualification of 4 out of 10 is needed in each of the two tasks to pass the subject. In any case, the average over the two sections must be at least 5 out of 10 to pass the subject.