Universidad Zaragoza

Academic Year/course: 2022/23

66433 - Advanced Materials in Mechanical Engineering

Syllabus Information

Academic Year: 2022/23
Subject: 66433 - Advanced Materials in Mechanical Engineering
Faculty / School: 110 - Escuela de Ingeniería y Arquitectura
Degree: 536 - Master's in Mechanical Engineering
ECTS: 4.5
Year: 1
Semester: Second semester
Subject Type: Optional
Module:

1. General information

1.1. Aims of the course

The course and its expected results respond to the following approaches and objectives:

- Provide the student with a broad training of the materials available for the numerous applications of Mechanical Engineering, deeping into the relationships between the structure and its relevant properties for the design, construction of parts, components, equipment and devices, and their behavior in service.

- Provide information on the techniques for selecting the most suitable materials for a specific application, based on the operational requirements, whether functional and/or structural, taking into account the size and geometry of the part or material element, as well as its cost. In the selection of materials, concepts related to environmental impact and ecological design are also introduced.

- Update the knowledge of the new materials that are in research and development for the different industrial applications, in the research processes that are followed and in the manufacturing methods that are used.

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

Objective 7: Affordable and clean energy.
Target 7.a By 2030, enhance international cooperation to facilitate access to clean energy research and technolog

including renewable sources, energy efficiency, and advanced and cleaner fossil fuel technologies, and promote

investment in energy infrastructure and clean technologies.

2. Learning goals

3. Assessment (1st and 2nd call)

4. Methodology, learning tasks, syllabus and resources

4.1. Methodological overview

The methodology that is proposed tries to promote the continuous work of the student.

In the sessions with the whole group, the theoretical aspects are dealt with in the form of participatory lectures and problems/cases, which are completed with laboratory practices, which are carried out in groups to encourage teamwork. Both the teacher's presentations and the scripts of the practices and the problem statements, as well as other material of interest for the follow-up of the subject, will be in the ADD (Moodle).

Another important aspect that is intended to be developed in students through directed work throughout the semester is decision-making, search, analysis and synthesis of information related to some topics of the course content, as well as its presentation and debate before the teacher and classmates.

4.2. Learning tasks

The course includes the following learning tasks:

- **Lectures** A01 (15 hours). The teacher explains the main contents of the course.
- **Practice sessions** A02 (15 hours). They consist of problem sets and case studies, and the public defenses of the student work.
- **Laboratory sessions** A03 (10 hours).
- **Special practice sessions** A04 (5 hours).
- **Assignment** A05 (25 hours). The student will study several research articles given by the teacher. It can be done individually or in pairs, depending on the number of students. If needed, students should analyze and seek additional information for full understanding of the articles. The student will prepare a report for each assignment and submit them to the teacher. This work will be defended orally in front of the teachers and the rest of the class.
- **Tutorials** A06 (5 hours). Students can attend office hours to review and discuss the materials and topics presented in both theoretical and practical classes.
- **Study of theory** A07 (32 hours).
- **Assessment** A08 (5.5 hours). Reports, assignments, and written tests.

4.3. Syllabus

The course will address the following topics:

1. Materials used in mechanical engineering and its application in various industrial sectors: automotive, aerospatial, naval, metalmechanic, chemical, energy, building.
2. Selection of materials for various applications in mechanical engineering. following the property diagrams method (by M. Ashby, Professor at University of Cambridge), including the shape/section of components. Resolution of practical cases.
3. The latest trends in materials in mechanical engineering and their manufacturing and forming processes, and their mechanical properties: High Entropy Alloys, Alloys for Mechanical Alloying, Glassy Alloys, Shape Memory Alloys, Advanced Polymers, Composites and Ceramics.

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 or to the Course website.