Universidad Zaragoza

Academic Year/course: 2022/23

29742 - Advanced Industrial Materials

Syllabus Information

Academic Year: 2022/23
Subject: 29742 - Advanced Industrial Materials
Faculty / School: 110 - Escuela de Ingeniería y Arquitectura
Degree: 434 - Bachelor's Degree in Mechanical Engineering
ECTS: 6.0
Year: 4
Semester: Second semester
Subject Type: Optional
Module:

1. General information

1.1. Aims of the course

The contents of the subject have as a general objective that the student knows some of the most innovative materials in modern mechanical engineering, together with the traditional materials, the techniques with whi fabricated and adequately joined with other materials, the advanced surface engineering techniques for a b in service, and their most important applications. An especially interesting aspect for the degree student them with arguments to open their minds in order to work and design with the materials and processes tha their creativity and allow them to be better professionals in their work. The importance of the analysis of m in service and the process to establish the root causes of the failures will be especially analyzed, and thus recommend solutions to the problems that have appeared.

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

• Goal 12: Guarantee sustainable consumption and production patterns.

Target 12.5: By 2030, substantially reduce waste generation through prevention, reduction, recycling and r

2. Learning goals

3. Assessment (1st and 2nd call)

4. Methodology, learning tasks, syllabus and resources

4.1. Methodological overview

The proposed methodology searches for promoting the constant work of the student

The lectures for the complete group will deal with theoretical and practical objectives, complemented trough practical and laboratory sessions. These sessions are made in small groups to promote teamwork.

Another important aspect to be developed is student decision making. For this aim, several works are proposed throughout the semester.

The evaluation will be centred on the basic aspects of material behaviour and the relationship material-processing-structure-application.

Classroom materials will be available via Moodle. These include a repository of the lecture notes used in class, the course syllabus, as well as other course-specific learning materials.

Further information regarding the course will be provided on the first day of class.

4.2. Learning tasks

The course includes 6 ECTS organized according to:

* Lectures: 37 hours
* Laboratory sessions: 12 hours
* Problem-solving tasks and Problem-based learning: 30 hours
* Individual work: 65 hours
* Examination: 6 hours

4.3. Syllabus

The course will address the following topics:

1. METALLIC AND NON METALLIC MATERIALS.

Advanced steels and cast irons. Alloys for low and high-temperature applications: Superalloys and ODS alloys. Shape memory alloys. Glassy metals. Metallic foams. Metal matrix composites. Properties and applications. Polymer matrix composites. Ceramic matrix composites.

2. WELDS AND ADHESIVE JOINTS.

Welding processes. Friction and Friction Stir welding. The microstructure of the welded zone in ferrous and non-ferrous alloys. Weldability. Cracking in welds: causes and remedies. Mechanical and non-destructive tests on metallurgical welds. Adhesives and adhesion mechanisms. Surfaces preparation. Joint design and strength. Joining wood, metals, plastics, composite structures and rubber. Applications.

3. MODIFICATION OF SURFACES AND COATINGS.

Classification. Classic surface treatments. New surface treatments. PVD (physical vapor deposition). CVD (chemical vapor deposition). Ion implantation. Thermal projection. The laser applied to surface treatments.

4. ANALYSIS OF FAILURES IN SERVICE.

Analysis methodology on damage and failure mechanisms: Brittle and ductile fracture, fatigue, creep, wear, corrosion, etc. Investigation and identification techniques: non-destructive tests, metallography, scanning electron microscopy, destructive tests. The technical report.

4.4. Course planning and calendar

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Lectures	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
Solving tasks and Problem			x	x	x					x	x	x	x		
Laboratory sessions		x	x	x	x	x	x	x	x	x	x	x	x		
Examination							x								x
Individual work	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

For further details concerning the timetable, classroom and further information regarding this course, please refer to the "Escuela de Ingenieria y Arquitectura " (EINA) website: https://eina.unizar.es/