

Academic Year/course: 2021/22

## 29742 - Advanced Industrial Materials

### Syllabus Information

**Academic Year:** 2021/22

**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

### 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 through 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 Ingeniería y Arquitectura " (EINA) website: <https://eina.unizar.es/>