

# COURSE SYLLABUS

## TITLE: MATERIALS SCIENCE IN TRANSPORT AND ENERGY INDUSTRIES

### General information

Code: 108

Degree/master: Master Universitario en Sistemas Inteligentes en Energía y Transporte

Faculty/school: Escuela de Ingenierías Industriales

Duration: 6 ECTS. 2<sup>nd</sup> semester

Lecturers: Dr Daniel Camas Peña ([dcp@uma.es](mailto:dcp@uma.es)), Dr M Alejandro Sanchez Cruces ([ascruces@uma.es](mailto:ascruces@uma.es)) and Dr Pablo Lopez Crespo ([plc@uma.es](mailto:plc@uma.es))

### Results

The course will focus on the fundamentals of mechanics of materials in relation to the failures of materials and structures. It will also help to apply this knowledge in solving specific problems in the analysis and design of materials used in energy, transportation and various industrial settings.

### Summary of course content

#### Fundamentals of fracture mechanics

Introduction.

Basic concepts of linear elastic fracture mechanics.

Fracture modes, Griffith theory, rate of energy release and fracture energy, stress intensity factor, plastic zones,

Fracture toughness.

#### Introduction to fatigue

Fatigue failure.

Stages: Nucleation and crack growth.

Basic relationships.

Cyclic behaviour.

Influence of various factors on behaviour.

#### Classic calculation models

Basic models in stresses.

Deformation based models.

Cumulative damage models.

Separation nucleation-growth.

Local strain method.

Fatigue with stress concentrators.

### **Fatigue crack growth**

Introduction.

da-dN curve.

Threshold fatigue.

Influence of R on growth.

Small crack growth.

Determination of growth life.

Crack closure.

Simulation models.

### **Multiaxial fatigue**

Models based on stress analysis.

Models based on deformation analysis.

Energy models.

Growth models.

### **Random fatigue**

Characterization of random charges.

Retardation effects.

Simulation models.

## **FORMATIVE ACTIVITIES**

### Face-to-Face Activities

Expository Activities: Lectures

Practical Activities in Specific Facilities: Laboratory Practices

### Non-Face-to-Face Activities

Practical Activities: Project Development and Evaluation

Self-Study: Personal Study

## **ASSESSMENT ACTIVITIES**

Face-to-Face Assessment Activities

Student Assessment Activities

Final Examination

Completion of Assignments and/or Projects