

## 28712 - Materials: Science and Technology

### Información del Plan Docente

Academic Year	2017/18
Faculty / School	175 - Escuela Universitaria Politécnica de La Almunia
Degree	423 - Bachelor's Degree in Civil Engineering
ECTS	6.0
Year	2
Semester	Second semester
Subject Type	Compulsory
Module	---

### **1.General information**

#### **1.1.Introduction**

#### **1.2.Recommendations to take this course**

#### **1.3.Context and importance of this course in the degree**

#### **1.4.Activities and key dates**

### **2.Learning goals**

#### **2.1.Learning goals**

#### **2.2.Importance of learning goals**

### **3.Aims of the course and competences**

#### **3.1.Aims of the course**

#### **3.2.Competences**

### **4.Assessment (1st and 2nd call)**

#### **4.1.Assessment tasks (description of tasks, marking system and assessment criteria)**

### **5.Methodology, learning tasks, syllabus and resources**

#### **5.1.Methodological overview**

The learning process designed for this subject is based on the following

The teaching methodology is based on a strong interaction between the teacher/student. This interaction is made a reality through a division of work and responsibilities between the students and the teacher. Nevertheless, it must be taken into account that, to a certain degree, students can set their learning pace based on their own needs and availability, following the guidelines set by the teacher.

## 28712 - Materials: Science and Technology

The current subject SCIENCE AND TECHNOLOGY OF MATERIALS is conceived as a stand-alone combination of contents, yet organized into three fundamental and complementary ways, which are: the theoretical concepts of each teaching unit, the solving of problems or resolution of questions and laboratory work, supported in turn by other activities.

1. Classroom activities:
  1. **Theory Classes** : the theoretical concepts of the subject will be explained.
  2. **Practical Classes** : Students will develop examples and conduct problems or case studies concerning the theoretical concepts studied.
  3. **Laboratory Workshop** : Students will develop tests to reinforce the theoretical concepts studied.
2. Reinforcement activities: Through a virtual education portal (Moodle) several activities which strengthen and expand the basic contents of the subject will be addressed. These activities will be personalized and controlled its realization.

Teaching organization:

\* **Theory Classes** : Master theoretical and / or practical lessons given mostly by the teacher.

\* **Practical Classes** / seminars / workshops: Theoretical or practical activities carried out in the classroom and requiring high student participation.

\* Lab / Working site / computer room: Practical activities in laboratories, in the working site, in the computer rooms.

\* Group tutorials: Learning tracking scheduled activities in which the teacher meets with a group of students to guide their autonomous learning work that requiring a very high degree of counselling from the teacher.

\* **Individual Tutorials** : Face-to-face or online.

### 5.2.Learning tasks

The programme offered to the student to help them achieve their target results is made up of the following activities:

Involves the active participation of the student, in a way that the results achieved in the learning process are developed, not taking away from those already set out, the activities are the following:

– **Face-to-face generic activities** :

– **Theory Classes** : The theoretical concepts of the subject are explained and illustrative examples are developed as support to the theory when necessary.

– **Practical Classes** : Problems and practical cases are carried out, complementary to the theoretical concepts studied.

– **Laboratory Workshop** : This work is tutored by a teacher, in groups of no more than 20 students.

## 28712 - Materials: Science and Technology

– **Generic non-class activities** :

• Study and understanding of the theory taught in the lectures.

• Understanding and assimilation of the problems and practical cases solved in the practical classes.

• Preparation of seminars, solutions to proposed problems, etc.

• Preparation of laboratory workshops, preparation of summaries and reports.

• Preparation of the written tests for continuous assessment and final exams.

- **Assisted Autonomous activities** : Although they will have a strong face-to-face character, they will be focused mainly on seminars and tutorials under the supervision of the teacher.

- **Reinforcement activities** : With a strong non-class character, through a virtual learning portal (Moodle) several activities that reinforce the basic contents of the subject will be conducted. These activities might be customized or not, but always under control.

The subject has 6 ECTS, which represents 150 hours of student work in the subject during the semester, in other words, 10 hours per week for 15 teaching weeks.

A summary of a weekly timetable guide can be seen in the following table. These figures are obtained from the subject file in the Accreditation Report of the degree, taking into account that the level of experimentation considered for the subject is moderate.

Activity	Weekly school hours
Lectures	3
Laboratory Workshop	1
Other Activities	6

## **28712 - Materials: Science and Technology**

Nevertheless, the previous table can be shown in greater detail, taking into account the following overall distribution:

&mdash; 45 hours of lectures, with 70% theoretical demonstration and 30% solving type problems.

&mdash; 9 hours of laboratory workshop, in 2 hours per sessions.

&mdash; 4 hours of written assessment tests, 2 hours per test.

&mdash; 2 hours of PPT presentations.

&mdash; 90 hours of personal study, over the 15 weeks of the 2 nd semester.

There is a tutorial calendar timetable set by the teacher that can be requested by the students who want a tutorial.

### **5.3.Syllabus**

#### **Contents of the subjects essential to achieve learning outcomes**

##### **Theoretical Contents**

The choice of the content of the different teaching units was made seeking the express clarification of the final goal so that with the addition of incidental knowledge, the student can achieve a structured and understandable knowledge to reach the competences of a Civil Engineering.

The theoretical contents are classified according to five teaching units, attached table, indivisible treatment blocks, taken into account the configuration of the subject under programming. These topics collect the contents needed for the acquisition of predetermined learning outcomes.

## 28712 - Materials: Science and Technology

Tema 1	Syllabus	Metals
		1. INTRODUCTION 2 CRYSTAL STRUCTURE 3 FORMATION AND NATURE OF ALLOYS 4 MECHANICAL PROPERTIES 5 CONCEPTS 6 PHYSICAL PROPERTIES 7 CHEMICAL PROPERTIES 8 UNIONS 9 FORMING 10 IRON AND ITS ALLOYS 11 COPPER AND ITS ALLOYS 12 ALUMINIUM AND ITS ALLOYS
Tema 2	Syllabus	Cements
		1 NATURE OF CEMENTS 2 RAW MATERIALS OF CEMENTS 3 CEMENT PRODUCTION 4 CEMENT CONSTITUENTS 5 CEMENT HYDRATION 6 CLASSIFICATION OF CEMENTS 7 PROPERTIES OF CEMENTS 8 TEST OF CEMENTS 9 USES OF CEMENT

## 28712 - Materials: Science and Technology

Tema 3	Syllabus	Bitumen
		1 ORIGIN OF BITUMEN 2 RHEOLOGICAL TESTS OF BITUMENS 3 CLASSIFICATION OF BITUMENS 4 NFU (OUT-OF-USE TYRES IN BITUMENS) 5 BITUMINOUS EMULSIONS 6 BITUMEN APPLICATIONS
Tema 4	Syllabus	Bituminous Mixtures
		1 PRODUCTION 2 TRANSPORT 3 ON-SITE POSITIONING 4 MIX TYPOLOGIES 5 MIX CLASSIFICATION 6 MIX RHEOLOGY 7 REGULATIONS 8 PATHOLOGIES
Tema 5	Syllabus	Concretes
		1 HISTORY 2 MANUFACTURING 3 TRANSPORT 4 ON-SITE POSITIONING  5 WET CONCRETE 6 HARDENED CONCRETE 7 MECHANICAL TESTING 8 REGULATIONS  9 PATHOLOGIES

### Practical Contents

The theoretical knowledge of the previous section, has associated practice tasks. The Laboratory practice tasks in Science and Technology of Materials are an important complement to the comprehensive training of the student in the Civil Engineering degree.

## 28712 - Materials: Science and Technology

It is impossible to even try to give a minimal description of the different types of gadgets and commercial devices used for measuring different magnitudes. This is not the purpose of the subject. It is to cover the learning outcomes through a comprehensive program of laboratory practice activities, including aspects related to the following issues:

\* Generically, a clear idea of the importance of the field of material testing as well as the implementation time and their application. \* Students must, at least, acquire knowledge about the most common techniques for measuring magnitudes such as: mechanical resistance, chemical resistance, environmental resistance, etc. of the materials used in construction.

### 5.4.Course planning and calendar

#### Assessment schedule

It will be fixed depending on the development of the lectures.

The written assessment tests will have a connection with the following topics:

- Test 1: Topic: Metals, Cement and Bitumen.
- Test 2: Topic: Concrete and Bituminous Mixtures.

The issues about which the projects will be developed will be proposed in the third week, and they should be handed in and presented before the last two teaching weeks. The exact dates will be specified along the year.

The dates of the final exams will be published at <http://www.eupla.es/secretaria/academica/examenes.html> .

Next, the practice tasks to be developed in the laboratory that will be carried out by the students in sessions of two hours are shown below.

Practice 1	Tests on aggregates (grain sizing and sand equivalent).
Practice 2	Tests on metals (Traction, hardness, identification of rebars , etc. ).
Practice 3	Material Density Determination Test.
Practice 4	Concrete Test Tube Dosage and Implementation
Practice 5	Mechanical tests of concrete (compression, bending strength, etc. ).
Practice 6	Proctor Test

## 5.5. Bibliography and recommended resources

### Materials

Materials	Soporte
Topic theory notes Topic problems	Paper/repository
Topic theory notes Topic presentations Topic problems Related links	Digital/Moodle E-Mail
Material de ensayos	Pc's laboratorio
Guión de prácticas	Paper/repository
Maquinas multiensayos Tamices Moldes de probetas Bandejas Etc.	

### Bibliography

In addition to the specific text of the subject published to the effect itself expressly made by the teacher, the following basic and complementary bibliography for student consultation / to be taken into account .



## 28712 - Materials: Science and Technology

ISBN	Bibliografía
	Monografías del Instituto Eduardo Torroja.
	W.E. SCHULZE. Geotecnia. Blume.
8472070085	JIMINEZ SALAS. Geotecnia y Cimientos I. Rueda (2 da . 1975)
8431313560	GARCIA VALCARCE. Manual de Edificación. Univ de Navarra. (1995)
843680404x	COCA ROSIQUE. Ciencia de Materiales. Piramide (15 ta . 1992)
848143132X	GEOTECNIA. ENSAYOS DE CAMPO Y DE LABORATORIO. AENOR 1999.
9788497566537	TECNOLOGIA DE MATERIALES. Dpto. de Ciencia de Materiales e Ingeniería Metalúrgica del CPS (Univ. de Zaragoza). J.A. Puértolas - Ricardo Ríos - A. Vilellas - J.M. Casals. Síntesis. (2 da . 2009)
9701056388	FUNDAMENTOS DE LA CIENCIA E INGENIERÍA DE MATERIALES. Editorial Mc Graw Hill. (William F. - Javad Hashemi).
8448139984	KRAEMER, C. Ingeniería de Carreteras. Mc Graw Hill (2004)
	W.E. SCHULZE. Geotecnia. Blume.
8495596512	BUSTOS PRETEL. PG-3. Liteam (4 ta . 2004)
8431313560	GARCIA VALCARCE. Manual de Edificación. Univ de Navarra. (1995)
84-923128-8-2	MATERIALES DE CONSTRUCCION. Manuel Bustillo Revuelta. Editorial Fuego



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978-84935279-1-4	HORMIGONES Y MORTEROS. Manuel Bustillo Revuelta. Editorial Fueyo
	HORMIGON ARMADO. Jiménez Montoya