

**1. General information****Course:** SCIENCE AND TECHNOLOGY OF CIVIL ENGINEERING MATERIALS**Type:** CORE COURSE**Degree:** 345 - UNDERGRADUATE DEGREE PROGRAMME IN CIVIL ENGINEERING**Center:** 603 - E.T.S. CIVIL ENGINEERS OF CR**Year:** 1**Main language:** Spanish**Use of additional languages:****Web site:****Code:** 38303**ECTS credits:** 6**Academic year:** 2023-24**Group(s):** 20**Duration:** First semester**Second language:** English**English Friendly:** Y**Bilingual:** N**Lecturer:** ELISA POVEDA BAUTISTA - Group(s): 20

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**Lecturer:** GONZALO FRANCISCO RUIZ LOPEZ - Group(s): 20

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**2. Pre-Requisites**

Not established

**3. Justification in the curriculum, relation to other subjects and to the profession**

This subject is the first one of the curriculum of the student of direct application to engineering. The material constitutes the element with which the engineer designs and builds his works, as well as the medium on which he places his construction. The knowledge of the materials throughout history has conditioned the form and typology of the structures, as well as their dimensions. The incorporation of new materials and the better knowledge of those already employed has led to new forms and structural typologies and a better use of available resources. Knowledge of materials, their relationship with the structural form, their properties and way of working, their applications and their implementation are essential aspects in the training of future engineers and necessary to correctly assimilate the contents of many of the subjects of the curriculum.

**4. Degree competences achieved in this course****Course competences**

Code	Description
CB01	Prove that they have acquired and understood knowledge in a subject area that derives from general secondary education and is appropriate to a level based on advanced course books, and includes updated and cutting-edge aspects of their field of knowledge.
CE06	Students have a basic knowledge of the use and programming of computers, operating systems, databases and software with engineering application.
CE11	Students have theoretical and practical knowledge of the chemical, physical, mechanical and technological properties of the materials most commonly used in construction.
CE12	Students have the ability to apply their knowledge of building materials to structural systems. Knowledge of the relationship between the internal structure of materials and the mechanical properties derived from it
CG02	Students can use proper oral and written communication

**5. Objectives or Learning Outcomes****Course learning outcomes****Description**

Students experimentally determine the mechanical properties of materials of interest in civil engineering.

Students recognize the relevant mechanical variables in each problem, learn how to measure them and calibrate the error in the measurement and results of their calculations.

Students know the materials of interest in civil engineering. In particular, the interrelationship between the internal structure of the material, their macroscopic properties and the structural forms derived from them. They also know the applications, ways of processing and placing on site of the main materials of interest in civil engineering. They select and design suitable materials for each application and structural form in civil engineering.

**6. Units / Contents****Unit 1: INTRODUCTION TO CIVIL ENGINEERING MATERIALS****Unit 2: FUNDAMENTALS OF MATERIALS****Unit 2.1** Atomic bonding**Unit 2.2** The architecture of solids**Unit 2.3** Development of microstructure**Unit 2.4** Surface Properties**Unit 3: MECHANICS OF MATERIALS**

**Unit 3.1** Behavior of materials under stress

**Unit 3.2** Failure and fracture

**Unit 3.3** Rheology of fluids and solids

**Unit 3.4** Fatigue

**Unit 4: KNOWLEDGE AND TECHNOLOGY OF CIVIL ENGINEERING MATERIALS**

**Unit 4.1** Particulate composites

**Unit 4.2** Aggregates

**Unit 4.3** Gypsum plaster

**Unit 4.4** Lime

**Unit 4.5** Cement

**Unit 4.6** Concrete

**Unit 4.7** Asphalt materials and asphalt concrete

**Unit 4.8** Steel

**Unit 4.9** Natural stone

**Unit 4.10** Ceramic materials

**Unit 4.11** Wood and timber

**Unit 4.12** Polymers and plastics

**Unit 4.13** Composites

**Unit 4.14** Glass

7. Activities, Units/Modules and Methodology							
Training Activity	Methodology	Related Competences (only degrees before RD 822/2021)	ECTS	Hours	As	Com	Description
Laboratory practice or sessions [ON-SITE]	Practical or hands-on activities	CE11 CE12	0.24	6	Y	Y	3 Laboratory sessions: Students go to the Laboratory to do tests and measurements on them, which reinforce the theory and practical concepts; they must follow the methodology appropriate for the Laboratory work, the general safety procedures and those established for the particular tests they have to work on. It can be made-up in final exams.
Class Attendance (theory) [ON-SITE]	Lectures	CB01 CE11	0.96	24	N		Theory classes: The instructor explains the theoretical topics using the blackboard plus electronic presentations in case graphical support is necessary; simple exercises highlighting basic theoretical concepts are given; attentive listening, taking notes, examples workout.
Class Attendance (practical) [ON-SITE]	Project/Problem Based Learning (PBL)	CE11 CE12	1.04	26	Y	N	Exercises classes: The instructor poses several series of problems so that students can solve as homework using the knowledge gained in theory classes and in personal study; the methodology to solve the problems is explained in these classes; moreover, the most representative problems of each series are solved in detail. It can not be made-up in final exams.
Study and Exam Preparation [OFF-SITE]	Other Methodologies	CE11 CE12	3.28	82	N		Personal study: This learning activity consists of personal study of the lessons explained in the theory classes, using the recommended books, the student notes and the copies of presentations or other material that can be handed out.
Practicum and practical activities report writing or preparation [OFF-SITE]	Group Work	CE06 CE11 CE12 CG02	0.32	8	Y	Y	Data analysis, elaboration of the Labwork report and presentation of the results: The instructor orients on how the Lab data have to be analyzed; he/she also teaches how to elaborate a report, following scientific standards, to inform about the measured data, discuss them and draw conclusions from them; writing the report and presenting its content reinforce the understanding of the Labwork and of the conclusions drawn. It can be made-up in final exams. Minimum mark of 4.

Mid-term test [ON-SITE]	Assessment tests	CB01 CE11 CE12	0.16	4	Y	Y	Partial exams of the continuous evaluation system. It can be made-up in final exams. Minimum mark of 4 in each partial to save this part in final exam.
Total:			6	150			
Total credits of in-class work: 2.4			Total class time hours: 60				
Total credits of out of class work: 3.6			Total hours of out of class work: 90				

As: Assessable training activity

Com: Training activity of compulsory overcoming (It will be essential to overcome both continuous and non-continuous assessment).

8. Evaluation criteria and Grading System			
Evaluation System	Continuous assessment	Non-continuous evaluation*	Description
Test	50.00%	75.00%	Written exams to evaluate the acquired basic knowledge and capacities. Please, see the description below.
Laboratory sessions	16.80%	25.00%	The grading is done by reviewing the Lab report complemented, if necessary, with a presentation on the Lab results. They are kept from one year to the next.
Assessment of problem solving and/or case studies	16.60%	0.00%	The students are asked to periodically deliver some of the exercises of the series, which are graded throughout the course (continuous evaluation system).
Assessment of active participation	16.60%	0.00%	Attendance and participation in theory and practice classes are fostered by assigning to them a small weight in the evaluation process (continuous evaluation system).
<b>Total:</b>	<b>100.00%</b>	<b>100.00%</b>	

According to art. 4 of the UCLM Student Evaluation Regulations, it must be provided to students who cannot regularly attend face-to-face training activities the passing of the subject, having the right (art. 12.2) to be globally graded, in 2 annual calls per subject, an ordinary and an extraordinary one (evaluating 100% of the competences).

#### Evaluation criteria for the final exam:

##### Continuous assessment:

The continuous evaluation system consists of 4 grades. The first one is the grade of the partial exams, graded between 0 and 10; it is compulsory to get 4 or more points in each partial exam to go on with the continuous evaluation. The second grade is assigned to the Labwork (report plus presentation, if needed), again from 0 to 10 with a minimum of 4. The third grade corresponds to the attendance and participation in theory and practice classes, which goes from 0 to 10. The fourth grade, from 0 to 10, is assigned to the review of deliverables.

Grades of 4 or more in partial exams are kept for the final exam right at the end of the term, although students can also decide to do these parts of the final so as to improve their grades. Grades of 5 or more in lab work is kept for the following year.

In the final exams of the same academic year, students can choose to examine only those parts in which they have not passed the minimum mark. They can also go, to improve his/her mark, to parts in which they have exceeded the minimum mark.

##### Non-continuous evaluation:

Unless stated otherwise, continuous evaluation criteria will be applied to all students. Anyone choosing non-continuous assessment must notify it to the lecturer within the class period of the subject. The option is only available if the students participation in evaluation activities (from the continuous assessment) has not reached 50% of the total evaluation for the subject. For the retake exam, the assessment type used for the final exam will remain valid.

Final exams consist of just one test covering the whole subject; the exam is graded between 0 and 10.

#### Specifications for the resit/retake exam:

Final exams consist of just one test covering the whole subject; the exam is graded between 0 and 10. Second final exams (exams extraordinary/additional exams) allow students to keep the grades obtained in partial exams.

#### Specifications for the second resit / retake exam:

Second exams cover the whole subject (with lab work). The exam is graded between 0 and 10, with a minimum of 5 to pass the subject.

9. Assignments, course calendar and important dates	
Not related to the syllabus/contents	
Hours	hours
<b>Unit 1 (de 4): INTRODUCTION TO CIVIL ENGINEERING MATERIALS</b>	
<b>Activities</b>	<b>Hours</b>
Class Attendance (theory) [PRESENCIAL][Lectures]	.5
<b>Unit 2 (de 4): FUNDAMENTALS OF MATERIALS</b>	
<b>Activities</b>	<b>Hours</b>
Class Attendance (theory) [PRESENCIAL][Lectures]	3
Class Attendance (practical) [PRESENCIAL][Project/Problem Based Learning (PBL)]	1
Study and Exam Preparation [AUTÓNOMA][Other Methodologies]	10
<b>Unit 3 (de 4): MECHANICS OF MATERIALS</b>	
<b>Activities</b>	<b>Hours</b>
Class Attendance (theory) [PRESENCIAL][Lectures]	7
Class Attendance (practical) [PRESENCIAL][Project/Problem Based Learning (PBL)]	7
Study and Exam Preparation [AUTÓNOMA][Other Methodologies]	18
Mid-term test [PRESENCIAL][Assessment tests]	1
<b>Unit 4 (de 4): KNOWLEDGE AND TECHNOLOGY OF CIVIL ENGINEERING MATERIALS</b>	
<b>Activities</b>	<b>Hours</b>

Laboratory practice or sessions [PRESENCIAL][Practical or hands-on activities]	6
Class Attendance (theory) [PRESENCIAL][Lectures]	13.5
Class Attendance (practical) [PRESENCIAL][Project/Problem Based Learning (PBL)]	18
Study and Exam Preparation [AUTÓNOMA][Other Methodologies]	54
Practicum and practical activities report writing or preparation [AUTÓNOMA][Group Work]	8
Mid-term test [PRESENCIAL][Assessment tests]	3
<b>Global activity</b>	
<b>Activities</b>	<b>hours</b>
Laboratory practice or sessions [PRESENCIAL][Practical or hands-on activities]	6
Class Attendance (theory) [PRESENCIAL][Lectures]	24
Class Attendance (practical) [PRESENCIAL][Project/Problem Based Learning (PBL)]	26
Study and Exam Preparation [AUTÓNOMA][Other Methodologies]	82
Practicum and practical activities report writing or preparation [AUTÓNOMA][Group Work]	8
Mid-term test [PRESENCIAL][Assessment tests]	4
<b>Total horas: 150</b>	

10. Bibliography and Sources						
Author(s)	Title/Link	Publishing house	Citv	ISBN	Year	Description
Neville, Adam M.	Properties of concrete	Longman Scientific & Technical John Wiley & S		0-582-23070-5	2008	
Young, J. F.	The science and technology of civil engineering materials	Prentice Hall		0-13-659749-1	1998	
Callister, William D., (jr.)	Introducción a la ciencia e ingeniería de los materiales	Reverté		978-84-291-7252-2	2009	
Fernández Cánovas, Manuel	Hormigón : adaptado a la instrucción de recepción de cemento	Colegio de Ingenieros de Caminos, Canales y Pue		84-7493-125-8	2004	
Mamlouk, Michael S.	Materials for civil and construction engineers	Pearson Education Internacional		0-13-506605-0	2009	