250223 - MATCONST - Construction Materials

Coordinating unit: 250 - ETSECCPB - Barcelona School of Civil Engineering
Teaching unit: 751 - DECA - Department of Civil and Environmental Engineering
Academic year: 2017
Degree: BACHELOR'S DEGREE IN PUBLIC WORKS ENGINEERING (Syllabus 2010). (Teaching unit Compulsory)
ECTS credits: 6
Teaching languages: Catalan, Spanish, English

Teaching staff
Coordinator: MIREN ETXEberria Larrañaga
Others: MIREN ETXEberria Larrañaga, ISAAC TAN Bachs

Degree competences to which the subject contributes
Specific:
3072. Ability to apply knowledge of construction materials to structural systems. Knowledge of the relation between the structure of materials and the mechanical properties resulting from them

Transversal:
588. SUSTAINABILITY AND SOCIAL COMMITMENT - Level 1. Analyzing the world's situation critically and systemically, while taking an interdisciplinary approach to sustainability and adhering to the principles of sustainable human development. Recognizing the social and environmental implications of a particular professional activity.
591. EFFICIENT ORAL AND WRITTEN COMMUNICATION - Level 1. Planning oral communication, answering questions properly and writing straightforward texts that are spelt correctly and are grammatically coherent.
598. EFFECTIVE USE OF INFORMATION RESOURCES - Level 2. Designing and executing a good strategy for advanced searches using specialized information resources, once the various parts of an academic document have been identified and bibliographical references provided. Choosing suitable information based on its relevance and quality.

Teaching methodology
The course consists of 3 hours per week of classes in the classroom (large group) and one hour per week with the students (group means) for carrying out laboratory practice.

3 hours, 2 hours a week devoted to lectures (large group), in which the teacher explains the concepts and basic materials of the subject, presents examples and exercises.
We spend 1 hour (large group), to resolve problems with greater interaction with students. Exercises are conducted to consolidate the general and specific learning objectives.

We spend 1 hour (group average) per week to laboratory work. There will be testing different construction materials in order to consolidate the general and specific learning objectives.

Support materials used in the form of detailed educational plan through the virtual campus ATENEA: content, programming and evaluation activities directed learning and literature.

Learning objectives of the subject
Students will learn to apply knowledge of construction materials in structural systems. They will also develop an
understanding of the relationship between the structure of materials and the resultant mechanical properties.

Upon completion of the course, students will have acquired the ability to: 1. Relate the materials used in a construction project to their mechanical and physical properties and to the structural needs of each specific case. 2. Organise and plan an analysis of the properties of the materials used in a construction project, by means of either field tests or laboratory tests. 3. Carry out a life-cycle energy analysis of construction materials.

The physical and mechanical properties, procurement process, manufacture and placement of construction materials; Rocks: properties, tests, pathologies and repair; Irons and steels; Concrete: manufacture, pouring, curing, durability, and mechanical and chemical properties; Properties and uses in metal construction; Ceramic materials: mechanical, thermal, electrical and acoustic properties; Properties of bituminous materials, including rheological properties, mixture with aggregates, dosing and manufacture; Other materials; Environmental impact and management of construction materials.

<table>
<thead>
<tr>
<th>Study load</th>
<th>Hours large group:</th>
<th>30h</th>
<th>20.00%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total learning time:</td>
<td>Hours medium group:</td>
<td>15h</td>
<td>10.00%</td>
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<tr>
<td></td>
<td>Hours small group:</td>
<td>15h</td>
<td>10.00%</td>
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<tr>
<td></td>
<td>Guided activities:</td>
<td>6h</td>
<td>4.00%</td>
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<tr>
<td></td>
<td>Self study:</td>
<td>84h</td>
<td>56.00%</td>
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</tbody>
</table>
### Content

<table>
<thead>
<tr>
<th>Item 1. Introduction to Construction Materials</th>
<th>Learning time: 4h 48m</th>
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<tbody>
<tr>
<td></td>
<td>Theory classes: 2h</td>
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<tr>
<td></td>
<td>Self study : 2h 48m</td>
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**Description:**
There will be an introduction of building materials used worldwide, stone, earth, wood, ceramic, concrete, metal, etc. Describe the advantages and disadvantages of each. We will work in the life cycle of materials.

<table>
<thead>
<tr>
<th>Transversal competences</th>
<th>Learning time: 4h 48m</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Practical classes: 2h</td>
</tr>
<tr>
<td></td>
<td>Self study : 2h 48m</td>
</tr>
</tbody>
</table>

**Description:**
Transversal competences. Search Databases. Library
### Item 2. Concrete

**Description:**
Concrete is the building material widely applied in civil engineering. This topic will work in the analysis of the constituents of concrete in the manufacturing process and putting in work. Besides will present the properties of fresh and hardened concrete and mass concrete durability and reinforced and prestressed concrete. It will place special emphasis on recycling and the applicability of recycled aggregates in new concrete. You will appreciate the high performance concrete. All aspects will be discussed theoretically and by problems. Laboratory work is to determine experimentally the differences between the natural aggregate and recycled aggregate concrete as well made them.

Chapter 1. Introduction. Cement. Water  
Chapter 2. Aggregates (theory)  
Chapter 2. Aggregates (issues)  
Chapter 2. Aggregates (laboratory)  
Chapter 3.4 & 5. Fresh concrete. Concrete Additives & Technology (theory)  
Dosage  
Chapter 6. Dosage (problems)  
Dosage and Manufacturing: Laboratory  
Chapter 7. Hardened Concrete (Theory)  
Chapter 7. Hardened Concrete (issues)  
Chapter 8 & 9. Durability (Theory)  
Chapter 8 & 9. Durability (exercicis)  
Chapter 7.8 & 9. Hardened concrete and durability (Lab)  
Chapter 10. Reinforced and Prestressed Concrete (rods and wires). Theory  
Chapter 11. concretes (theory)

### EXAM

**Learning time:** 21h 36m  
Practical classes: 2h  
Laboratory classes: 7h  
Self study : 12h 36m

**Description:**
laboratory reports submission practices  
Cuestiones_Laboratorio (15%)

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### Item 3. Metallic Materials

**Description:**
mechanical properties of steel (exercicis)
It will analyze the different microstructures of ferrous alloys and its influence on mechanical properties. You can explore different heat treatments.
(The properties of the bars and wires have been studied in the previous topic)

- Chapter 12. Ferrous alloys. Microstructure (Theory)
- Chapter 13. Phase transformations. Heat treatment (Theory)

**Learning time:** 14h 23m
- Theory classes: 4h
- Practical classes: 2h
- Self study: 8h 23m

### Item 4. Bituminous Materials

**Description:**
Chapter 16 & 17. Filler aggregates & bituminous mixtures
Chapter 17. Bituminous mixtures. Manufacturing and placing (Issues)
Determination of properties of bituminous mixtures (Lab)

**Learning time:** 14h 23m
- Theory classes: 4h
- Practical classes: 2h
- Self study: 8h 23m

### Item 5. Ceramic Materials

**Description:**
Chapter 18 & 19. Composition and manufacturing. Properties. Types and Applications (Theory)

**Learning time:** 4h 48m
- Theory classes: 2h
- Self study: 2h 48m

### Item 6. Polymers

**Description:**
We will study the polymerization processes and different types of additives used and their applications will be discussed

**Learning time:** 2h 24m
- Theory classes: 1h
- Self study: 1h 24m
The rating of the course is obtained from continuous assessment scores and the corresponding laboratory.

Continuous assessment is to do different activities, both individual and group additive and formative in nature, made during the course (classroom and beyond.)

Screening tests consist of a part with questions on concepts related to the learning objectives of the course in terms of knowledge or understanding, and a set of exercises.

Evaluatio method:
Activity 1: 7% final grade
Test 1: 28% final grade
Activity 2: 10% final grade
Test 2: 40% final grade

Delivery of laboratory work and presentation: 15% final grade

Criteria for re-evaluation qualification and eligibility: Students that failed the ordinary evaluation and have regularly attended all evaluation tests will have the opportunity of carrying out a re-evaluation test during the period specified in the academic calendar. Students who have already passed the test or were qualified as non-attending will not be admitted to the re-evaluation test. The maximum mark for the re-evaluation exam will be five over ten (5.0). The non-attendance of a student to the re-evaluation test, in the date specified will not grant access to further re-evaluation tests. Students unable to attend any of the continuous assessment tests due to certifiable force majeure will be ensured extraordinary evaluation periods.

These tests must be authorized by the corresponding Head of Studies, at the request of the professor responsible for the course, and will be carried out within the corresponding academic period.

Regulations for carrying out activities

The assistance in laboratory practice are required.
Bibliography

Basic:

- Callister, W.D. Introducción a la Ciencia e Ingeniería de Materiales. 2a ed. Editoria Reverté s.s, 2009. ISBN 9786075000251.

Complementary: