Course guide
2500011 - GECMATCONS - Construction Materials

Unit in charge: Barcelona School of Civil Engineering
Teaching unit: 751 - DECA - Department of Civil and Environmental Engineering.

Degree: BACHELOR'S DEGREE IN CIVIL ENGINEERING (Syllabus 2020). (Compulsory subject).
Academic year: 2022 ECTS Credits: 6.0 Languages: Spanish, English

LECTURER

Coordinating lecturer: MARILDA BARRA BIZINOTTO, MIREN ETXEBERRIA LARRAÑAGA
Others: DIEGO FERNANDO APONTE HERNÁNDEZ, MARILDA BARRA BIZINOTTO, MIREN ETXEBERRIA LARRAÑAGA, SUSANA VALLS DEL BARRIO

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
14400. Ability to apply knowledge of building materials in structural systems. Knowledge of the relationship between the structure of the materials and the mechanical properties that derive from it. (Common module to the Civil branch)
14401. Ability to analyze and understand how the characteristics of structures influence their behavior. Ability to apply knowledge about the resistant operation of structures to size them according to existing regulations and using analytical and numerical calculation methods. (Common module to the Civil branch)

General:
14380. Scientific-technical training for the exercise of the profession of Technical Engineer of Public Works and knowledge of the functions of advice, analysis, design, calculation, project, construction, maintenance, conservation and exploitation.

TEACHING METHODOLOGY

The course consists of 2 hours per week of classroom activity (large size group) and 1.6 hours weekly with half the students (medium size group).

The 2 hours in the large size groups are devoted to theoretical lectures, in which the teacher presents the basic concepts and topics of the subject, shows examples and solves exercises.

The 1.6 hours in the medium size groups is devoted to solving practical problems with greater interaction with the students. The objective of these practical exercises is to consolidate the general and specific learning objectives.

The rest of weekly hours devoted to laboratory practice.

Support material in the form of a detailed teaching plan is provided using the virtual campus ATENEA: content, program of learning and assessment activities conducted and literature.

To do the laboratory practices you need the following personal protective equipment (PPE):
* Protection gloves - Chemical
* Protection gloves - Mechanical
LEARNING OBJECTIVES OF THE SUBJECT

Knowledge of the mechanical and technological properties of the most used materials in construction; Construction materials and structural systems. Relationship between the structure of the materials and the mechanical properties derived from them. Obtaining, manufacturing and placing of the main building materials (concrete, steel, bituminous and ceramic materials). Physical, chemical and mechanical properties of concrete, steel and other metals, bituminous materials, ceramic materials, polymers and composite materials. Regulations for quality control of construction materials. Environmental impact and management of building materials. Study of the energy consumption and of the life cycle of the building materials.

1. Ability to relate the materials used in construction with their mechanical and physical properties and the structural needs existing in each case.
2. Ability to organize and plan analysis of properties of materials involved in a civil work, both through on-site and laboratory tests.
3. Ability to carry out an energy and life cycle study of construction materials.

Knowledge of the physical and mechanical properties, process of obtaining, manufacturing and putting into work of the materials of building. Knowledge of rocks including properties and tests, pathologies and repair. Knowledge of foundries and steels. Knowledge of concrete including fabrication, commissioning, curing, durability, mechanical and chemical properties. Knowledge of properties and uses in construction of metals. Knowledge of ceramic materials, as well as their mechanical, thermal, electrical and acoustic properties. Knowledge of the properties of bituminous materials including their rheological properties, mixing with aggregates, as well as dosing and manufacturing. Knowledge of other materials. Knowledge of the impact and environmental management of construction materials.

Knowledge of the mechanical and technological properties of the materials most used in construction; building materials and structural systems. Relationship between the structure of materials and the mechanical properties derived from them. Relationship between the mechanical properties of the materials and the most suitable structural systems for each of them. Obtaining, manufacturing and implementing the main building materials (concrete, steel, bituminous materials and ceramics). Physical, chemical and mechanical properties of concrete, steel and other metals, bituminous materials, ceramic materials, polymers and composite materials. Quality control regulations for construction materials. Environmental impact and management of construction materials.

STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Hours small group</td>
<td>6,0</td>
<td>4.00</td>
</tr>
<tr>
<td>Self study</td>
<td>84,0</td>
<td>56.00</td>
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<tr>
<td>Hours medium group</td>
<td>24,0</td>
<td>16.00</td>
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<tr>
<td>Hours large group</td>
<td>30,0</td>
<td>20.00</td>
</tr>
<tr>
<td>Guided activities</td>
<td>6,0</td>
<td>4.00</td>
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Total learning time: 150 h

CONTENTS

T1: Mechanical and technological properties of construction materials

Description:
Mechanical properties of solids. Basic concepts of stress, strain, fracture mechanics and toughness. Thermal and electrical properties. Liquids, viscoelasticity and gels. Surface phenomena

T1 - Application problems

Full-or-part-time: 12h
Theory classes: 2h
Practical classes: 3h
Self study: 7h
### T2: Building materials, structural systems

**Description:**
T1 - Mechanical and technological properties of construction materials

**Full-or-part-time:** 3h 35m
- Theory classes: 1h 30m
- Self study: 2h 05m

### T3: Aggregates

**Description:**
T3: Aggregates
- T3: Exercises
- Practice 1 (P1): Aggregates

**Full-or-part-time:** 14h 23m
- Theory classes: 1h
- Practical classes: 3h
- Laboratory classes: 2h
- Self study: 8h 23m

### T4: Concrete

**Description:**
- Laboratory practice 1 (P1): Properties of fresh concrete
- T4: Mix design
- Laboratory practice 3 (P3): Properties of hardened concrete

**Full-or-part-time:** 33h 36m
- Theory classes: 7h
- Practical classes: 4h
- Laboratory classes: 3h
- Self study: 19h 36m

### T5: Steel and other metals

**Description:**
- T5: Application problems

**Full-or-part-time:** 19h 12m
- Theory classes: 5h
- Practical classes: 3h
- Self study: 11h 12m
T6: Polymers

**Description:**
Polymers of general interest in construction. Properties, tests and specific regulations.

**Full-or-part-time:** 8h 24m
Theory classes: 3h 30m
Self study: 4h 54m

T7: Fibre composites

**Description:**
T7: Exercises

**Full-or-part-time:** 13h 12m
Theory classes: 3h 30m
Practical classes: 2h
Self study: 7h 42m

T8: Bituminous materials

**Description:**
T8: Exercises
Laboratory practice 4 (P4): Properties of bituminous mixtures

**Full-or-part-time:** 15h 36m
Theory classes: 3h 30m
Practical classes: 2h
Laboratory classes: 1h
Self study: 9h 06m

T9: Ceramic materials

**Description:**
T9: Ceramic materials

**Full-or-part-time:** 7h 11m
Theory classes: 3h
Self study: 4h 11m

T10: Criteria for the selection and sustainable use of construction materials

**Description:**

**Full-or-part-time:** 9h 36m
Theory classes: 4h
Self study: 5h 36m
**Assessment**

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<tr>
<th>Full-or-part-time:</th>
<th>7h 11m</th>
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<tbody>
<tr>
<td>Laboratory classes:</td>
<td>3h</td>
</tr>
<tr>
<td>Self study:</td>
<td>4h 11m</td>
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**GRADING SYSTEM**

The mark of the course is obtained from the ratings of continuous assessment and their corresponding laboratories and/or classroom computers.

Continuous assessment consist in several activities, both individually and in group, of additive and training characteristics, carried out during the year (both in and out of the classroom).

The teachings of the laboratory grade is the average in such activities.

The evaluation tests consist of a part with questions about concepts associated with the learning objectives of the course with regard to knowledge or understanding, and a part with a set of application exercises.

**EXAMINATION RULES.**

The final grade of the course will be the weighted average of the directed studies (*ED), the laboratory practices (P) and the exams (E), \( N = 0.75E + 0.20P + 0.05ED \)

Attendance at the laboratory sessions is mandatory to pass the course.

**BIBLIOGRAPHY**

**Basic:**

**Complementary:**