

28712 - Materials: Science and Technology

Syllabus Information

Academic year: 2023/24

Subject: 28712 - Materials: Science and Technology

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

The purpose of the **Materials Science and Technology** subject is for the student to acquire the necessary knowledge for the adequacy of construction materials (aggregates, bitumens, bituminous mixtures, pavements, cements, concrete, metals) to the uses and specifications of the different types of works. For this purpose, its chemical, physical and mechanical characteristics will be studied, as well as its manufacturing processes, testing, transportation, installation, execution control and reception.

These approaches and objectives are aligned with the Sustainable Development Goals (SDGs) of the 2030 Agenda of United Nations (<https://www.un.org/sustainabledevelopment/es/>), specifically with Goals 4, 6, 9 and 12, in such a way that the acquisition of the learning results of the subject provides training and competence to contribute in some measure to their achievement.

2. Learning results

1. To know the physical-chemical-mechanical behavior and technology of **bitumens, bituminous materials, aggregates, pavements, metals, cements and concrete.**
2. Explain the manufacturing technologies and the technologies for the installation and transportation of these materials.
3. Explain the differentiating criteria for the "classification" of the different families of construction materials (concretes, bitumens, cements, metals, bituminous mixtures, aggregates, pavements) according to their structure and properties.
4. Relate the properties of the materials, obtained from the tests, with the applications and their behavior in service.
5. Choose the most suitable materials of construction and their variations for each use according to the applications and their behavior in service.
6. Design and carry out adequately, and in accordance with the regulations and prescriptions in force, a quality control of reception and execution of construction materials.
7. Possess the ability to broaden and deepen the study and development of materials used in construction.
8. To understand the importance of innovation in the development of manufacturing, commissioning and applications of construction materials.
9. Critically analyze the results obtained in an experimental work and draw correct conclusions, expressing them in a technical report.

3. Syllabus

Block 1: Aggregates and Roads

Origin of aggregates / Physical and mechanical properties / Testing / Classification of aggregates and their typologies / Designation of aggregates / Paving and pavements / Types of Soils / Types of Pavements / Urban Pavements / Soil compaction

Block 2: Bitumen

Introduction / Manufacture - Origin / Bitumen Tests / Bitumen and Emulsion Classes _PG3 / Irrigations without gravel / Irrigations with gravel / NFU

Block 3: Bituminous Mixtures

Classification and Types / Designation _PG3 / Uses and Layers / Manufacturing / Testing / Transport and Commissioning / MB Recycling / Regulations / Pathologies

Block 4: Metals

Introduction / Microstructure of Metals / Testing of Metals / Oxidation in Metals / Forming / Joints / Iron and its alloys / Iron and its alloys / Steel in the construction industry

Block 5: Cement

Nature of cements / Raw materials / Manufacture / Constituents / Cement chemistry / Cement hydration / Classification / Properties / Tests / Uses /

Block 6: Concrete

Introduction / Manufacturing and Commissioning / Fresh Concrete / Water and Aggregates / Testing of Fresh Concrete

Durability of Concrete / Coating / Exposure Classes - Environment / Designation / Attacks on Concrete Pathologies

Admixtures and admixtures / Concrete curing / Shrinkage and creep of concrete

Hardened concrete: physical-mechanical properties, elasticity, strength, characteristics, destructive and non-destructive testing

Specialty concretes (light, heavy, with fibers, printed, refractory, gunned-sprayed, self-compacting, non structural, cleaning, cyclopean, recycled, HAR, UHPC,...) Quality Control / Execution Control / Reception / Concrete Dosage

4. Academic activities

- Participative lectures.
- Problem solving and case studies.
- Laboratory practices and preparation of technical reports. Visits to: construction sites, material control laboratories and factories / construction materials processing or storage facilities.
- Lectures, seminars and technical conferences.

Evaluation Tests. This should include:

- Study and personal work.
- Tutorials and generic non face-to-face activities.

5. Assessment system

There are two assessment systems: continuous and global assessment.

Continuous assessment

It will consist of:

- Theoretical-Practical Tests (short and multiple-choice questions). 45%
- Test of Problems. 45%
- Individual activities in class (exercises, participation, short works, presentations, laboratory practices, reports,...). 10%

To be eligible for the Continuous Evaluation system, 100% of the class activities/presentations/technical visits/seminars/lectures must be attended/completed and all laboratory practicals.

Based on the above weightings, the course will be passed when at least 50% of the total grade is obtained.

In addition, it is an indispensable criterion to obtain at least 50% in each of the theoretical-practical tests and at least 40% in the test of problems in order to be able to mediate. On the first day of class there will be a presentation of the subject where the parts that make up the continuous assessment, the evaluation criteria and the teaching method followed will be indicated.

Overall assessment

For those students who cannot follow the continuous assessment there is a global assessment modality consisting of a global assessment test.

This test will consist of two parts:

- Written theory test: 50 %
- Problem testing: 50 %

The subject will be passed when at least 50% of the total grade is obtained. In order to be able to mediate it is necessary to obtain in each part (theory and problems) at least 40%.