

## Course file

<b>Study cycle</b>	BACHELOR IN CIVIL ENGINEERING		
<b>Course</b>	CONSTRUCTION MATERIALS TECHNOLOGY I	Mandatory	<input checked="" type="checkbox"/>
		Optional	<input type="checkbox"/>
<b>Course scientific area</b>	CIVIL ENGINEERING	Category	B

Course category: B - Basic; C - Core Engineering; E - Specialization; P - Complementary.

Year: 2nd	Semester: 3rd	ECTS: 4		Total: 108
Contact time	T: 22,5	TP: 22,5	PL:	S: OT:

T - Lectures; TP - Theory and practice; PL - Lab Work; S - Seminar; OT - Tutorial Guidance.

Course Director	Title	Position
Maria Dulce e Silva Franco Henriques	Doutor	Professor Adjunto

### Learning objectives (knowledge, skills and competences to be developed by students)

(max. 1000 characters)

Knowledge of some traditional building materials technology. Addresses aspects related to the properties, the specification at the design stage, the applications and the evaluation at use stage. It is intended that the student:

Understands the most important properties, application techniques, regulatory requirements and standards, as well as the degradation processes and the life cycle of each material; -At the design stage: be critical with the choice of materials with better features to comply with the usage demands, maximizing their durability;

- During construction: be critical with the choice and application of the best constructive solutions, in terms of behaviour, cost and execution schedule;

- Analyse and evaluate the characteristics of new materials in order to propose alternatives with better performance and durability;

- Acquire knowledge on the processes of materials maintenance integrated into existing buildings; understand the anomalies and how to repair them in situ.

### Syllabus

(max. 1000 characters)

1. General Characteristics of the Materials and Construction Products Regulation;

2. Natural stones extraction, transformation and quality requirements of natural stones
3. Aggregates: raw materials, uses and quality requirements;
4. Study of the ceramic products
5. Study of the conglomerates
6. hydrophilic binders
7. Hydrophobic binders (polymers)

**Demonstration of the consistency between the syllabus and the course objectives**

(max. 1000 characters)

The student led to achieve those objectives through understanding of various aspects of each content submitted in this course, namely: How to provide knowledge methodologies in order to choose, specify and apply the common construction products and, by analogy, to choose alternative/new construction products. Apply the European and Portuguese Norms. To have the necessary knowledge to choose and apply the materials according to the use specifications in Design, Supervision, Construction, Maintenance, Rehabilitation and Deconstruction.

Other less common aspects of some building materials are developed by the student in his theoretical assignment.

**Teaching methodology (evaluation included)**

(max. 1000 characters)

The syllabus is taught in 30 theoretical / practical classes (PC) of 1.5 hours each, twice a week. At TPC classes are solved exercises and include two classes at the laboratory, taught with the support of the laboratory technicians.

The student must also develop two assignments, both in groups and in extra-curricular time, which complement the acquisition of skills. It is conducted with the monitoring of senior staff assigned to the laboratory and also by the teacher under a tutorial regime:

- Laboratory assignment (LA) performed in the laboratory, producing a final report of about 8 pages;

- Theoretical assignment (TA) of about 20 pages. It takes the form of a text and also of an oral presentation (OP) to the class and to the teacher (OP);

Continuous assessment: 70% single test + 30% (LA + TA + OP)

Evaluation by exam: 70% exam + 30% (LA + TA + OP)

It is mandatory to obtain a positive grade on the test or exam.

The assignments are mandatory for approval to the unit.

### **Demonstration of the consistency between teaching methodology and the course learning objectives**

(max. 3000 characters)

All lectures include, besides the transmission of the theoretical contents listed above, viewing and handling of material samples collected at building sites or included in catalogs, which are exposed in the room of Construction Materials. Some lectures end with the students, accompanied by the teacher, visiting the laboratory, where other materials and equipment, which by their size, can not be exposed in the classroom are stored.

The theoretical and practical classes aim at solving practical exercises on determining the general properties of aggregates (mainly physical and geometrical). The laboratory practice seeks direct contact with the student with stone products, ceramics, aggregates and binders, through its handling and testing.

In practical work it is intended that the students acquire sensitivity in handling the equipment and the mortar in the fresh state and learn to recognize the behavioural differences of various types, both during and after setting.

With the theoretical work the student is intended to develop the knowledge of a subject, fundament it, discuss it and transmit it to others. The student will have to find information about some aspects of materials that exceed what is taught, in order to understand their function, application techniques, durability, maintenance procedures and selection criteria based on performance or will make a comparison of different solutions to the same type of use, including its technical and economic analysis.

The oral presentation serves as a lesson that is given by the groups of students to the rest of the class and the teacher, giving them responsibility for the proper transmission of the acquired knowledge. It is believed that the methodology of teaching currently used is quite comprehensive and able to make the student competent to understand the material, whether in the project phase, or in the construction phase, whether it be new a construction, maintenance or repair. This view has been corroborated by the students.

**Main Bibliography**

(max. 1000 characters)

Coutinho A. de S. – Fabrico e propriedades do Betão, Volume I, Laboratório Nacional de Engenharia Civil – LNEC, Lisboa, ISBN: 972-49-0326-5, 1997, 401 p.

APICER, Associação Portuguesa da indústria de cerâmica – Manual de aplicação de revestimentos cerâmicos, APICER, Coimbra, depósito legal: 195605/03, 2003, 248 p.

APICC, Associação Portuguesa da indústria de cerâmica da construção – Manual de aplicação de telha cerâmica, APICC, Coimbra, depósito legal: 122566/98, 1998, 160 p.

APICER, Associação Portuguesa da indústria de cerâmica – Manual de alvenaria de tijolo, APICER, Coimbra, depósito legal: 122566/98, 2000, 208 p.

Alexander M., Mindess S. – Aggregates in concrete (Modern concrete technology series nº 13), Taylor & Francis, UK, ISBN: 0-415-25839-1, 2005, 435 p

NP EN 12620, 2002 + A1, 2010 - Agregados para betão, Lisboa, Portugal, IPQ, 61 p.

Portuguese, European and approval documentation standards.