



Universidad  
de Alcalá

# GUÍA DOCENTE

MATERIALES DE  
CONSTRUCCIÓN //  
BUILDING MATERIALS

**Undergraduate Degree in the  
Fundamentals of Architecture and  
Town Planning  
University of Alcalá**

**Curso Académico 2020/21**

Curso 2º - 2º Cuatrimestre

## GUÍA DOCENTE

Nombre de la asignatura:	Materiales de Construcción // Building Materials
Código:	256014
Titulación en la que se imparte:	Grado en Fundamentos de Arquitectura y Urbanismo
Departamento y Área de Conocimiento:	Departamento de Arquitectura Área de Construcciones Arquitectónicas
Carácter:	Obligatoria
Créditos ECTS:	6.0
Curso:	Segundo curso - Primer Cuatrimestre
Profesorado:	Gonzalo Barluenga Badiola (coordinator) Ana Marin Palma Irene Palomar Herrero
Horario de Tutoría:	jueves y viernes, 13:00-15:00
Idioma en el que se imparte:	Español/Inglés

### 1. COURSE DESCRIPTION

This course, along with Introduction to Construction, is part of the Fundamentals of Construction Subject and is the students' first introduction to the Technical side of the degree: Architectural Construction, Structures and Building Services.

The aim of this course is to provide a fundamental knowledge of the microstructure of materials, properties, building products and applications, manufacturing processes, and the codes and regulations that determine the choice of appropriate building materials and products. This decision is based on objective selection criteria in which technical, environmental, legal, and quality requirements all must be taken into consideration.

The course is based on theoretical lessons and practical sessions (in small groups) working on a range of topics. These include evaluation parameters, laboratory seminars, sample descriptions of different materials, visiting manufacturing plants and expositions, along with tutored group work and further development tailored to each individual student.

## 2. COURSE OBJECTIVES

### General Competences

By the end of this course (along with others) you should be able to:

- Create architectural projects that satisfy both aesthetic and technical requirements;
- Understand problems related to the structural, constructive, and engineering concepts associated with buildings;
- Understand the problems of physics and technology, building functionality, and the technical solutions to control internal environmental conditions and climate control systems;
- Show that you can employ architectural solutions to satisfy user's requirements, according to the limits of budget and building codes.

### Specific Competences

- Recognise building materials and their main properties, being able to select, using objective criteria, the most adequate for specific architectural applications, those which fulfil all aesthetic, technological, regulatory, and quality requirements.
- Understand the microstructure and related properties of building materials, using physical principles and simple mathematical models to assess their main technological properties.
- Differentiate the types, properties, manufacturing processes, testing methods, standards and regulations, technical designations, and applications of building materials.
- Manage, search, and classify technical documents of commercial building materials, identifying their main characteristics, quality marks, and suitability for [borrado] specific building applications.

## 3. COURSE CONTENTS

- 1. Building Materials in Architecture.** Building materials and products: typologies. Organoleptic and technological properties. Environmental issues.

Structure of raw materials. Microstructure. Scales of observation: technological, microstructural and atomic. Chemical bonding: types and characteristics. Crystalline and amorphous microstructures. Single-phase and polyphasic materials. Composite materials.

2. **Physical properties.** Aspect and shape. Weight and density. Porosity. Physical actions. Hydric behavior. Thermal behavior. Acoustic behavior. Light behavior. Fire behavior. Frost-thaw resistance. Physical tests. Durability and deterioration processes. Protection against environmental agents.
3. **Mechanical properties.** Stress and strain. Stiffness. Strain types and mechanisms. Strain-hardening. Creep. Fracture mechanisms. Mechanical actions and laboratory tests.
4. **Quality control, Sustainability and regulations.** Concept of quality. Experimental characterization of materials. Quality control. Quality standards and marks. CE marking. Regulatory frame of building materials. Sustainability criteria and strategies.
5. **Stones and soil.** Minerals in nature. Origin and classification of natural stones. Microstructure and properties of natural stone. Extraction, processing and applications. Types of soil. Architecture with rammed earth. Aggregates. Standards, designation and applications of aggregates.
6. **Ceramic and glass.** Microstructure and properties of building ceramics. Manufacturing processes. Ceramic products: codes and standards, product designation and building applications. Microstructure and properties of building glass. Manufacturing processes. Glass products: codes and standards, product designation and building applications.
7. **Binders and conglomerated composites.** The conglomerate process: setting and hardening. Hydraulicity. Gypsum and plaster. Air and hydraulic lime. Cements. Admixtures and additions. Derived and composite materials. Mortars: Types, designation, applications and standards.
8. **Concrete.** Components. Manufacture, mixing and cast-in-place techniques. Fresh and hardened properties. Aggregate grading. Concrete composition and proportioning. Massive, Reinforced and pre-stress concrete. Advanced concretes: lightweight, high performance, self-compacting, recycled and fiber reinforced. Designation, applications and codes.
9. **Metals.** Microstructure and properties of metallic materials. Types. Alloys. Steel and iron alloys: iron-carbon systems. Other metallic materials and alloys. Manufacture, processing and conformation techniques. Metallic joints: welding. Designation, applications and codes.
10. **Wood and derivative composites.** Microstructure and properties of Wood. Main species. Cut and conversion of Wood. Wood treatment and protective actions. Wood products and Wood derivatives. Other vegetal products: cork and fibers. Designation, applications and codes.
11. **Polymeric materials: plastics.** Microstructure and properties of polymeric materials. Types of plastics. Manufacture and conformation processes. Polymeric products and composites. Designation, applications and codes.

- 12. Bituminous materials, adhesives, thermal insulations and paintings.** Properties of bituminous materials. Bituminous mixes. Designation, applications and standards. Properties of adhesives. Designation, applications and standards. Thermal insulation materials. Paintings and varnishes: components, types and applications.
- 13. Building Materials selection.** Incorporation of building materials in architecture. Selection criteria: suitability, compatibility and durability. Research, progress and innovation in building materials.

### Timetable

Topic	WEEK	Work load (6 ECTS x 25 horas/ECTS)
INTRODUCTION TO BUILDING MATERIALS	• WEEK 1	• 10 hours
MATERIALS CHARACTERIZATION AND QUALITY CONTROL	• WEEK 2-5	• 40 hours
INORGANIC MATERIALS	• WEEK 6-9	• 50 hours
METALS	• WEEK 10	• 10 hours
ORGANIC MATERIALS	• WEEK 11-13	• 30 hours
MATERIALS' SELECTION	• WEEK 14	• 10 hours
		TOTAL 150 hours

### 4. METHODOLOGY AND CLASS ACTIVITIES

#### Student Workload:

Class hours: 50	• Theory and Practical classes
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Independent study: 100

- Study, homework and exam preparation

## Materials and resources

All documents, class notes, and practical exercises can be found on the course page online (MiPortal, UAH). All materials worked on in class will also be posted on the platform.

## 5. ASSESSMENT

### Assessment Criteria

The completion of course contents, application to specific cases, and the ability to use evaluation parameters and definition of Building Materials.

Knowledge of regulations, quality, and sustainability requirements, ability to analyze the suitability of specific building materials to realistic applications.

Students should have acquired the desirable level in each of the competences specified in the assessment criteria. The assessment process will apply continuously during the semester, supported on evidence with theory tests, class and home practice, and a final test of a theoretical-practical nature. A positive assessment of each [borrado] of these will be necessary to pass the course.

In order to [borrado] show what is expected of you, a set of **class rules** have been created:

- Class attendance is mandatory, both to theory and practice classes. A maximum of one unjustified absence will be permitted. To justify an absence, the student should give the lecturer a signed and dated document explaining the [borrado] cause of the absence (health, family or work issues).
- [borrado] All practical work will be graded and a minimum grade of 5 points out of 10 is required in order to pass. All practical work, both class and homework, must be completed and submitted to the class teacher.
- Corrected practical work will be returned to the students during the semester. Students can request a meeting with their teacher if they have any queries about the

contents, solutions and assessment criteria used in grading.

- A minimum of 3 out of 10 in both the theory and practice parts of the final exam and an average of 4 out of 10 overall is required in the final exam to pass this course.

### Grading Criteria

After passing, grades will be calculated as follows:

- Completion of course contents (class attendance, participation and theory tests) 10 %.
- Application of course contents to specific cases (class practical work) 20 %
- Case study analyses (Homework practice) 30 %.
- Final exam 40 %

## 6. BIBLIOGRAPHY

### Basic Bibliography

Building Materials:

- Brookes, A. J. y Poole, D.; *Innovation in Architecture*, Spoon Press, 2003.
- Doran, D. K.; *Construction materials reference book*, Ed. Butterworth, 1999.
- Hegger, M; *Construction Materials Manual*, Ed. Detail, Birkhauser, 2006.
- Hornbostel, C.; *Materiales para construcción. Tipos, usos y aplicaciones*, Ed. Limusa Wiley, 2002.
- Weston, R.; *Materiales, forma y Arquitectura*, Ed. Blume, 2003.

Materials Science and Engineering:

- Callister, W.; *Introducción a la Ciencia e ingeniería de materiales*, Ed. Limusa Wiley, 2013.
- Smith, W.; *Fundamentos de ciencia e ingeniería de los materiales*, Ed. McGraw-Hill, 2014.

Stone and soil:

- Olarte Tristán, J. L. y Guzmán, E.; Manual de edificación con tierra armada: Diseño, cálculo y construcción con el sistema CET, D. G. Arquitectura CM, 1993.
- Fernández Madrid, J.; Manual del granito para arquitectos, Asociación gallega de graniteros, 1996.
- García de los Ríos, J. I., Báez, J. M.; La piedra en Castilla y León, Junta de Castilla y León, 1994.

#### Ceramic and glass:

- Porcar Ramos José Luis, Manual-guía técnica de los revestimientos y pavimentos cerámicos, Inst. de Tec. Cerámica-A. de Inv. de las Ind. Cerámicas, Castellón, 1987.
- CITAV; Manual del vidrio, CITAV, 2001.
- Vasquez, C; El vidrio: Arquitectura y Técnica, Ed. ARQ, Chile, 2006.

#### Binders, mortars and concrete:

- Alejandro Sánchez, F. J.; Historia, caracterización y restauración de morteros, IUCC, Universidad de Sevilla, 2002.
- Fernández Canovas, M; Hormigón: adaptado a la Instrucción de Recepción de Cementos y a la Instrucción de Hormigón Estructural EHE, 10<sup>a</sup> Ed., COICCP, 2013.
- Mehta, P. K. y Monteiro, P.; Concrete: structure, properties and materials, Prentice-Hall, 2013.

#### Steel:

- Alaman, A; Materiales metálicos en construcción, Colegio Ing. CCP, 2000.
- Araujo, R. y Seco, E.; Construir arquitectura en España con acero, ENSIDESA, 1994 (Reeditado)
- Araujo, R. Construir con acero. Arquitectura en España 1993-2007, APTA, 2009.

#### Wood:

- Guindeo, A. y otros; Especies de madera para carpintería, construcción y mobiliario, AITIM, 1997.

#### Plastic, bituminous materials, adhesives and paintings:

- Dietz, A. G. H.; Plásticos para arquitectos y constructores, Ed. Reverté, 2003
- Vigil, M; Los plásticos como materiales de construcción, UNED, 2002.
- González Martín, J; La pintura en la construcción, Fundación Escuela de la Edificación, COAATM, 1997.



CODES, REGULATIONS AND STANDARDS.

- Ley de Ordenación de la Edificación (LOE, 38/1999).
- Código Técnico de la Edificación.
- Directiva 89/106/CEE sobre los productos de la construcción (R.D. 1630/1992) y desarrollo de Mercado CE de materiales y productos de la construcción.
- Instrucción para la Recepción de Cementos, RC-16.
- Instrucción de Hormigón Estructural, EHE-08
- Normas UNE-EN de materiales y productos de construcción.

## ANEXO PARA LA ASIGNATURA:

MATERIALES DE CONSTRUCCIÓN // BUILDING MATERIALS

Código: 256014

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