1. BASIC INFORMATION

Course	Construction II: Materials
Degree program	Bachelor's in the Fundamentals of Architecture
School	Architecture, Engineering and Design.
Year	Second Year
ECTS	6 ECTS (150 hours)
Credit type	Basic
Language(s)	English and Spanish
Delivery mode	Campus-based
Semester	S2
Academic year	2024-2025
Coordinating professor	Luis Alvarez Alfaro

2. PRESENTATION

The subject is taught in the second year of the degree, during the second term. Introduces the student to:

- Knowledge of the chemical characteristics of the materials used in construction, their manufacturing processes, the methodology of the tests for determining their characteristics, their geological origin, environmental impact, recycling and waste management.
- Ability to use the knowledge acquired in subsequent subjects, especially in construction, quality control and environmental management.
- Ability to adapt construction materials to the type and use of the building, manage and direct the reception and quality control of materials, their implementation, execution control and the performance of final tests and trials.
- Knowledge of the specific procedures for controlling the material execution of the building work.

3. COMPETENCIES AND LEARNING OUTCOMES

Core competencies: 1, 2, 3, 4, 5

- CB1: That students have demonstrated knowledge and understanding in a field of study that is based on general secondary education, at a level which, although supported by advanced textbooks, imply some knowledge of the vanguard of their field of study.

- CB2: That students can apply their knowledge to their work or vocation in a professional way and have competences that can be displayed by means of elaborating and sustaining arguments and solving problems in their field of study.
- CB3: That students have the ability to gather and interpret relevant data (usually within their field of study) to make judgements that include reflection on relevant social, scientific or ethical issues.
- CB4: That students can communicate information, ideas, problems and solutions to both the specialist and non-specialist.
- CB5: That students have developed the necessary learning skills to undertake further studies with a high level of autonomy.

Cross-curricular competencies: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

- CT1: Responsibility: aptitude or capacity to face responsibility that the profession of architect has in society, particularly when elaborating projects that take into consideration social and environmental factors.
- CT2: Self-confidence.
- CT3: Awareness of ethical values: ethical commitment, which includes the understanding and knowledge of the rights and duties of individuals and professional people, fostering respect for human rights, the protection of the most vulnerable members of society and respect for the environment.
- CT4: Communication skills in the native language (both oral and written) and in the English language, in accordance with the principles the Universidad Europea de Madrid, any concept or specification for the development of the regulated profession of architect. This includes learning the specific vocabulary of the degree as well as the ability to manage information.
- CT5: Interpersonal skills.
- CT6: Flexibility.
- CT7: Teamwork: Ability to work in teams of architects, or in interdisciplinary teams (with shared responsibility in many cases), managing and planning work groups that are necessary in the scheme of competences and tasks that are defined for projects of a

certain scale, in which several disciplines come together. This ability includes skills for interpersonal relations and team leadership.

- CT8: Initiative and the spirit of an entrepreneur, both in the area of architecture as well as in business.
- CT9: Planning and time management: Ability to plan work in order to comply with delivery times and to respect the limits imposed by budgets and building codes.
- CT10: Innovation and creativity: Creativity, imagination and aesthetic sensitivity applied to the design in order to satisfy the both the aesthetic and technical demands. This competence includes critical reasoning and historical culture.

Specific competencies: 24, 26

- CE24: Adequate knowledge of solid, continuum and soil mechanics, as well as plastic and elastic qualities and strength of materials in heavy construction.
- CE26: Adequate knowledge of the physical and chemical characteristics, production procedures, pathology and use of building materials.

Learning outcomes:

- RA1: Understand the chemical characteristics of materials used in construction, their manufacturing process, the testing methods to determine their characteristics, their geological origin, the environmental impact, recycling and waste management.
- RA2: Use the knowledge acquired to study subsequent subjects, especially construction, quality control and environmental management.
- RA3: Adapt construction materials to the typology and use of the building, manage and direct the reception and quality control of the materials, their installation, implementation of work units, testing and final trials.
- RA4: Gain knowledge of the specific control procedures for the material implementation of construction.

The following table shows the relationship between the competencies developed during the course and the learning outcomes pursued:

Competencies	Learning outcomes
CB1, CB4, CG4, CT1, CT3, CT9, CE24	RA1: Understand the chemical characteristics of materials used in construction, their manufacturing process, the testing methods to determine their characteristics, their geological origin, the environmental impact, recycling and waste management.
CB2, CB5, CT2, CT8, CT10	RA2: Use the knowledge acquired to study subsequent subjects, especially construction, quality control and environmental management.
CB3, CG5, CT4, CT5, CT6, CT7, CE26	RA3: Adapt construction materials to the typology and use of the building, manage and direct the reception and quality control of the materials, their installation, implementation of work units, testing and final trials.
CG6,	RA4: Gain knowledge of the specific control procedures for the material implementation of construction.

4. CONTENT

The subject is organized into three learning units, which, in turn, are divided into lessons or sections:

LU1: Theory of materials. Lectures

- Lesson 1: Introduction: history and concept of building materials.
- Lesson 2: Families of materials. Properties of materials.
- Lesson 3: Stone I: Properties and types; Wood II: Formats; Wood III: Finishes.
- Lesson 4: Wood I: Species and II: Shapes and Finishes.
- Lesson 5: Ceramics I. Properties and types II. Formats
- Lesson 6: Metals I: Properties. Metals II: Steel Metals III: Aluminum. Metals IV: Formats
- Lesson 7: Binders. Cements, Limes and Plasters
- Lesson 8: Concrete I: Composition and properties. Concrete II: Types and textures.
- Lesson 9: Glass
- Lesson 10: Synthetic materials
- Lesson 11: Insulating Materials. Paints, adhesives, sealants and bituminous materials.
- Lesson 12: Other materials, fibers, composites and new materials.

LU2: Laboratory Tests

- Laboratory session group 1: ceramic-based materials.
- Laboratory session group 2: metal-based materials
- Laboratory session group 3: polymeric-based materials

LU3: Research Project

- Project 01: Applied materials
- Project 02: Creation of a hybrid or composite material.

5. TEACHING-LEARNING METHODOLOGIES

The types of teaching-learning methodologies used are indicated below:

- Lectures
- Guided studies, practical exercises and problem solving

- Presentation of projects
- Independent study/work
- Tutorials, academic monitoring and assessment
- Laboratory practices

6. LEARNING ACTIVITIES

Listed below are the types of learning activities and the number of hours the student will spend on each one:

Campus-based mode:

Learning activity	Number of hours
Lectures	12.5 h
Guided studies, practical exercises and problem-solving	37.5 h
Presentation of projects	5 h
Team work	30 h
Independent study/work	15 h
Tutorials, academic monitoring and assessment	25 h
Lab tests	25 h
TOTAL	**150 h**

7. ASSESSMENT

Listed below are the assessment systems used and the weight each one carries towards the final course grade:

Campus-based mode:

Assessment system	Weight
Projects and research	50 %
Personal exposition of acquired knowledge	40 %
Practical application through lab tests	10 %
Additionally: Performance observation (class participation and attendance)	10 %

When you access the course on the *Campus Virtual*, you'll find a description of the assessment activities you have to complete, as well as the delivery deadline and assessment procedure for each one.

7.1. First exam period

To pass the course in the first exam period, you must obtain a final course grade of at least 5 out of 10 (weighted average).

In any case, it will be necessary to obtain a grade higher or equal to 4.0 as an average mark in the theoretical exams, as well as a minimum mark of 4.0 in the last practical research project of the course in order to obtain an average mark for the rest of the activities. Students who do not obtain an average mark of at least 4.0 in the theory exams and a mark of at least 4.0 in the last practical research project will automatically fail the course, even if the aggregate average mark for all the activities exceeds 5.0.

7.2. Second exam period

To pass the course in the second exam period, you must obtain a final grade of at least 5 out of 10 (weighted average).

Students who have followed the course and have not passed the practical exercises have the option of completing them during the extraordinary exam period and handing them in on the day of the exam.

Students who have followed the course and have not passed the theory exams will keep the grade obtained for the practical exercises during the course and will take the theory exam on the day of the extraordinary exam.

Students who have not followed the course will have to complete the practical exercises during the period prior to the extraordinary exam and hand them in on the day of the extraordinary exam. In addition, they will also have to take the theory exam on the day of the extraordinary exam.

In any case, it will be necessary to obtain a grade higher than or equal to 4.0 in the theory exam, as well as a minimum grade of 4.0 in the practical research work of the course so that it can be averaged with the rest of the activities. Students who do not obtain a mark of at least 4.0 in the theory exam and a mark of at least 4.0 in the practical research work will automatically fail, even if the average aggregate mark for all the activities exceeds 5.0.

8. SCHEDULE

This table shows the delivery deadline for each assessable activity in the course:

Assessable activities	Deadline
Project 01: Applied materials. Submission I	Week 3
Project 01: Applied materials. Submission II	Week 5
Project 02: Creation of a new material. Submission I	Week 8
Project 02: Creation of a new material. Submission II	Week 12
Project 02: Creation of a new material. Submission III	Week 16

This schedule may be subject to changes for logistical reasons relating to the activities. The student will be notified of any change as and when appropriate.

9. BIBLIOGRAPHY

The recommended Bibliography is:

GENERAL CONCEPTS

- Manfred Hegger, Volker Auch-Schwelk, Matthias Fuchs & Thorsten Rosenkranz. *Construction Materials Manual*. Birkhäuser Architecture; Basel 2006
- Deplazes A. (ed). *Constructing Architecture, Materials Processes Structures.* A Handbook. Birkhäuser; Basel 2008
- ALLEN, Edward; IANO, Joseph. Fundamentals of Building Construction: Materials and Methods. Wiley. 7th Edition, 2019.
- Cowan H., Smith P., *The Science and technology of building materials*. Van Nostrand Reinhold Company Inc. New York 1988.
- Manfred Hegger, Hans Drexler & Martin Zeumer *Materials*. Basics Birkhäuser Architecture; Basel 2017.
- Arredondo y Verdú, Francisco. *Generalidades sobre materiales de Construcción. ETS Ingenieros de Caminos. Madrid 1990.*
- Camuñas, A. *Materiales de Construcción. Guadiana Publicaciones SA. Madrid, 1971*

REINFORCED CONCRETE:

- F. CASINELLO, Fernando. Hormigonería. Madrid: Rueda, 1996.
- J. CALAVERA, José. Manual detalles constructivos obras de hormigón armado, Madrid: Intemac, 2004.

STEEL:

- HART, F. et al. El Atlas de la construcción metálica. Barcelona: Gustavo Gili, 1976. (N.B. Out of print; ask for an extract).
- ARAUJO, Ramón y SECO, Enrique. Construir arquitectura en España en Acero, Pamplona: Ensidesa (Aceralia), 1994.
- HURTADO MINGO et al. Estructuras de acero en edificación. APTA, 2008.

TIMBER:

- Miguel A.R. Nevado. Diseño Estructural en Madera. Madrid: AITIM, 1999.
- T. Herzog et al. Timber Construction Manual. Munich: Birkhäuser, ed. Detail, 2004.

MASONRY:

- KUMMER, Robinson M. Masonry construction. Basel, Switzerland: Birkhäuser, 2007.

10. DIVERSITY MANAGEMENT UNIT

Students with specific learning support needs:

Curricular adaptations and adjustments for students with specific learning support needs, in order to guarantee equal opportunities, will be overseen by the Diversity Management Unit (UAD: Unidad de Atención a la Diversidad).

It is compulsory for this Unit to issue a curricular adaptation/adjustment report, and therefore students with specific learning support needs should contact the Unit at unidad.diversidad@universidadeuropea.es at the beginning of each semester.

11. ONLINE SURVEYS

Your opinion matters!

The Universidad Europea encourages you to participate in several surveys which help identify the strengths and areas we need to improve regarding professors, degree programs and the teaching-learning process.

The surveys will be made available in the “surveys” section in virtual campus or via e-mail.

Your assessment is necessary for us to improve.

Thank you very much for your participation.