

Course guide

310407 - 310407 - Advanced Materials in Building Construction

Last modified: 18/12/2023

Unit in charge: Barcelona School of Building Construction
Teaching unit: 753 - TA - Department of Architectural Technology.

Degree: MASTER'S DEGREE IN ADVANCED BUILDING CONSTRUCTION (Syllabus 2014). (Optional subject).

Academic year: 2023 **ECTS Credits:** 5.0 **Languages:** Spanish

LECTURER

Coordinating lecturer: Haurie Ibarra, Laia
Others: Ruiz Merida, Francisco
Corominas González, Andreu

PRIOR SKILLS

Knowledge about construction and materials

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:

- 7. Define the characteristics of the seismic action and apply the present regulations to the seismic calculation of structures in building construction.
- 13. Capacity of innovation: identify the reasons and the mechanisms of the technologic and technical changes.

Generical:

- 8. Provide to the student the capacity to apply the knowledge acquired in the resolution of complex problems in any sector of the building construction.
- 9. Prepare to communicate with efficiency, orally but also in written.
- 10. Develop and/or apply ideas with originality in a context of investigation, identifying and formulating hypothesis or innovative ideas and submit them to a objectivity, coherence, and viability test.

Transversal:

- 11. ENTREPRENEURSHIP AND INNOVATION: Knowing about and understanding how businesses are run and the sciences that govern their activity. Having the ability to understand labor laws and how planning, industrial and marketing strategies, quality and profits relate to each other.
- 12. EFFECTIVE USE OF INFORMATION RESOURCES. Managing the acquisition, structure, analysis and display of information from the own field of specialization. Taking a critical stance with regard to the results obtained.

Basic:

- 2. Possess and understand knowledge which provide a basis or opportunity to be original in the development and/or application of ideas, usually in a context of research.
- 3. The students must be able to apply the acquired knowledges and their ability of resolution of problems in new or little known environments inside more wide environments (or multidisciplinary) related with their study field.
- 4. The students must be able to integrate knowledges and front to the complexity to formulate opinions from an information which, being incomplete or limited, includes reflections about the social and ethical responsibilities linked to the application of their knowledges and opinions.
- 5. The students must be able to communicate their conclusions and the knowledges and ultimate reasons which support to specialised and non-specialised audiences in a clear mode and without ambiguities.
- 1. The students must possess the learning abilities which allow them to continue studying in a way which should be to a large extent self-directed and autonomous.

TEACHING METHODOLOGY

The teacher will combine the dynamic classes with other activities such as experimental classes in the laboratory, technical visits, seminars and conferences and problem resolution.

LEARNING OBJECTIVES OF THE SUBJECT

Train students in the use of new materials that are being incorporated or may be incorporated in the near future in the building sector. Use materials selection criteria and the currently existing tools.

STUDY LOAD

Type	Hours	Percentage
Hours medium group	5,0	4.00
Hours large group	15,0	12.00
Hours small group	5,0	4.00
Guided activities	10,0	8.00
Self study	90,0	72.00

Total learning time: 125 h

CONTENTS

New materials? Advanced materials?

Description:

In this chapter we pretend to open the discussion about the broad concept of new materials.

Related competencies :

CB6. Possess and understand knowledge which provide a basis or opportunity to be original in the development and/or application of ideas, usually in a context of research.

Full-or-part-time: 2h

Theory classes: 2h

Historical approach to new materials

Description:

This section will make a historical overview of new materials throughout history.

Virtually all materials have been new materials at some point.

The influence of its appearance will be analyzed in the world of construction and will be seen as affecting the techniques and forms of construction time.

Full-or-part-time: 1h

Theory classes: 1h

New manufacturing techniques of construction materials

Description:

This section describes the new manufacturing techniques of construction materials through which we can obtain new materials with properties superior to traditional or may significantly improve the properties of existing traditional materials are described.

Full-or-part-time: 1h

Theory classes: 1h

Solving real world problems using construction techniques and materials selection tools.

Description:

Description of different selection methods. Establishment of preconditions, geometric constraints, application, environmental conditions, etc.

Detection of the most important parameters and selection of materials with improved properties.

Using databases and software to aid the selection of materials (type CES Edupack)

Full-or-part-time: 4h

Theory classes: 2h

Guided activities: 2h

Composites

Description:

Description and classification of the various types of composites.

Polymer matrix composites: fibers and matrices. Manufacturing technology. Films, sheets and tissues. Mechanical behavior.

Composite sandwich: typology and mechanical behavior

Matrix composites cement: Essential Components of concretes and mortars reinforced with fibers. Fiber-matrix interaction mechanisms. Properties of these compounds both fresh and hardened state.

Full-or-part-time: 5h

Theory classes: 3h

Guided activities: 2h

Advanced ceramic materials

Description:

In this section the most advanced and far superior performance to traditional ceramic products will be studied.

Full-or-part-time: 1h

Theory classes: 1h

High performance glass

Description:

Glass has acquired a very important importance and presence in today's construction.

In this section the most advanced products will be studied.

A visit will be made to a leading company in glass construction and buildings in which glass is of great importance will be visited.

Full-or-part-time: 6h

Theory classes: 4h

Guided activities: 2h

High performance mortars and concretes

Description:

In recent years there have been mortars and concretes with high performance that enable new challenges in construction. This section will delve into this field.

Full-or-part-time: 2h

Theory classes: 2h

Nanotechnology in Construction

Description:

Nanotechnology is the word most fashionable in the world of new materials. In this section, the possible applications of nanomaterials in the construction world will be studied. Nanostructured cements . Nanoparticles as additions. Impregnation of traditionally difficult materials impregnated with nanosized preparations.

Full-or-part-time: 3h

Theory classes: 1h

Guided activities: 2h

Smart materials. Shape memory materials.

Description:

Smart materials. Shape memory materials.

Full-or-part-time: 1h

Theory classes: 1h

Self-healing materials

Description:

Along with smart materials, self-repairing materials offer a world of possibilities in the world of construction.

Full-or-part-time: 1h

Theory classes: 1h

Wood. New material?

Description:

From the wood, the most traditional of the construction materials, there is being developed a range of transformed products which are causing that the wood is considered as a new material.

Full-or-part-time: 3h

Theory classes: 2h

Practical classes: 1h

GRADING SYSTEM

70% of the marks will correspond to different exercises that should cover the different topics treated during the course. The other 30% will be obtained through conventional evaluation tests along the course.

BIBLIOGRAPHY

Basic:

- Ashby, M. F; Johnson, Kara. Materials and design : the art and science of material selection in product design. Amsterdam: Butterworth Heinemann, 2002. ISBN 0750655542.
- Knippers, Jan; Cremers, Jan; Gabler, Markus; Lienhard, Julian. Construction manual for polymers + membranes : materials, semi-finished products, form-finding, design. Basel : Munich: Birkhäuser ; Detail, cop. 2011. ISBN 9783034607261.
- Material world 2 : innovative materials for architecture and design. Basel [etc.] : Amsterdam: Birkhäuser ; Frame, cop. 2006. ISBN 3764372796.
- Fernandez, John. Material architecture : emergent materials for innovative buildings and ecological construction. Oxford: Architectural Press, cop. 2006. ISBN 0750664975.
- Kaltenbach, Frank. Translucent materials : glass, plastics, metals. Basel: Birkhäuser : Detail, cop. 2004. ISBN 3764370335.
- Engelsmann, Stephan; Peters, Stefan; Spalding, Valerie. Plastics : in Architecture and Construction. Basel: Birkhäuser, 2010. ISBN 9783034603225.

Complementary:

- Mijangos, Carmen; Moya Corral, José Serafín. Nuevos materiales en la sociedad del siglo XXI. Madrid: Consejo Superior de Investigaciones Científicas, 2007. ISBN 9788400084530.