# Advanced Materials in Construction (250721)

## General information

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| **School:** | ETSECCPB |
| **Departments:** | Departament d'Enginyeria Civil i Ambiental (DECA) |
| **Credits:** | 5.0 ECTS |
| **Programs:** | MÀSTER UNIVERSITARI EN ENGINYERIA ESTRUCTURAL I DE LA CONSTRUCCIÓ, pla 2015 - (codi pla 1140) |
| **Course:** | 2015/2016 |
| **Course language:** | Castellano |

## Faculty

Responsible faculty: Sergio Henrique Pialarissi Cavalaro

Teachers: Antonio Aguado De Cea, Ana Blanco Álvarez, Sergio Henrique Pialarissi Cavalaro, Pablo Pujadas Álvarez

## Generic objectives

Subject to know the properties of new materials in construction

- Knowledge of building materials associated with certain less standardized building systems . Knowledge of new materials through an integrated approach of the material within the entire construction process (planning, design, execution, operation and reintegration) - Ability to analyze future perspectives in the design of new materials and their possible applications in civil and building construction.

Design of materials under the requirements of the application and the construction technique . Hydraulic base materials: conglomerants , additions , additives , granular skeletons ( natural aggregates , artificial , recycled ), different kinds of fibers. Special concretes : high flow , high performance , with metal and plastic fibers , shotcrete, self-compacting , light, heavy , in marine environment, under extreme temperatures, prefabricated, translucent. Organic based materials . Nature of organic matrices. Granular structures. Polymeric concrete. Polymers in construction. Metallic high-performance materials : stainless steel, titanium .

- Properties of new materials used in construction

- Knowledge about building materials associated with certain little standardized construction systems. Knowledge of new materials through an integrated approach considering the material in the entire construction process (planning, design, implementation, operation and reintegration)

- Ability to analyze future prospects in the design of new materials and their possible applications in construction.

- Design of materials under the requirements of the application and the construction technique.

Hydraulic based materials: binders, additions, admixtures, granular skeletons (natural aggregates, artificial, recycled) fibers of various types. Special concrete: high performance with metallic and plastic fibers, projected, SCC, light, heavy, marine environment, extreme temperatures, prefabricated translucent. Organic based materials. Nature of organic matrices. Granular structures. Polymer concrete. Polymers in construction. Metallic high-performance materials: stainless steel, titanium.

## Skills

***Specific skills***

Designing and building using traditional materials (reinforced concrete, prestressed concrete, structural steel, masonry, wood) and new materials (composites, stainless steel, aluminum, shape memory alloys?).

To apply innovative and sustainable technological aspects in the management and implementation of projects and works.

To analyze the multiple technical and legal conditions arising in the construction of public works, and use proven methods and proven technologies with the aim of achieving greater efficiency in construction while respecting the environment and protecting the safety and health of workers and users of public works.

***Generic skills of subject***

To develop, improve and use conventional materials and new construction techniques to ensure the safety requirements, functionality, durability and sustainability.

To define construction processes and methods of organization and management of projects and works.

To design plans for safety, quality and environmental and socioeconomic impacts related to the construction process.

## ECTS credits: total hours of student work

| | | Dedication | |
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| | | **Hours** | **Percent** |
| **Supervised Learning** | **Theory** | 30.00 | 66.7% |
| | **Assignments** | 6.00 | 13.3% |
| | **Laboratory** | 9.00 | 20.0% |

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| | **Supervised activities** | 15.00 | 33.3% |
| **Self-Learning** | | 80.00 | |

## Contents

### *Introduction*

#### *Dedication*

3.0h. Theory

#### *Description*

Basics about conventional building materials

### *Special concretes*

#### *Dedication*

18.0h. Theory + 6.0h. Assignments

#### *Description*

Self-compacting concrete

High strength concrete

Sprayed concrete

Fiber reinforced concrete

Concrete with high aesthetic performance

Study on the application of special concrete to real cases

High density concrete, lightweight concrete, porous concrete

### *Other advanced materials*

#### *Dedication*

9.0h. Theory + 9.0h. Laboratory

#### *Description*

Controlled low strength material

Construction materials prone to biological growth

Smart building materials

## Activities

### *Dosage and production of special concretes*

#### *Dedication*

6.0 h. Supervised activities

### *Work on advanced materials*

***Dedication***

9.0 h. Supervised activities

## Grading rules (*)

***(*) The evaluation calendar and grading rules will be approved before the start of the course.***

The mark of the course is obtained from the ratings of continuous assessment and their corresponding laboratories and/or classroom computers.

Continuous assessment consist in several activities, both individually and in group, of additive and training characteristics, carried out during the year (both in and out of the classroom).

The teachings of the laboratory grade is the average in such activities.

The evaluation tests consist of a part with questions about concepts associated with the learning objectives of the course with regard to knowledge or understanding, and a part with a set of application exercises.

## Test rules

Failure to perform a laboratory or continuous assessment activity in the scheduled period will result in a mark of zero in that activity.

## Teaching methodology

The course consists of 3.0 hours per week of classroom activity (large size group).

The 2.5 hours in the large size groups are devoted to theoretical lectures, in which the teacher presents the basic concepts and topics of the subject, shows examples and solves exercises.

The rest of weekly hours devoted to laboratory practice.

Support material in the form of a detailed teaching plan is provided using the virtual campus ATENEA: content, program of learning and assessment activities conducted and literature.

## Office hours

The hours will be concentrated during Friday morning. Alternatively, students can schedule directly with each teacher by e-mail.

## Basic bibliography


- Pierre-Claude Aïtcin. **High performance concrete**. CRC Press. 2011. ISBN 0419192700.
- Ahmed Loukili. **Self Compacting Concrete**. Wiley-ISTE. 2011. ISBN 1848212909.

- Varios. **Sprayed Concrete Technology**. E& FN SPON. 1996. ISBN 0203785363.
- Varios. **Concrete Technology for a Sustainable Development in the 21st Century**. 2000. ISBN 0419250603.