Course guide
250716 - 250716 - Durability of Structures

Last modified: 22/05/2025

Unit in charge: Barcelona School of Civil Engineering
Teaching unit: 751 - DECA - Department of Civil and Environmental Engineering.

Degree: MASTER'S DEGREE IN STRUCTURAL AND CONSTRUCTION ENGINEERING (Syllabus 2015). (Optional subject).

Academic year: 2025 **ECTS Credits:** 5.0 **Languages:** Spanish

LECTURER

Coordinating lecturer: MARILDA BARRA BIZINOTTO

Others: VICENTE ALEGRE HEITZMANN, DIEGO FERNANDO APONTE HERNÁNDEZ, MARILDA BARRA BIZINOTTO, SUSANA VALLS DEL BARRIO

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
13367. To apply innovative and sustainable technological aspects in the management and implementation of projects and works.
13370. 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.

Generical:
13360. To conceive, design, analyze and manage structures or structural elements of civil engineering or building, encouraging innovation and the advance of knowledge.
13361. To develop, improve and use conventional materials and new construction techniques to ensure the safety requirements, functionality, durability and sustainability.
13362. To define construction processes and methods of organization and management of projects and works.
13363. To design plans for safety, quality and environmental and socioeconomic impacts related to the construction process.

TEACHING METHODOLOGY

The course consists of 3 hours a week of classes in a classroom (large group) is dedicated to lectures 2 hours in a large group, in which he exposes the teaching materials and basic concepts of the subject, and presents examples performs exercises. Devotes one hour (Intermediate), solving problems with greater interaction with students. Practical exercises are conducted in order to consolidate the general and specific learning objectives. The rest of weekly hours dedicated to studies and homework.

Although most of the sessions will be given in the language indicated, sessions supported by other occasional guest experts may be held in other languages.

LEARNING OBJECTIVES OF THE SUBJECT

Subject to introduce to the engineer the basic concepts that govern the behaviour of concrete in front of agressive environments

- Knowledge of the basic concepts that govern the concrete behavior under aggressive environments .

Durability and lifespan concepts. Main causes ofmaterials deterioration. Concrete structures. Deterioration of concrete: design errors , construction defects , damage from external causes. The transport mechanisms in the concrete. Steel corrossion in concrete. In situ tests. Laboratory tests: microscopy, strength, transportation parameters, XRD, cement composition. Real case studies of structures affected by phenomena related to durability.

Knowledge of the basic concepts that govern the behavior of concrete deal with environmental damage. Concepts durability and service life. Main causes of deterioration of materials. The concrete and its structure. Deterioration of concrete: errors in project, construction defects, damage from external causes. Transport mechanisms in concrete. Corrosion of steel in concrete. Tests in situ. Laboratory tests: microscopy, resistance, transport parameters, DRX, composition of cement. Case studies of structures affected by phenomena durability.

STUDY LOAD

Type	Hours	Percentage
Self study	80,0	64.00
Hours large group	45,0	36.00

Total learning time: 125 h

CONTENTS

Durability and sustainability.

Description:
Durability concepts. Durability and Sustainability.

Full-or-part-time: 4h 48m
Theory classes: 2h
Self study : 2h 48m

Bases for the formulation of a durable concrete.

Description:
* Hydration of cement * Genesis and features of the microstructure of the hydrated cement paste. * Additives and additions.
* The porous structure and transport mechanisms * Shrinkage, creep and cracking.
Durability of concrete in: * Natural waters * acids environment. Preventive actions.

Full-or-part-time: 28h 47m
Theory classes: 9h
Laboratory classes: 3h
Self study : 16h 47m

Endogenous expansive reactions

Description:
Endogenous reactions attributable to the aggregates. Diagnosi. Preventive actions.

Full-or-part-time: 7h 11m
Theory classes: 3h
Self study : 4h 11m

Physical deterioration of concrete

Description:
Physical deterioration of concrete * Fire Action. * freezing and thawing. * cavitation and abrasion.

Full-or-part-time: 7h 11m
Theory classes: 3h
Self study : 4h 11m

Durability of concrete in chemically aggressive media

Description:
Durability of concrete in Sulfátic and Marine environment.

Full-or-part-time: 7h 11m
Theory classes: 3h
Self study : 4h 11m

Carbonation and chloride penetration

Description:
Carbonation and chloride penetration

Full-or-part-time: 7h 11m
Theory classes: 3h
Self study : 4h 11m

Corrosion and durability of reinforcement

Description:
Corrosion and durability of reinforcement
Practice steel corrosion

Full-or-part-time: 14h 23m
Theory classes: 3h
Laboratory classes: 3h
Self study : 8h 23m

Calcium aluminate cements - CAC

Description:
Durability of concretes with calcium aluminate cements

Full-or-part-time: 7h 11m
Theory classes: 3h
Self study : 4h 11m

Durability prediction models

Description:
Durability models for predicting the behavior of the concrete. Life cycle

Full-or-part-time: 7h 11m
Theory classes: 3h
Self study : 4h 11m

Deterioration. Case studies.

Description:
Studies case. Diagnosis. Repair proposals.

Full-or-part-time: 7h 11m
Theory classes: 3h
Self study : 4h 11m

Diagnosing causes of deterioration

Description:
Diagnosing causes of deterioration of the concrete structure

Full-or-part-time: 7h 11m
Practical classes: 3h
Self study : 4h 11m

Repairs

Description:
Repairs. Material and methods.

Full-or-part-time: 2h 24m
Theory classes: 1h
Self study : 1h 24m

GRADING SYSTEM

Continuous assessment will formulate written questions on the subject of the class will be delivered on paper at the beginning of the next class. All deliveries will be described and its absence a qualified zero. The course will approve the average ongoing assessments, which represent 25% of the note, a test will represent 40% of the final and will represent 35% of the note. The final work will be delivered on paper and will be presented orally in class (20 minutes).

EXAMINATION RULES.

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

BIBLIOGRAPHY

Basic:
- Ollivier, Jean-Pierre; Vichot, Angélique. La Durabilité des bétons : bases scientifiques pour la formulation de bétons durables dans leur environnement. 2º. Paris: Presses de l'école nationale des Ponts et chaussés, 2008. ISBN 9782859784348.