Course guides
250710 - 250710 - Inspection, Analysis and Restoration of Historical Constructions

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: 2020  ECTS Credits: 5.0  Languages: Catalan, Spanish, English

LECTURER
Coordinating lecturer: LUCA PELA
Others: DANIEL ALARCÓN FERNÁNDEZ, CLIMENT MOLINS BORRELL, LUCA PELA, PEDRO ROCA FABREGAT

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
13364. To conceive and design civil and building structures that are safe, durable, functional and integrated into its surroundings.
13365. Designing and building using traditional materials (reinforced concrete, prestressed concrete, structural steel, masonry, wood) and new materials (composites, stainless steel, aluminum, shape memory alloys?).
13366. To evaluate, maintain, repair and strengthen existing structures, including the historic and artistic heritage.
13369. To apply methods and advanced design software and structural calculations, based on knowledge and understanding of forces and their application to the structural types of civil engineering.

General:
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.

TEACHING METHODOLOGY

The teaching method combines educational sessions about the basic concepts with practical sessions on the methods presented (for analysis, inspection and intervention) and critical discussion of case-studies.

An essential aspect of the teaching method relies on the realization by groups of students of a study of a real building, including the analysis of previous studies, the diagnosis, the project of inspection and monitoring activities, the structural analysis and the design of interventions. The proposals by the students are presented and discussed regularly during scheduled sessions, where the participation of teachers and students is important to assess the accuracy of the diagnosis and the adequacy of the proposal interventions.
LEARNING OBJECTIVES OF THE SUBJECT

Subject to know the materials and typological features of heritage buildings, modern heritage conservation criteria, structural analysis of masonry or wood, inspection techniques and strengthening.

Capacity for analysis of structures masonry or wood using traditional and advanced methods. Ability to design applicable to the conservation and enhancement of historic buildings solutions.


* Apply modern criteria of conservation and restoration of architectural heritage structures in accordance with regulations and international documents.
* Analyze the characteristics of materials and typologies of heritage buildings.
* Analyze the behavior of existing timber structures, brick and stone masonry structures, under static and seismic actions, by means of classical and advanced methods.
* Conceive and design specific activities of non-destructive and minor destructive inspection. Applying modern techniques for the monitoring of historical structures.
* Develop design solutions applicable to the conservation, repair, stabilization and strengthening of heritage buildings.

STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guided activities</td>
<td>6,0</td>
<td>4.80</td>
</tr>
<tr>
<td>Self study</td>
<td>80,0</td>
<td>63.95</td>
</tr>
<tr>
<td>Hours small group</td>
<td>9,8</td>
<td>7.83</td>
</tr>
<tr>
<td>Hours large group</td>
<td>19,5</td>
<td>15.59</td>
</tr>
<tr>
<td>Hours medium group</td>
<td>9,8</td>
<td>7.83</td>
</tr>
</tbody>
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Total learning time: 125.1 h

CONTENTS

Basic concepts and criteria of Conservation and Restoration

Description:
Introduction to the criteria for the conservation and restoration of heritage buildings. Presentation of charts, documents and international regulations.
Examples

Full-or-part-time: 7h 11m
Theory classes: 2h
Practical classes: 1h
Self study: 4h 11m
**Structural analysis methods**

**Description:**
Methods Classics: Graphic Statics  
Problems of graphic statics  
Classical Methods: Kinematic Analysis  
Problems of kinematic analysis  
Seismic behavior of masonry structures  
Examples  
Advanced methods: introduction to computational methods

**Full-or-part-time:** 33h 36m  
Theory classes: 7h  
Practical classes: 7h  
Self study: 19h 36m

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**Structural behavior of traditional materials**

**Description:**  
Behavior of masonry structures  
Behavior of timber structures

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

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**Damage and collapse mechanisms**

**Description:**  
Mechanisms of damage and collapse  
Examples

**Full-or-part-time:** 12h  
Theory classes: 2h  
Practical classes: 3h  
Self study: 7h

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**Group work - Case studies**

**Description:**  
Workshop 1 - Historic and Visual Inspection, Damage Diagnosis  
Examples of integrated studies of historical structures  
Workshop 2 - Structural analysis and design of interventions

**Full-or-part-time:** 19h 12m  
Practical classes: 1h  
Laboratory classes: 7h  
Self study: 11h 12m
**Inspection and monitoring techniques**

**Description:**
Inspection and monitoring techniques

**Examples**

**Full-or-part-time:** 7h 11m  
Theory classes: 2h  
Practical classes: 1h  
Self study: 4h 11m

**Intervention**

**Description:**
Repair and strengthening

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

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**GRADING SYSTEM**

The grade is obtained from continuous assessment and final exam.

Continuous assessment involves different activities, both individual and in group, made during the year (in the classroom and outside of it).

The evaluation tests consist of questions on theoretical concepts and practical exercises.

The final grade is defined by adding the contributions of each activity performed by the student, according to the weights listed below:
- Individual assignments: 40%
- Group work: 25%
- Final exam of theory: 35%

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**EXAMINATION RULES.**

If one of the activities scheduled during the period is not done, it will be considered with zero grade.

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**BIBLIOGRAPHY**

**Basic:**

**Complementary:**
- Como, M. Statics of historic masonry constructions [on line]. 3rd ed. Cham: Springer International Publishing, 2017 [Consultation: