250710 - Inspection, Analysis and Restoration of Historical Constructions

Coordinating unit: 250 - ETSECCPB - Barcelona School of Civil Engineering
Teaching unit: 751 - DECA - Department of Civil and Environmental Engineering
Academic year: 2019
Degree: MASTER'S DEGREE IN STRUCTURAL AND CONSTRUCTION ENGINEERING (Syllabus 2015). (Teaching unit Optional)
ECTS credits: 5  
Teaching languages: Catalan, Spanish, English

Teaching staff
Coordinator: LUCA PELA
Others: DANIEL ALARCÓN FERNÁNDEZ, CLIMENT MOLINS BORRELL, LUCA PELA, PEDRO ROCA FABREGAT

Opening hours
Timetable: Email the lecturer of the course.

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
250710 - Inspection, Analysis and Restoration of Historical Constructions

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><strong>Total learning time:</strong> 125h</th>
<th>Hours large group: 19h 30m</th>
<th>15.60%</th>
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<tbody>
<tr>
<td>Hours medium group:</td>
<td>9h 45m</td>
<td>7.80%</td>
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<tr>
<td>Hours small group:</td>
<td>9h 45m</td>
<td>7.80%</td>
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<tr>
<td>Guided activities:</td>
<td>6h</td>
<td>4.80%</td>
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<tr>
<td>Self study:</td>
<td>80h</td>
<td>64.00%</td>
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</table>
## Content

<table>
<thead>
<tr>
<th>Basic concepts and criteria of Conservation and Restoration</th>
<th>Learning time: 7h 11m</th>
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</thead>
<tbody>
<tr>
<td>Description:</td>
<td></td>
</tr>
<tr>
<td>Introduction to the criteria for the conservation and</td>
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<tr>
<td>restoration of heritage buildings. Presentation of</td>
<td></td>
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<tr>
<td>charts, documents and international regulations.</td>
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<tr>
<td>Examples</td>
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</table>

### Structural analysis methods

<table>
<thead>
<tr>
<th>Learning time: 33h 36m</th>
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<tbody>
<tr>
<td>Theory classes: 7h</td>
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<tr>
<td>Practical classes: 7h</td>
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<tr>
<td>Self study : 19h 36m</td>
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</tbody>
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### Structural behavior of traditional materials

<table>
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<tr>
<th>Learning time: 7h 11m</th>
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<tbody>
<tr>
<td>Theory classes: 3h</td>
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<tr>
<td>Self study : 4h 11m</td>
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</table>

### Damage and collapse mechanisms

<table>
<thead>
<tr>
<th>Learning time: 12h</th>
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<tbody>
<tr>
<td>Theory classes: 2h</td>
</tr>
<tr>
<td>Practical classes: 3h</td>
</tr>
<tr>
<td>Self study : 7h</td>
</tr>
</tbody>
</table>

### Description:

- Behavior of masonry structures
- Behavior of timber structures
- Mechanisms of damage and collapse
- Examples

- Methods Classics: Graphic Statics
- Problems of graphic statics
- Classical Methods: Kinematic Analysis
- Problems of kinematic analysis
- Seismic behavior of masonry structures
- Advanced methods: introduction to computational methods
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**Group work - Case studies**

**Learning time:** 19h 12m  
Practical classes: 1h  
Laboratory classes: 7h  
Self study: 11h 12m

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

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**Inspection and monitoring techniques**

**Learning time:** 7h 11m  
Theory classes: 2h  
Practical classes: 1h  
Self study: 4h 11m

**Description:**  
Inspection and monitoring techniques  
Examples

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**Intervention**

**Learning time:** 7h 11m  
Theory classes: 3h  
Self study: 4h 11m

**Description:**  
Repair and strengthening

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**Qualification 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%
Regulations for carrying out activities

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

Bibliography

Basic:


Complementary:

