250475 - ESTMIXCOMP - Mixed and Composite Structures

Coordinating unit: 250 - ETSECCPB - Barcelona School of Civil Engineering
Teaching unit: 751 - DECA - Department of Civil and Environmental Engineering
Academic year: 2015
Degree: MASTER'S DEGREE IN CIVIL ENGINEERING (RESEARCH TRACK) (Syllabus 2007). (Teaching unit Optional)
MASTER'S DEGREE IN CIVIL ENGINEERING (PROFESSIONAL TRACK) (Syllabus 2012). (Teaching unit Optional)
MASTER'S DEGREE IN CIVIL ENGINEERING (PROFESSIONAL TRACK) (Syllabus 2012). (Teaching unit Optional)
MASTER'S DEGREE IN CIVIL ENGINEERING (RESEARCH TRACK) (Syllabus 2009). (Teaching unit Optional)
MASTER'S DEGREE IN STRUCTURAL AND CONSTRUCTION ENGINEERING (Syllabus 2009). (Teaching unit Optional)
MASTER'S DEGREE IN STRUCTURAL AND CONSTRUCTION ENGINEERING (Syllabus 2015). (Teaching unit Optional)
ECTS credits: 5 Teaching languages: Catalan, Spanish, English

Teaching staff
Coordinator: ENRIQUE MIRAMBELL ARRIZABALAGA
Others: ANTONIO RICARDO MARI BERNAT, ENRIQUE MIRAMBELL ARRIZABALAGA

Opening hours
Timetable: The consultations will take place on appointment.

Degree competences to which the subject contributes

Specific:
8162. Knowledge of all kinds of structures and materials and the ability to design, execute and maintain structures and buildings for civil works.
8228. Knowledge of and competence in the application of advanced structural design and calculations for structural analysis, based on knowledge and understanding of forces and their application to civil engineering structures. The ability to assess structural integrity.

Teaching methodology

The course consists of 3 hours per week of classroom activity during 13 weeks.

In the theoretical lectures, the teacher presents the basic concepts and topics of the subject, shows examples and solves exercises.

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.

Learning objectives of the subject

Specialization subject in which knowledge on specific competences is intensified.
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Knowledge and skills at specialization level that permit the development and application of techniques and methodologies at advanced level.

Contents of specialization at master level related to research or innovation in the field of engineering.

<table>
<thead>
<tr>
<th>Study load</th>
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<tbody>
<tr>
<td><strong>Total learning time:</strong> 125h</td>
<td>Theory classes:</td>
<td>19h 30m</td>
<td>15.60%</td>
</tr>
<tr>
<td></td>
<td>Practical classes:</td>
<td>9h 45m</td>
<td>7.80%</td>
</tr>
<tr>
<td></td>
<td>Laboratory classes:</td>
<td>9h 45m</td>
<td>7.80%</td>
</tr>
<tr>
<td></td>
<td>Guided activities:</td>
<td>6h</td>
<td>4.80%</td>
</tr>
<tr>
<td></td>
<td>Self study:</td>
<td>80h</td>
<td>64.00%</td>
</tr>
</tbody>
</table>
## Content

### Overview

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

**Description:**

Materials: Structural steel, steel reinforcement, concrete

### Structural behavior. Time dependent effects

<table>
<thead>
<tr>
<th>Learning time: 7h 11m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory classes: 2h</td>
</tr>
<tr>
<td>Practical classes: 1h</td>
</tr>
<tr>
<td>Self study: 4h 11m</td>
</tr>
</tbody>
</table>

**Description:**

### The prestressed composite structures. Ultimate limit states

<table>
<thead>
<tr>
<th>Learning time: 7h 11m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory classes: 2h</td>
</tr>
<tr>
<td>Practical classes: 1h</td>
</tr>
<tr>
<td>Self study: 4h 11m</td>
</tr>
</tbody>
</table>

**Description:**
### Serviceability limit states

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

**Description:**  
Resolution of exercise of verification of the limit state of cracking in an intermediate support cross-section of a continuous composite beam.

### Shear connection

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

**Description:**  
Flush effort calculation: Beams with past efforts and calculated according to elastic theory under plastic theory.  
Total and partial connection connection with connectors dúctiles. Capacidad resistente ductil or last of the connectors: Pin connectors. Other types of connectors. Distribution connectors along the element. Limitations.  
Construction layout. Transverse reinforcement in the connection area.  
Resolution of exercise related to the design of connection in composite beam.

### Construction process

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

**Description:**  
Resolution of an exercise related to the construction process of a steel-concrete composite structures.
## Composite columns

**Description:**

Resolution of exercise of the verification of a composite column under axial load and biaxial bending.

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

## Composite slabs with profiled sheet

**Description:**

Resolution of exercise of composite slab with profiled sheet.

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

## Composite bridges

**Description:**

**Learning time:** 7h 11m
- Theory classes: 3h
- Self study: 4h 11m
The mark of the course is obtained from the continuous assessment. It consists of four activities and a final exam. The final mark \( F \) is obtained from the exam mark \( E \) and the activities directed \( AD \)

\[
F = 0.7E + 0.3AD
\]

The maximum score assigned to each activity will be the same.

### Qualification system

<table>
<thead>
<tr>
<th>Composite structures with different types of concrete</th>
<th><strong>Learning time:</strong> 21h 36m</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Theory classes: 9h</td>
</tr>
<tr>
<td></td>
<td>Self study: 12h 36m</td>
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</tbody>
</table>

**Description:**


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

### Evaluation

The mark of the course is obtained from the continuous assessment.

It consists of four activities and a final exam.

The final mark \( F \) is obtained from the exam mark \( E \) and the activities directed \( AD \)

\[
F = 0.7E + 0.3AD
\]

The maximum score assigned to each activity will be the same.

### Regulations for carrying out activities

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

Basic: