250440 - ENGCOMPREX - Computational Engineering for Design and Operation

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 CIVIL ENGINEERING (PROFESSIONAL TRACK) (Syllabus 2012). (Teaching unit Optional)
MASTER'S DEGREE IN CIVIL ENGINEERING (PROFESSIONAL TRACK) (Syllabus 2012). (Teaching unit Optional)
ECTS credits: 5
Teaching languages: English

Teaching staff
Coordinator: AMIR ABDOLLAHI HOSNIJEH
Others: AMIR ABDOLLAHI HOSNIJEH, NATIVITAT PASTOR TORRENTE

Degree competences to which the subject contributes

Transversal:
8559. ENTREPRENEURSHIP AND INNOVATION: Being aware of and understanding the mechanisms on which scientific research is based, as well as the mechanisms and instruments for transferring results among socio-economic agents involved in research, development and innovation processes.
8560. SUSTAINABILITY AND SOCIAL COMMITMENT: Being aware of and understanding the complexity of the economic and social phenomena typical of a welfare society, and being able to relate social welfare to globalisation and sustainability and to use technique, technology, economics and sustainability in a balanced and compatible manner.
8561. TEAMWORK: Being able to work in an interdisciplinary team, whether as a member or as a leader, with the aim of contributing to projects pragmatically and responsibly and making commitments in view of the resources that are available.

Teaching methodology
Taught module delivery: thirteen weeks of teaching, coursework and self-study. Apart from the 3 hours per week in the classroom, self-study must last an average of 4.5 hours per week.
At least a half of the classroom hours are devoted to work in small groups (computer laboratory, evaluations, etc.)

Learning objectives of the subject
Specialization subject in which knowledge on specific competences is intensified.
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.
Tutored weekly class where case studies and practical examples are reproduced by the students. Topics in computational engineering are reviewed and worked in depth using commercial software.
## Study load

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

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

- Basic steps in computer modeling
- Modeling exercise with pdetools. Error measures, convergence.

<table>
<thead>
<tr>
<th>Governing physics</th>
<th>Learning time: 7h 11m</th>
</tr>
</thead>
<tbody>
<tr>
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<td>Theory classes: 2h</td>
</tr>
<tr>
<td></td>
<td>Laboratory classes: 1h</td>
</tr>
<tr>
<td></td>
<td>Self study : 4h 11m</td>
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- Balance equations: solids, fluids. Thermal balance. Transport equation
- Exercise on heat transfer.

<table>
<thead>
<tr>
<th>Discretization methods</th>
<th>Learning time: 7h 11m</th>
</tr>
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<tbody>
<tr>
<td>Description:</td>
<td>Theory classes: 2h</td>
</tr>
<tr>
<td></td>
<td>Laboratory classes: 1h</td>
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<td>Self study : 4h 11m</td>
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</tbody>
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- Finite elements
- Abaqus. SAP. Other commercial software.

<table>
<thead>
<tr>
<th>Linear Elasticity</th>
<th>Learning time: 21h 36m</th>
</tr>
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<tbody>
<tr>
<td>Description:</td>
<td>Theory classes: 1h</td>
</tr>
<tr>
<td></td>
<td>Laboratory classes: 8h</td>
</tr>
<tr>
<td></td>
<td>Self study : 12h 36m</td>
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- Bulk and structural elements.
- Introduction to SAP
- Exercise with SAP
### Dynamics

**Learning time:** 12h  
- Theory classes: 2h  
- Laboratory classes: 3h  
- Self study: 7h

**Description:**  
Modal and direct time-integration algorithms, explicit, implicit, stability.  
Introduction to Abaqus

### Evaluation

**Learning time:** 16h 48m  
- Laboratory classes: 7h  
- Self study: 9h 48m

### Non-linearities

**Learning time:** 14h 23m  
- Theory classes: 1h  
- Laboratory classes: 5h  
- Self study: 8h 23m

**Description:**  
Exercise with Abaqus

### Buckling

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

**Description:**  
Linear and non-linear Buckling  
Exercise
The mark of the course is obtained as follows:

Mark = Q*0.2 + A*0.3 + P*0.5

where
Q is the mark of the in-class written exam
A is the average of the marks of the three assignments
P is the mark of the final project

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

Basic: