240EI016 - Theory of Structures

**Coordinating unit:** 240 - ETSEIB - Barcelona School of Industrial Engineering

**Teaching unit:** 737 - RMEE - Department of Strength of Materials and Structural Engineering

**Academic year:** 2017

**Degree:** MASTER’S DEGREE IN INDUSTRIAL ENGINEERING (Syllabus 2014). (Teaching unit Compulsory)

**ECTS credits:** 4,5  

**Teaching languages:** Catalan, Spanish

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**Teaching staff**

**Coordinator:** Frederic Marimon Carvajal

**Others:** Josep Maria Pons Poblet

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**Opening hours**

**Timetable:** Information in Campus Atenea by UPC

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**Prior skills**

Knowledge of Solid Mechanics and/or Strength of Materials

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**Teaching methodology**

MD01. Lectures. The teacher exposes the practical and theoretical contents of the syllabus of the course, with the active participation of students.

MD03. Project Based Learning. During the evolution of the projects will be introduced additional practical issues that are directly related to the subject contents. Two realistic projects to be solved by students in small groups (2 or 3 people) and they will be evaluated: Case Study I and II.

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**DISABILITY SUPPORT PROGRAM (PAD)**

The course Theory of Structures is fully subscribed to action undertaken by the UPC in the Disability Support Programme (PAD) to support students who their problems are recognized in the program; physical, sensory, and especially those related to learning difficulties, considering their specific educational needs and assessment. For more information please contact the teacher responsible for the course frederic.marimon@upc.edu

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**Learning objectives of the subject**

**SPECIFIC SKILLS**

CE17- Ability to design, construction and operation of industrial plants.

CE19- Knowledge and skills for the calculation and design of structures.

CE23- Knowledge and skills for certifications, audits, inspections, tests and reports.
### Study load

<table>
<thead>
<tr>
<th>Description</th>
<th>Total Learning Time: 112h 30m</th>
<th>Hours Large Group:</th>
<th>Hours Small Group:</th>
<th>Guided Activities:</th>
<th>Self Study:</th>
<th>Total Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total learning time</td>
<td>112h 30m</td>
<td>27h</td>
<td>13h 30m</td>
<td>0h</td>
<td>72h</td>
<td>24.00%</td>
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<tr>
<td>Hours large group</td>
<td></td>
<td>24.00%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hours small group</td>
<td></td>
<td>12.00%</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Guided activities</td>
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<td>0.00%</td>
<td></td>
<td></td>
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<tr>
<td>Self study</td>
<td></td>
<td>64.00%</td>
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</tbody>
</table>
## Content

### TEMA I - Structural Analysis

**Learning time:** 42h  
Theory classes: 18h  
Self study : 24h

**Description:**  
I. 1 Actions and structural safety  
I. 2 Global structural analysis  
I. 3 Moment distribution method or Cross Method. Application to plane frames. Symmetry and antimmetry  
I. 4 Matrix structural analysis. Application to 2D and 3D structures  
I. 5 Simplified calculation methods. Predimensioning, Trusses  
I. 6 Theory of plates and shells. Tanks. Pressure vessels  
I. 7 Using the finite element method

### TEMA II - Steel Structures

**Learning time:** 21h  
Theory classes: 9h  
Self study : 12h

**Description:**  
II. 1 Elements calculations. Beams. Columns. European buckling curves  
II. 2 Steel Connection Design

### TEMA III - Concrete Structures

**Learning time:** 21h  
Theory classes: 9h  
Self study : 12h

**Description:**  
III. 1 Basis of calculations. Theory of limit states.  
III. 3 Prestressed concrete and post-tensioned

### Case Study

**Learning time:** 24h  
Practical classes: 4h 30m  
Self study : 19h 30m

**Description:**  
Case Study I  
Case Study II
240EI016 - Theory of Structures

Qualification system

SE01. Final Written Exam. A multidisciplinary exercise with a formulae sheet for support
SE02. Case Study I and Case Study II. Both are mandatory.
The final mark will be the average of Final Exam and all the Case Study in the subject:
FINAL MARK = 50% SE01 + 50% SE02
The possibility to revaluate provided by ETSEIB during the month July is limited to Final Written Exam, i.e. the note SE02.

Regulations for carrying out activities

FINAL EXAM: Final Written Exam. A multidisciplinary exercise with a formulae sheet for support.
CASE STUDY: Team of 2 or 3 students. Oral defense of the projects from the teacher questions.

Bibliography

Basic:

Complementary:

Others resources:

Computer material
ESTRUWIN 3D
Software

FTool
Software