250120 - RESIMATEST - Strength of Materials and Structures

Coordinating unit: 250 - ETSECCPB - Barcelona School of Civil Engineering
Teaching unit: 751 - DECA - Department of Civil and Environmental Engineering
Academic year: 2018
Degree: BACHELOR’S DEGREE IN CIVIL ENGINEERING (Syllabus 2017). (Teaching unit Compulsory)
BACHELOR’S DEGREE IN CIVIL ENGINEERING (Syllabus 2010). (Teaching unit Compulsory)
ECTS credits: 9

Teaching staff
Coordinator: JUAN MIQUEL CANET, RICCARDO ROSSI
Others: GUILLERMO CASAS GONZÁLEZ, JUAN MIQUEL CANET, RICCARDO ROSSI

Opening hours
Timetable: Hours of students is as follows: Wednesday from 12 to 14 hours

Degree competences to which the subject contributes
Specific:
3026. Ability to analyse and understand how the characteristics of structures influence their behaviour. Ability to apply knowledge of the resistance dynamics of structures in order to dimension them in accordance with existing regulations using analytical and numerical calculation methods.
3027. Ability to calculate structures with interactive resistant mechanisms based on analytical and computational models approved by European Union regulations.
3038. Knowledge of the design, calculation, construction and maintenance of building works in regard to their structure, finishes, installations and equipment.

Transversal:
592. EFFICIENT ORAL AND WRITTEN COMMUNICATION - Level 2. Using strategies for preparing and giving oral presentations. Writing texts and documents whose content is coherent, well structured and free of spelling and grammatical errors.
596. TEAMWORK - Level 1. Working in a team and making positive contributions once the aims and group and individual responsibilities have been defined. Reaching joint decisions on the strategy to be followed.
599. EFFECTIVE USE OF INFORMATION RESOURCES - Level 3. Planning and using the information necessary for an academic assignment (a final thesis, for example) based on a critical appraisal of the information resources used.
602. SELF-DIRECTED LEARNING - Level 3. Applying the knowledge gained in completing a task according to its relevance and importance. Deciding how to carry out a task, the amount of time to be devoted to it and the most suitable information sources.
584. THIRD LANGUAGE. Learning a third language, preferably English, to a degree of oral and written fluency that fits in with the future needs of the graduates of each course.

Teaching methodology
The course consists of 6 hours per week of classes during a semester. Of these, about half belong to classes of theoretical developments, while the other half is in the resolution of practical exercises in applying the theory previously exposed. With a proposed weekly series of exercises that students must meet outside of class time and submit for assessment. ATENEA used as a communication tool with students notes, proposed exercises, training material, etc.

Learning objectives of the subject
250120 - RESIMATEST - Strength of Materials and Structures

Students will learn to analyse how the characteristics of structures influence structural behaviour. They will also develop the skills to solve structural behaviour problems in the structural design process.

Upon completion of the course, students will have acquired the ability to: 1. Find laws of stress and deformation in isostatic structures by means of analytical calculation methods. 2. Find laws of stress and deformation in hyperstatic structures by means of analytical calculation methods. 3. Find the stress distributions that generate the forces in a structure.

Fundamentals of strength of materials and structures (deformable solids, stress, motion and boundary conditions, deformation and Hooke’s law); Elastic behaviour; Determination of stress and displacement due to external forces; Laws of stress and deformation; Sectional behaviour and stresses derived from the forces acting on a section (axial, bending, shear and torsional); Energy theorems (virtual work, Castigliano, least work, Maxwell, etc.); Methods for solving standard forms (continuous beams, portal frames, arches)

Study load

<table>
<thead>
<tr>
<th>Total learning time: 225h</th>
<th>Hours large group: 48h</th>
<th>21.33%</th>
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<tbody>
<tr>
<td></td>
<td>Hours medium group: 32h</td>
<td>14.22%</td>
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<tr>
<td></td>
<td>Hours small group: 10h</td>
<td>4.44%</td>
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<tr>
<td></td>
<td>Guided activities: 9h</td>
<td>4.00%</td>
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<tr>
<td></td>
<td>Self study: 126h</td>
<td>56.00%</td>
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# Content

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

**Description:**

<table>
<thead>
<tr>
<th>Section</th>
<th>Learning time: 31h 12m</th>
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<tbody>
<tr>
<td><strong>Efforts Laws</strong></td>
<td>Practical classes: 11h</td>
</tr>
<tr>
<td></td>
<td>Laboratory classes: 2h</td>
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<tr>
<td></td>
<td>Self study : 18h 12m</td>
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**Description:**

<table>
<thead>
<tr>
<th>Section</th>
<th>Learning time: 7h 11m</th>
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<tbody>
<tr>
<td><strong>Axial force</strong></td>
<td>Theory classes: 2h</td>
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<tr>
<td></td>
<td>Practical classes: 1h</td>
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<tr>
<td></td>
<td>Self study : 4h 11m</td>
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**Description:**
Navier hypothesis. Stresses and strains. Movements. Mechanical deformations. Sections of different materials. Strain energy

<table>
<thead>
<tr>
<th>Section</th>
<th>Learning time: 19h 12m</th>
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<tbody>
<tr>
<td><strong>Bending moment</strong></td>
<td>Theory classes: 3h</td>
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<tr>
<td></td>
<td>Practical classes: 5h</td>
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<tr>
<td></td>
<td>Self study : 11h 12m</td>
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**Description:**

Problems
<table>
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<tr>
<th>Section</th>
<th>Learning time</th>
<th>Description</th>
</tr>
</thead>
</table>
| Shear                    | 26h 24m       | Theory classes: 4h  
Practical classes: 4h  
Laboratory classes: 3h  
Self study: 15h 24m  

**Description:**  
Shear center. Strain energy. Guests Section  
Activities aimed  
| Simple beams             | 19h 12m       | Theory classes: 4h  
Practical classes: 4h  
Self study: 11h 12m  

**Description:**  
Problems  
| Articulated structures   | 4h 48m        | Theory classes: 2h  
Self study: 2h 48m  

**Description:**  
| Strain energy            | 16h 48m       | Theory classes: 3h  
Practical classes: 3h  
Laboratory classes: 1h  
Self study: 9h 48m  

**Description:**  
Problems  

Continuous beams

**Description:**
Method of support: (i) Calculation of vertical reactions. Method of support: (ii) Theorem of the three moments
Movements of support. Stiffness method

**Learning time:** 4h 48m
- Theory classes: 2h
- Self study: 2h 48m

Porticoes and arches

**Description:**

**Learning time:** 79h 12m
- Theory classes: 14h
- Practical classes: 15h
- Laboratory classes: 4h
- Self study: 46h 12m

Qualification system

De forma continuada y en las fechas que se indica en la tabla se propondrán ejercicios. La entrega de los ejercicios es voluntaria. Dichos ejercicios deberán entregarse necesariamente a través de la Plataforma Atenea en los plazos indicados

Bajo las condiciones y en las fechas que indique la Escuela, a final de curso habrá un examen de re-evaluación. Los alumnos con nota final entre 4 y 5 que se presenten al examen de reevaluación no verán en ningún caso disminuída su nota, sea cual sea la nota obtenida en el examen de reevaluación

Regulations for carrying out activities

Attendance at all the various assessments is compulsory
Bibliography

Basic:


Complementary:


