250470 - ESTREDIF - Building 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 (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: English

Teaching staff
Coordinator: CLIMENT MOLINS BORRELL
Others: CLIMENT MOLINS BORRELL, LUCA PELA, PEDRO ROCA FABREGAT, VICENTE VILLALBA HERRERO

Opening hours
Timetable: To consult the teachers, students will be assisted in and out of class, if possible. Otherwise, they have to arrange an appointment with the teacher they want via email, on a schedule that is right for both.

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 1,8 hours per week of classroom activity (large size group) and 0,8 hours weekly with half the students (medium size group).

The 1,8 hours in the large size groups are devoted to theoretical lectures, in which the teacher presents the basic concepts and topics of the subject, shows examples and solves exercises.

The 0,8 hours in the medium size groups is devoted to solving practical problems with greater interaction with the students. The objective of these practical exercises is to consolidate the general and specific learning objectives.

The rest of weekly hours devoted to laboratory practice.

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.
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**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.

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

Study load
### Content

<table>
<thead>
<tr>
<th>Functions and systems of the building</th>
<th>Learning time: 7h 11m</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Theory classes: 3h</td>
</tr>
<tr>
<td></td>
<td>Self study: 4h 11m</td>
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</tbody>
</table>

**Description:**

**Specific objectives:**
Knowledge of the functions, elements and systems that make up the building. Knowledge of structural systems and subsystems to the horizontal and vertical actions, and the main elements involved.
Structural system: floor slabs

Learning time: 28h 47m
- Theory classes: 8h
- Practical classes: 4h
- Self study: 16h 47m

Description:

Specific objectives:
Building physics

**Description:**
The envelope of the building with different systems of closures and roofs with a combination of materials and thicknesses is studied. In particular, the energetic behavior is studied from the review of key concepts of thermodynamics. Analysis of the thermal resistance of walls and roofs and their hygrometric behavior. Prescriptions on such elements.

Thermal behavior example
Nature and effects of the action of fire. Levels of activity before the occurrence of fires. Characterization of the action "fire" and the response of buildings and their elements. Effects and response to fire of different materials and structural elements. Presentation of the protective conditions. General and simplified methods for testing the fire resistance of structures. Treatment and prescriptions set out in regulations. Retardant coatings. Division in the building sector and analysis of the conditions of evacuation of the building in case of fire

Practice developed in the classroom on the practical implementation of methods and normative criteria related to the verification of the fire resistance of structural elements of the building.

**Specific objectives:**
Review the basics of thermodynamics to study the energy performance of edificis. Capacity to apply different types of enclosures and covers for buildings. Knowledge of the code requirements and checking. Analyze the energy performance of buildings.
Understanding the effects of fires in buildings and levels and solutions that are applicable for protection.
Knowledge of the behavior of various structural materials resistant to fire. Presentation of the basic techniques of analysis of the buildings before the fire. Approach the conditions and requirements evacuació derived for the design of the building.
Demonstration of practical application of concepts and methods related to verification of the fire resistance of the structure of buildings.

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**Learning time:** 14h 23m
- Theory classes: 4h
- Practical classes: 2h
- Self study: 8h 23m
### Structural system: lateral stability

**Description:**

**Specific objectives:**
Discussion of the behavior of buildings against horizontal actions. Knowledge of various specific solutions to improve the capacity of the building facing horizontal actions and their use depending on the height of the building. Methods for calculating the structural system to horizontal actions. Knowledge and practical application of available methods for the analysis of structural systems based on simple walls of constant height. Analysis of the efficiency of different systems depending on the geometrical arrangement of the walls.

<table>
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<tbody>
<tr>
<td>Theory classes: 3h</td>
</tr>
<tr>
<td>Practical classes: 2h</td>
</tr>
<tr>
<td>Laboratory classes: 1h</td>
</tr>
<tr>
<td>Self study: 8h 23m</td>
</tr>
</tbody>
</table>

### Earthquake resistant design of buildings

**Description:**

Determination of the seismic action to be considered for the design and verification of a resistant building located in a certain area of seismicity. Determination of the seismic acceleration calculation based on the seismic zone, importance of building and ground. Determination of equivalent static seismic forces and the forces generated in the structure of the building. Selection of appropriate construction details.

**Specific objectives:**
Knowledge of the effects of earthquakes on structures and aspects to consider when designing a building earthquake resistant. Ability to check the earthquake resistance of a building structure. Demonstration of the practical application of the current earthquake resistant regulations for determining the seismic action to be considered in designing a building.

**Learning time: 21h 36m**

- Theory classes: 6h
- Practical classes: 3h
- Self study: 12h 36m
**Special Buildings**

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Practical classes: 2h</td>
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<tr>
<td>Laboratory classes: 1h</td>
</tr>
<tr>
<td>Self study: 4h 11m</td>
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**Description:**
In tall buildings and in buildings with some aspects that are unimportant in conventional buildings, acquire great importance. Such aspects as: the effect of natural frequencies of vibration on the dynamic behavior under the action of wind on tall buildings, importance of vertical transport, structural systems for buildings of great light and its main application.

**Specific objectives:**
Knowledge of the specific aspects of tall buildings or high light, which are different from conventional buildings.

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**Qualification system**

The mark of the course is obtained from the ratings of continuous assessment and their corresponding laboratories and/or classroom computers.

Continuous assessment consist in several activities, both individually and in group, of additive and training characteristics, carried out during the year (both in and out of the classroom).

The teachings of the laboratory grade is the average in such activities.

The evaluation tests consist of a part with questions about concepts associated with the learning objectives of the course with regard to knowledge or understanding, and a part with a set of application exercises.

**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.
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Bibliography

Basic:


Ministerio de Fomento. EHE-08: Instrucción para el proyecto y la ejecución del hormigón estructural.. Madrid, 2008.


