250250 - CONSINFRA - Maintenance of Infrastructures

Coordinating unit: 250 - ETSECCPB - Barcelona School of Civil Engineering
Teaching unit: 751 - DECA - Department of Civil and Environmental Engineering
Academic year: 2017
Degree: BACHELOR'S DEGREE IN PUBLIC WORKS ENGINEERING (Syllabus 2010). (Teaching unit Optional)
ECTS credits: 4,5
Teaching languages: Catalan, Spanish

Teaching staff

Coordinator: JOSE RODRIGO MIRO RECASENS
Others: RAMON BOTELLA NIETO, FRANCESC XAVIER MASSALLE PUIG, JOSE RODRIGO MIRO RECASENS

Degree competences to which the subject contributes

Specific:
3091. Ability to construct, conserve, dimension and design roads and the items comprising basic road provision
3092. Ability to construct and conserve railway lines with knowledge of the application of the specific technical regulations, differentiating the characteristics of the rolling stock

General:
3105. Students will learn to identify, formulate and solve a range of engineering problems. They will be expected to show initiative in interpreting and solving specific civil engineering problems and to demonstrate creativity and decision-making skills. Finally, students will develop creative and systematic strategies for analysing and solving problems.
3106. Students will learn to assess the complexity of the problems examined in the different subject areas, identify the key elements of the problem statement, and select the appropriate strategy for solving it. Once they have chosen a strategy, they will apply it and, if the desired solution is not reached, determine whether modifications are required. Students will use a range of methods and tools to determine whether their solution is correct or, at the very least, appropriate to the problem in question. More generally, students will be encouraged to consider the importance of creativity in science and technology.
3107. Students will learn to identify, model and analyse problems from open situations, consider alternative strategies for solving them, select the most appropriate solution on the basis of reasoned criteria, and consider a range of methods for validating their results. More generally, students will learn to work confidently with complex systems and to identify the interactions between their components.
3111. Students will learn to plan, design, manage and maintain systems suitable for use in civil engineering. They will develop a systematic approach to the complete life-cycle of a civil engineering infrastructure, system or service, which includes drafting and finalising project plans, identifying the basic materials and technologies required, making decisions, managing the different project activities, performing measurements, calculations and assessments, ensuring compliance with specifications, regulations and compulsory standards, evaluating the social and environmental impact of the processes and techniques used, and conducting economic analyses of human and material resources.
3112. Students will develop an understanding of the different functions of engineering, the processes involved in the life-cycle of a construction project, process or service, and the importance of systematising the design process. They will learn to identify and interpret the stages in preparing a product design specification (PDS), draft and optimise specifications and planning documents, and apply a systematic design process to the implementation and operation phases. Students will learn to write progress reports for a design process, use a range of project management tools and prepare final reports, and will be expected to show an awareness of the basic economic concepts associated with the product, process or service in question.
3113. Students will learn to identify user requirements, to draft definitions and specifications of the product, process or service in question, including a product design specification (PDS) document, and to follow industry-standard design management models. Students will be expected to show advanced knowledge of the steps involved in the
design, execution and operation phases and to use the knowledge and tools covered in each subject area to the
design and execution of their own projects. Finally, students will assess the impact of national, European and
international legislation applicable to engineering projects.

Transversal:

586. ENTREPRENEURSHIP AND INNOVATION - Level 2. Taking initiatives that give rise to opportunities and to new
products and solutions, doing so with a vision of process implementation and market understanding, and involving
others in projects that have to be carried out.
589. SUSTAINABILITY AND SOCIAL COMMITMENT - Level 2. Applying sustainability criteria and professional codes of
conduct in the design and assessment of technological solutions.
594. TEAMWORK - Level 3. Managing and making work groups effective. Resolving possible conflicts, valuing working
with others, assessing the effectiveness of a team and presenting the final results.
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 3 hours per week of classroom activity.

The 2.2 hours are devoted to theoretical lectures, in which the teacher presents the basic concepts and topics of the
subject, and the 0.6 hours are devoted to show examples and solves exercises (average).

The rest of weekly hours devoted to tests.

Support material in the form of a detailed teaching plan is provided using the virtual campus ATENEA: content, program
of assessment activities and conducted learning, literature.

Learning objectives of the subject

Study load

<table>
<thead>
<tr>
<th>Total learning time: 112h 30m</th>
<th>Theory classes: 29h</th>
<th>25.78%</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Practical classes: 9h</td>
<td>8.00%</td>
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<tr>
<td></td>
<td>Laboratory classes: 7h</td>
<td>6.22%</td>
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<td></td>
<td>Guided activities: 4h 30m</td>
<td>4.00%</td>
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<tr>
<td></td>
<td>Self study: 63h</td>
<td>56.00%</td>
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</tbody>
</table>
1. Presentation

**Learning time:** 2h 24m
- Laboratory classes: 1h
- Self study: 1h 24m

2. The road network

**Learning time:** 2h 24m
- Theory classes: 1h
- Self study: 1h 24m

**Description:**
The road network in Spain. Status and conservation needs.

**Specific objectives:**
Acquiring knowledge about:
The road network in Spain. Status and conservation needs.

3. Pavement condition

**Learning time:** 26h 24m
- Theory classes: 11h
- Self study: 15h 24m

**Description:**
Structural characteristics. Surface characteristics: adherence, noise, roughness, optical properties.
Damage mechanisms and agents. Pavement types and modes of distress. Catalogs damage.

**Specific objectives:**
Acquiring knowledge about:
Structural characteristics. Surface characteristics: adherence, noise, roughness, optical properties.
Acquiring knowledge about:
Damage mechanisms and agents. Pavement types and modes of distress. Catalogs damage.
Acquiring knowledge about:
### 4. Conservation techniques

<table>
<thead>
<tr>
<th><strong>Learning time:</strong> 40h 48m</th>
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<tbody>
<tr>
<td><strong>Theory classes:</strong> 6h</td>
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<tr>
<td><strong>Practical classes:</strong> 4h</td>
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<tr>
<td><strong>Laboratory classes:</strong> 7h</td>
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<tr>
<td><strong>Self study:</strong> 23h 48m</td>
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</table>

**Description:**
Routine maintenance. Surface rehabilitation
Structural reinforcement. Standard 6.3-IC "Rehabilitación de firmes".
Calculation of reinforcement thickness. Method IA. Method AASHO.

**Specific objectives:**
- Acquiring knowledge about:
  - Routine maintenance. Surface rehabilitation
  - Structural reinforcement. Standard 6.3-IC "Rehabilitación de firmes".
  - Calculation of reinforcement thickness. Method IA. Method AASHO.

### 5. Pavement Management Systems

<table>
<thead>
<tr>
<th><strong>Learning time:</strong> 16h 48m</th>
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<tbody>
<tr>
<td><strong>Theory classes:</strong> 5h</td>
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<tr>
<td><strong>Practical classes:</strong> 2h</td>
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<tr>
<td><strong>Self study:</strong> 9h 48m</td>
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</table>

**Description:**
HDM
Inventory. Comprehensive maintenance contracts. Management indicators.

**Specific objectives:**
- Acquiring knowledge about:
  - HDM
  - Inventory. Comprehensive maintenance contracts. Management indicators.
The course is divided into two parts: Road Structures and Road Signs. The final grade for the course will be the weighted average of both parts according to the following formula:

\[
\text{Final score} = 0.6 \times \text{Road Structures score} + 0.4 \times \text{Road Signs score}.
\]

Both scores will be based on a theoretical examination and a series of take-home works. To pass the course, the final grade should be greater than or equal to 5.

Criteria for re-evaluation qualification and eligibility: Students that failed the ordinary evaluation and have regularly attended all evaluation tests will have the opportunity of carrying out a re-evaluation test during the period specified in the academic calendar. Students who have already passed the test or were qualified as non-attending will not be admitted to the re-evaluation test. The maximum mark for the re-evaluation exam will be five over ten (5.0). The non-attendance of a student to the re-evaluation test, in the date specified, will not grant access to further re-evaluation tests. Students unable to attend any of the continuous assessment tests due to certifiable force majeure will be ensured extraordinary evaluation periods.

These tests must be authorized by the corresponding Head of Studies, at the request of the professor responsible for the course, and will be carried out within the corresponding academic period.

**Qualification system**

**Regulations for carrying out activities**

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

Basic:

