250130 - HIDHID - Hydraulics and Hydrology

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 CIVIL ENGINEERING (Syllabus 2010). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN CIVIL ENGINEERING (Syllabus 2017). (Teaching unit Compulsory)
ECTS credits: 9
Teaching languages: Catalan, Spanish

Teaching staff
Coordinator: JOSE DOLZ RIPOLLES
Others: ERNEST BLADE CASTELLET, JOSE DOLZ RIPOLLES, MARIA SOLEDAD ESTRELLA TORAL, MARTI SANCHEZ JUNY

Opening hours
Timetable: Tuesday and Thursday from 12 to 13:30 h.
Also in hours to be arranged.

Degree competences to which the subject contributes

Specific:
3033. Knowledge of hydrostatics and fluid mechanics and dynamics, and their application to hydraulics and hydrology.
Knowledge of the concepts and technical aspects of both pressure and free surface conduction systems.
3034. Students will acquire knowledge of hydrostatics and fluid mechanics and dynamics and the ability to design and dimension hydraulic works and plan and manage hydraulic resources.

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.
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Teaching methodology

The course consists of 3 hours per week of classroom activity (large size group) and 2 hours weekly with half the students (medium size group).

The 3 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 2 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.

Learning objectives of the subject

Students will acquire knowledge of concepts and technical aspects related to both pressurised and open channel flow systems. They will also learn to solve hydraulic engineering problems.

Upon completion of the course, students will have acquired the ability to: 1. Apply equations of fluid motion to engineering cases related to pressurised or open channel flow systems. 2. Solve problems related to pipe networks, including support elements such as fittings and valves. 3. Analyse open channel water flow in basic geometries or conditions.

History of hydraulic works; Characteristics of fluids: compressibility, viscosity, phase transitions and surface tension; Fluid statics; Equations of fluid motion and their application to ducted flow; Continuity, momentum and Bernoulli's trinomial; Turbulent motion and the Reynolds number; Permanent and variable flow in pipes, including the conservation of energy and pressure-drop analysis, as well as pumping systems; Permanent and variable flow in open channel flow systems and its application to the functioning of channels; Erodible channels; Dimensional analysis; Similarity law; Models; Basic concepts of surface hydrology; Basic concepts of aerodynamics

Study load

<table>
<thead>
<tr>
<th>Total learning time: 225h</th>
<th>Theory classes: 42h</th>
<th>18.67%</th>
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<tbody>
<tr>
<td></td>
<td>Practical classes: 34h</td>
<td>15.11%</td>
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<tr>
<td></td>
<td>Laboratory classes: 14h</td>
<td>6.22%</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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<tr>
<td>I. Introduction to the subject</td>
<td>Learning time: 16h 48m</td>
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<tr>
<td></td>
<td>Theory classes: 3h</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Practical classes: 3h</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Laboratory classes: 1h</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Self study: 9h 48m</td>
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</tbody>
</table>

**Description:**

Solving practical exercises previously proposed to students

<table>
<thead>
<tr>
<th>II. Hydrostatic</th>
<th>Learning time: 21h 36m</th>
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<tbody>
<tr>
<td></td>
<td>Theory classes: 4h</td>
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<tr>
<td></td>
<td>Practical classes: 5h</td>
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<td></td>
<td>Self study: 12h 36m</td>
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</tbody>
</table>

**Description:**

Solving practical exercises previously proposed to students

<table>
<thead>
<tr>
<th>III. Concepts and fundamental equations of fluid motion</th>
<th>Learning time: 24h</th>
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<tbody>
<tr>
<td></td>
<td>Theory classes: 6h</td>
</tr>
<tr>
<td></td>
<td>Practical classes: 3h</td>
</tr>
<tr>
<td></td>
<td>Laboratory classes: 1h</td>
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<tr>
<td></td>
<td>Self study: 14h</td>
</tr>
</tbody>
</table>

**Description:**
### IV. Steady free surface flow

**Learning time:** 88h 48m
- Theory classes: 19h
- Practical classes: 13h
- Laboratory classes: 5h
- Self study: 51h 48m

**Description:**
Resolution of previously proposed practical exercises to students.
Backwater curves: classification, boundary conditions and integration.
Solving practical exercises previously proposed to students
Solving practical exercises previously proposed to students
Analysis of a flow event by means of HECRAS model
General concepts. Threshold of movement: critical stress,

### V. Steady flow in pipes

**Learning time:** 28h 47m
- Theory classes: 6h
- Practical classes: 6h
- Self study: 16h 47m

**Description:**
Resolution of previously proposed practical exercises to students.

### VI. Introduction to physical models

**Learning time:** 7h 11m
- Theory classes: 3h
- Self study: 4h 11m

**Description:**
VII. Introduction to surface hydrology

**Description:**

**Learning time:** 28h 47m
- **Theory classes:** 6h
- **Practical classes:** 2h
- **Laboratory classes:** 4h
- **Self study:** 16h 47m

**Qualification system**
Approved if:

\[ 0.06 \times (T_1 + T_2 + T_3 + T_4 + P) + 0.25E_1 + 0.15E_2 + 0.3MG \]

is equal or higher than 5

where:
- \( T_1 \) is the qualification of test 1 (basic concepts and item I)
- \( T_2 \) is the qualification of test 2 (items II and III)
- \( T_3 \) is the qualification of test 3 (first part of item IV)
- \( T_4 \) is the qualification of test 4 (HECRAS theory)
- \( E_1 \) is the qualification of exam 1 (items I, II, III and IV)
- \( E_2 \) is the qualification of exam 2 (items V, VI and VII)
- \( P \) is the qualification of the practical exercise of flow in canals
- \( MG \) is the geometric mean of \( E_1 \) and \( E_2 \)

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.

**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:


C. Gutiérrez. Apuntes de Hidráulica. A Atenea,