# 250220 - HIDRCOND - Hydraulics

**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 PUBLIC WORKS ENGINEERING (Syllabus 2010). (Teaching unit Compulsory)  
**ECTS credits:** 9  
**Teaching languages:** Catalan

## Teaching staff

**Coordinator:** MARTI SANCHEZ JUNY  
**Others:** MARIA SOLEDAD ESTRELLA TORAL, MARTI SANCHEZ JUNY

## Opening hours

**Timetable:** From Thursday to Thursday from 12 a.m. to 1:30 p.m.

## Degree competences to which the subject contributes

### Specific:

- **3076.** Knowledge of the concepts and technical aspects of both pressure and free surface conduction systems  
- **3077.** Knowledge of the basic concepts of surface and underground hydrology.  
- **3087.** Knowledge of and ability to design and dimension hydraulic works and facilities, energy systems and the harnessing of hydroelectric energy, and plan and manage surface and underground hydraulic resources  
- **3090.** Knowledge and understanding of supply and treatment systems, and of how to dimension, construct and conserve them

### 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.
250220 - HIDRCOND - Hydraulics

Teaching methodology

The subject consists of 3 hours a week of attend classes, the professor exposes some concepts and basic materials, he presents examples and he realizes some exercises. 1 hour a week is used to solve practical exercises. A good interaction between students and the professor is expected. The students can consult notes, discuss the exercises with the classmates, etc. The teacher follows the work of the students; he answers questions about the resolution. The teacher collects the exercises to correct and evaluate them. After evaluation terms of reference are delivered to the students by the result across Atenea

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 basic 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.

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

Study load

<table>
<thead>
<tr>
<th>Total learning time: 225h</th>
<th>Theory classes: 39h</th>
<th>17.33%</th>
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<tbody>
<tr>
<td></td>
<td>Practical classes: 31h</td>
<td>13.78%</td>
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<tr>
<td></td>
<td>Laboratory classes: 20h</td>
<td>8.89%</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>Item 1 Mechanical properties of fluids</th>
<th>Learning time: 12h</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Theory classes: 3h</td>
</tr>
<tr>
<td></td>
<td>Practical classes: 2h</td>
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<tr>
<td></td>
<td>Self study: 7h</td>
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</tbody>
</table>

**Description:**

**Exercises**

<table>
<thead>
<tr>
<th>Item 2 Hydrostatics</th>
<th>Learning time: 21h 36m</th>
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<tbody>
<tr>
<td></td>
<td>Theory classes: 4h</td>
</tr>
<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>
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**Description:**

**Exercises**

<table>
<thead>
<tr>
<th>Item 3 Concepts and fundamental equations in movement of fluids</th>
<th>Learning time: 26h 24m</th>
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<tbody>
<tr>
<td></td>
<td>Theory classes: 6h</td>
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<tr>
<td></td>
<td>Practical classes: 3h</td>
</tr>
<tr>
<td></td>
<td>Laboratory classes: 2h</td>
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<td>Self study: 15h 24m</td>
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**Description:**

**Exercises**
## Item 4 Flow in pipelines

<table>
<thead>
<tr>
<th>Learning time: 43h 12m</th>
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<tbody>
<tr>
<td>Theory classes: 10h</td>
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<tr>
<td>Practical classes: 6h</td>
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<tr>
<td>Laboratory classes: 2h</td>
</tr>
<tr>
<td>Self study: 25h 12m</td>
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</tbody>
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**Description:**
- Exercises
  - Introduction to unsteady flow in pipelines. Waterhammer in pipelines due to instant valve closure. Periodic waves, pressure wave and depression wave.
- Exercises

## Item 5 Open channel flow

<table>
<thead>
<tr>
<th>Learning time: 88h 48m</th>
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<tbody>
<tr>
<td>Theory classes: 18h</td>
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<tr>
<td>Practical classes: 13h</td>
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<tr>
<td>Laboratory classes: 6h</td>
</tr>
<tr>
<td>Self study: 51h 48m</td>
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**Description:**
- Introduction to the open channel flow. Classification of open channel flow in relation with time and space. Geometric parameters of the channels, main hydraulic variables of the flow, definition of Froude number. Steady uniform flow.
- Calculation of the capacity for a cross section, coefficient of Manning. Canalization.
- Specific energy. Critical regime. Control section. Hydraulic jump
- Exercises
  - Back water curves: classification, boundary conditions and integration.
- Exercises
- Exercises
  - Introduction to the main applications of the HECRAS open channel flow model
- Hydrograph concept. Equations of Saint-Venant,
### Topic 6 Introduction to physical models

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

**Description:**  
Dimensions. Pi theorem. Dimensionless numbers in hydraulics. Meaning of Froude number and Reynolds number. Theory of similarity, Froude similarity. Scale effects

### Item 7 Surface Hydrology

**Learning time:** 16h 48m  
Theory classes: 5h  
Laboratory classes: 2h  
Self study: 9h 48m

**Description:**  
The qualification of the subject is obtained based on the continuous assessment qualification. The continuous evaluation consists of doing different activities, individual and group, of an additive and formative nature, carried out during the course (inside and outside the classroom).

The evaluation tests consist of questions about concepts associated with the learning objectives of the subject in terms of knowledge or understanding, and a set of application exercises. The final grade (NF) is the weighted average between the periodic evaluation exercises (NA), the exercises and related activities during the class sessions (NC) and the course work (NT). The final grade is obtained by doing:

\[ NF = 0.6 \cdot NA + 0.3 \cdot NC + 0.2 \cdot NT \]

The student may renounce the continuous assessment process or by writing to the responsible lecturer at the beginning of the course or by the No attendance to 20% of NC activities. In this case, the NF of the subject will be calculated by doing:

\[ NF = 0.9 \cdot NA + 0.1 \cdot NT \]

Qualification and admission criteria for reassessment: Students suspended for regular assessment that have been regularly presented in the tests Assessment of the suspended subject will have the option to carry out a reassessment test during the period set in the academic calendar. Students who have already passed the qualification as not yet presented may not be submitted to the re-evaluation test of a subject. The maximum qualification in the case of submitting to the re-evaluation exam will be five (5.0). The non-attendance of a student summoned to the test of re-evaluation, celebrated in the fixed period will not be able to give rise to the accomplishment of another test with later date. Extraordinary assessments will be made for students who have not been able to carry out any of the continuous assessment tests due to their accredited force majeure. These tests must be authorized by the corresponding head of studies, at the request of the professor responsible for the subject, and will be carried out within the corresponding teaching period.

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

Basic:


Complementary:


