250256 - INSTASSOH - Instrumentation and Testing in Hydraulic Works

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 Optional)
ECTS credits: 4,5
Teaching languages: Spanish

Degree competences to which the subject contributes

Specific:
3090. Knowledge and understanding of supply and treatment systems, and of how to dimension, construct and conserve them

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 1.8 hours per week of classroom activity (large size group) and 0.5 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 0.5 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**

---

**Study load**

<table>
<thead>
<tr>
<th>Total learning time: 112h 30m</th>
<th>Theory classes: 22h</th>
<th>19.56%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Practical classes: 9h</td>
<td></td>
<td>8.00%</td>
</tr>
<tr>
<td>Laboratory classes: 14h</td>
<td></td>
<td>12.44%</td>
</tr>
<tr>
<td>Guided activities: 4h 30m</td>
<td></td>
<td>4.00%</td>
</tr>
<tr>
<td>Self study: 63h</td>
<td></td>
<td>56.00%</td>
</tr>
</tbody>
</table>
## Content

### Pressure Sensors

**Description:**
- Water Column (barometer, piezometer, piezometer water column, the column of mercury differential manometer, inclined manometer)
- Mechanical: (Bourdon tube, diaphragm, spring).
- Electro-Mechanical
- Electronics (gauges, piezoresistiu, ceramic. Piezoelectric, piezoelectric effect, capacitive)
- Differences between relative and absolute pressure sensor, operation and use.

**Learning time:** 7h 11m
- Theory classes: 2h
- Laboratory classes: 1h
- Self study: 4h 11m

### Level Sensors - draft

**Description:**
- Difference between level and depth
- Ruler limnimètric.
- Recording stage gauges (mechanical hand, mail).
- Recording stage gauges tire.
- Sensors wells level (level sensors)
- Ultrasonic sensors (temperature compensation, bar)
- Rada sensors.

**Learning time:** 7h 11m
- Theory classes: 2h
- Laboratory classes: 1h
- Self study: 4h 11m
# Speed sensors

**Learning time:** 7h 11m  
- Theory classes: 2h  
- Laboratory classes: 1h  
- Self study: 4h 11m

**Description:**  
- Pitot tube  
- Pinwheel (operation, equations grinder)  
- Ultrasound (Cross as the liquid sheet and interest-free installation and piping)  
- Ultrasonic (Doppler effect, on pipes, limitations)  
- Electromagnetic (Faraday's law, used in pipes and sheet free, limitations).  
- Grinders with Doppler and electromagnetic.  
- Hot thread and temperature differences.  
- Vortex Effect  
- Laser.

# Flow sensors

**Learning time:** 14h 23m  
- Theory classes: 4h  
- Laboratory classes: 2h  
- Self study: 8h 23m

**Description:**  
- Rotâmeter (rotâmeters with spring).  
- Turbins.  
- Accountants (Wollman, turbine).  
- Flowmeters (venturi meter, diaphragms, nozzles)

- Weirs  
- Pared thick.  
- Flumes, (Parshall).  
- Current meter gauging.  
- Gauging, Limnigrama hydrograph.  
- Chemical injection.
Measurements of water quality, meteorològiueques. Data Collection

Learning time: 7h 11m
Theory classes: 2h
Laboratory classes: 1h
Self study: 4h 11m

Description:
Water Quality Measures:
- Mostradors.
- Probes
Measurements of precipitation:
- Rain gauges (siphon, single bowl, bowls)
- Radar
Meteorològiueques Measures:
- Relative humidity.
- Temperature-friendly.
- Wind (direction, speed).
- Solar radiation.
Data Collection:
- Datalogger, Computer.
- Telemetry and control systems (telephone, radio, satellite)
- Ways of collecting data.
  - Basic scheme of a measuring station.

Hydraulic Valves

Learning time: 7h 11m
Theory classes: 2h
Laboratory classes: 1h
Self study: 4h 11m

Description:
Opening-closing, regulation, air purge, against sobrepressions, retention, reducing pressure.
# 250256 - INSTASSOH - Instrumentation and Testing in Hydraulic Works

## Hydraulic pumps

**Description:**
- Peristaltic pumps,
- Centrifugal pumps (horizontal, submersible, axial flow)
- Vertical
- Specials

**Learning time:** 14h 23m
- Theory classes: 2h
- Laboratory classes: 4h
- Self study: 8h 23m

## Instrumentation channels

**Description:**
Explanation, expansion of theme

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

## Instrumentation in dams

**Description:**
- Types of dams
- Variables to be measured (deformations, stresses, pressures,....)
- Inverted Pendulum
- Sliding micrometer
- Pendulum Live
- Extensiômetres
- Oscillatory phenomena
### Practices

<table>
<thead>
<tr>
<th>Learning time: 21h 36m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Practical classes: 9h</td>
</tr>
<tr>
<td>Self study : 12h 36m</td>
</tr>
</tbody>
</table>

**Description:**
- Theoretical explanation of the practice.
- Calculation of a coefficient of drain tank
- Capacity of a channel
- Differential equation for calculating the drain of a stock
- Hydraulic laboratory practice.
- Calculation of a coefficient of drain tank
- Practice laboratory
- Seating is on a channel

### Review

<table>
<thead>
<tr>
<th>Learning time: 7h 11m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laboratory classes: 3h</td>
</tr>
<tr>
<td>Self study : 4h 11m</td>
</tr>
</tbody>
</table>
The students in this course should be divided into groups of 2 or 3 people, according to the number of students enrolled for the course. Each group should jointly make the following tasks:

I. Oral presentation of the subject matter (20 to 30 minutes).
II. Laboratory.
III. Work - Report of the laboratory results and of a project instrumentation.
IV. Oral presentation of the results and the project.

The course consists of two parts:

a) Theory classes consist of:

I. Short written test (10-15 min.) On the topic in class before.
II. Presentation on the subject by the student group is required.
III. "Explanation - Extension - Correction" by the teacher of the presentation made by students.

b) Practical classes consist of:

I. Two practices laboratory projects (in the morning) with subsequent presentation of the report.
II. Project implementation: this involves a project on the measurement of some variable water in a river, canal, pipe, etc.. The measurement may be based on reality or totally invented. Should seek information from the group and define brand and model of the sensor or sensors and the reason for their choice.
The work should be chosen as a project could be presented as a quote to a potential customer.

To pass the course must have a Final grade:

Final grade = (grade classes + grade practice) / 2  >= 5.0

Class grade: There will be the average of:

I. Average rating of the tests made at the beginning of the class.
II. Oral presentation of the topic.
III. Grading the final exam that will be the last day of class.

Practical grade: There will be the arithmetic mean:

I. Half of the work - reports of two projects over the project.
II. Oral presentation of the two jobs and the project.

The grades of work done by the group which will correspond to each of its components. In the case of detecting a group with very marked differences among members, could be described differently in each one of them.

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.

**Bibliography**

**Basic:**


