250257 - AIGPROVEIM - Water Supply

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, English

Degree competences to which the subject contributes

Specific:
3089. Knowledge of the design of urban services and utilities to do with water distribution and sewage treatment

Generical:
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 for lectures.

Theoretical lectures, supported by audio visual equipment, and practical lectures where problems will be solved in groups to encourage students' participation.

Support material (such as evaluation activities' timetable and literature) is provided using the virtual campus ATENEA.

**Learning objectives of the subject**

Familiaritzar l'alumne amb els fonaments científics i principis tècnics de l'abastament d'aigües, des de la captació fins a la distribució. S'incideix especialment en els processos de tractament destinats a millorar la qualitat de l'aigua. Familiarizar al alumno con los fundamentos científicos y principios técnicos del abastecimiento de aguas, desde la captación hasta la distribución. Se incide especialmente en los procesos de tratamiento destinados a mejorar la calidad del agua. To know scientific and technical principles of water supply. Most of the course is devoted to treatment processes to improve water quality.

**Study load**

<table>
<thead>
<tr>
<th><strong>Total learning time:</strong> 112h 30m</th>
<th>Hours large group: 24h 21.33%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hours medium group: 9h 8.00%</td>
</tr>
<tr>
<td></td>
<td>Hours small group: 12h 10.67%</td>
</tr>
<tr>
<td></td>
<td>Guided activities: 4h 30m 4.00%</td>
</tr>
<tr>
<td></td>
<td>Self study: 63h 56.00%</td>
</tr>
</tbody>
</table>
### Content

<table>
<thead>
<tr>
<th>Water quality</th>
<th><strong>Learning time:</strong> 9h 36m</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description:</strong> Basics on water quality parameters. National and European rules and regulations on water cycle (Water Framework Directive (2000/60 / EC), RD 140/2003). An overview on all phases for water management and treatment, from catchment to distribution. The urban water cycle. An overview on all processes to treat water in a drinking water treatment plant.</td>
<td></td>
</tr>
<tr>
<td><strong>Specific objectives:</strong> To know the basics about quality, management and treatment of water supply.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Water flows and water demand</th>
<th><strong>Learning time:</strong> 4h 48m</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Specific objectives:</strong> To understand concepts related to water demand estimation.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Catchment and pre-treatment</th>
<th><strong>Learning time:</strong> 2h 24m</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description:</strong> Basic principles. Catchments of surface and groundwater. Main stages for pre-treatment.</td>
<td></td>
</tr>
<tr>
<td><strong>Specific objectives:</strong> To understand concepts related to water catchments and pre-treatment in a drinking water treatment plant.</td>
<td></td>
</tr>
</tbody>
</table>
### Coagulation and flocculation

**Description:**
Coagulation-flocculation: basic principles, reactors and energy intake. The effect and adding polyelectrolyte. The jar test, the optimal dose of coagulant. Coagulation-flocculation reactors. Design of coagulation-flocculation systems.

**Specific objectives:**
To understand the concepts related to coagulation-flocculation processes. To develop the ability to identify and solve problems related to coagulation and flocculation system design.

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

### Sedimentation

**Description:**

**Specific objectives:**
To understand concepts related to gravity separation. To develop capacity to identify, formulate and solve problems related to the design of a gravity separation system.

**Learning time:** 9h 36m
- Theory classes: 2h
- Practical classes: 2h
- Self study: 5h 36m

### Granular media filtration

**Description:**

**Specific objectives:**
To understand concepts related to filtration. To develop capacities to identify, formulate and solve problems for the calculation of pressure drop in filtration systems.

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

### Description:

### Specific objectives:
To understand concepts related to activated carbon filtration.
To develop capacity to identify, formulate and solve problems for filter design and calculation of adsorption isotherms.

### Learning time:
9h 36m
- Theory classes: 2h
- Practical classes: 2h
- Self study: 5h 36m

## Disinfection

### Description:
Disinfection methods: advantages and disadvantages.
Kinetics of disinfection (Chick-Watson law and the model c x t). Disinfection tanks: construction and operational aspects.
Ozone disinfection: advantages and technical requirements.
Exerciceses on chlorine needs and kinetic model for chlorine disinfection.

### Specific objectives:
To understand concepts related to water disinfection.
To develop capacities to identify, formulate and solve problems for calculating the concentration/dose of disinfectant or contact time.

### Learning time:
9h 36m
- Theory classes: 3h
- Practical classes: 1h
- Self study: 5h 36m
## Sludge treatment and management

**Learning time:** 4h 48m  
Theory classes: 2h  
Self study: 2h 48m

**Description:**  
Basic principles. Origin and composition of sludge generated in a drinking water treatment plant. Pre-treatment, thickening and dewatering.

**Specific objectives:**  
To understand concepts related to sludge treatment and management.

## Softening

**Learning time:** 9h 36m  
Theory classes: 2h  
Practical classes: 2h  
Self study: 5h 36m

**Description:**  
Calculation of lime and soda needs for softening.

**Specific objectives:**  
To understand concepts related to water softening.  
To develop capacity to identify, formulate and solve problems for calculating soda and lime needs.

## Desalination

**Learning time:** 4h 48m  
Theory classes: 2h  
Self study: 2h 48m

**Description:**  

**Specific objectives:**  
To understand concepts related to water desalination.  
To develop skills to identify guidelines for the proper management of brackish water in a desalination plant.
# Water Supply System Management

**Description:**
Basic principles. Types of networks, types of tanks. Applications. Managing a water supply system: basic concept. Rate and bills in the metropolitan area of Barcelona.

**Specific objectives:**
To understand concepts related to water supply management and distribution networks.

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

---

# Design and Operation of a Drinking Water Treatment Plant

**Description:**
Design of a drinking water treatment plant. Application of the concepts acquired during the course.

**Specific objectives:**
To understand concepts related to the design of drinking water treatment plants

**Learning time:**
- Theory classes: 2h
- Self study: 2h 48m

---

# Technical Visit

**Description:**
Technical visit to a drinking water treatment plant

**Learning time:**
- Laboratory classes: 4h
- Self study: 5h 36m

---

# Evaluation

**Description:**
Two evaluation tests including both theoretical and practical questions (40% + 60% of the final mark) on concepts related to the objectives of the course.

**Specific objectives:**
To assess the knowledge acquired by the student during the course.

**Learning time:**
- Laboratory classes: 5h
- Self study: 7h
Qualification system

The final mark is obtained considering the continuous assessment.

Continuous assessment consists of several activities, both individually and in group, carried out during the year. Activities will account for 20% of the final mark.

Evaluation tests include two exams with both theoretical and practical questions (40% + 60% of final mark) about concepts associated with the learning objectives of the course. Tests will account for 80% of the final mark.

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:


Complementary: