250236 - TECNAMB - Environmental Technology

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: 4,5  Teaching languages: Catalan, Spanish

Teaching staff
Coordinator: IVET FERRER MARTI
Others: IVET FERRER MARTI, JOAN GARCIA SERRANO, ENRICA UGGETTI

Opening hours
Timetable: Appointments may be fixed by e-mail or during the lectures.

Degree competences to which the subject contributes

Specific:
3086. Knowledge and understanding of supply and treatment systems, and how to dimension, construct and conserve them
3088. Knowledge and understanding of the functioning of ecosystems and environmental factors
3089. Knowledge of the design of urban services and utilities to do with water distribution and sewage treatment
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
Students will acquire an understanding of water-supply and sanitation systems, as well as the design, construction and preservation of sewage treatment plants.

Upon completion of the course, students will have acquired the ability to: 1. Carry out a water quality analysis that includes chemical and biological factors. 2. Analyse the cycle of a sewage treatment plant. 3. Analyse the cycle of a water purification plant.

Basic concepts of ecology and ecosystems; Microbial growth kinetics; Microbiological water quality; Chemistry and biogeochemical cycles: nitrogen, phosphorus, carbon, and sulphur. BOD5 and COD. Environmental management: water quality assessment, environmental impact, limnology and biological diversity; Water purification: disinfection and fluoridation; Sewage treatment (urban and industrial), sanitation networks, basic and secondary sewage treatment processes, activated sludge; Sludge digestion: physical-chemical methods, lagooning and decentralised sanitation; Marine outfalls and the reuse of sewage and sludge
Knowledge and understanding of the main treatment systems of drinkable water, wastewater and municipal solid waste.

### Study load

<table>
<thead>
<tr>
<th></th>
<th>Total learning time: 112h 30m</th>
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<tbody>
<tr>
<td>Hours large group:</td>
<td>23h</td>
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<tr>
<td>Hours medium group:</td>
<td>14h</td>
</tr>
<tr>
<td>Hours small group:</td>
<td>8h</td>
</tr>
<tr>
<td>Guided activities:</td>
<td>4h 30m</td>
</tr>
<tr>
<td>Self study:</td>
<td>63h</td>
</tr>
</tbody>
</table>

- Hours large group: 23h (20.44%)
- Hours medium group: 14h (12.44%)
- Hours small group: 8h (7.11%)
- Guided activities: 4h 30m (4.00%)
- Self study: 63h (56.00%)
# Content

## Presentation

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

**Description:**  
Presentation of the course

## 1. Water quality assessment

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

**Description:**  
Urban water circuit  
Sampling and preservation of samples  
Mass emission rate  
Inhabitant equivalent  

**Specific objectives:**  
To describe the urban water circuit  
To explain the process of sampling and preservation of samples  
To define the concepts of mass emission rate and inhabitant equivalent

## 2. Water characterization

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

**Description:**  
Composition of water  
Physico-chemical water quality  
Microbiological water quality  

**Specific objectives:**  
To describe the typical composition of different water sources  
To define the main physico-chemical and microbiological water quality parameters
# 3. Drinkable water treatment

**Learning time:** 16h 48m  
Theory classes: 3h  
Practical classes: 4h  
Self study: 9h 48m

| Description: |  
|---|---|---|---|---|
| Standards for water supply |  
| Distribution networks |  
| Objectives of drinkable water treatment processes |  
| Coagulation and flocculation |  
| Applying the theory of reactors in the coagulation-flocculation |  
| Exercises on coagulation-flocculation |  
| Sedimentation |  
| Granular media filtration |  
| Adsorption |  
| Exercises on coagulation-flocculation, sedimentation and filtration |  

**Specific objectives:**
- To list water supply quality standards
- To describe the distribution networks
- To explain the processes of coagulation and floculació
- To apply the theory of reactors in the coagulation-flocculation
- To solve exercises on coagulation-flocculation
- To describe the process of sedimentation
- To compare the filtration in slow and fast granular media filters
- To explain the role of active carbon adsorption
- To solve exercises on the processes of coagulation-flocculation, sedimentation and filtration
4. Water disinfection

**Description:**
- Importance of disinfection
- Chlorination
- Disinfection with ozone
- Disinfection with UV

- Applying the theory reactors to water disinfection
- Exercises on water disinfection

**Specific objectives:**
- To compare the main methods of water disinfection
- To describe the process of breakpoint chlorination

- Applying the theory of the disinfection reactors
- Solving exercises in water disinfection

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

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5. Desalination of water

**Description:**
- Filtration membranes
- Reverse Osmosis
- Desalination plants

**Specific objectives:**
- To define the process of reverse osmosis
- To describe the treatment line of a desalination plant

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

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**Evaluation**

**Learning time:** 14h 23m
- Laboratory classes: 6h
- Self study: 8h 23m
### 6. Wastewater treatment

**Description:**
- Regulation of wastewater
- Sanitation networks
- Theory of wastewater treatment
- Pretreatment
- Utfalls
- Primary treatment
- Secondary treatment
- Tertiary treatment
- Outfalls
- Kinetics of microbial growth
- Application of microbial kinetics in a CSTR with and without recirculation
- Exercises on activated sludge systems

**Specific objectives:**
- To list the wastewater regulations
- To describe the processes used on wastewater pretreatment, primary treatment, secondary treatment and tertiary treatment
- To apply a microbial kinetics in a CSTR with and without recirculation
- To solve exercises on activated sludge systems

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

### 7. Sludge treatment

**Description:**
- Characteristics of sludge
- Thickening
- Dewatering
- Anaerobic Digestion
- Final Destination of sludge
- Exercises of sludge treatment systems

**Specific objectives:**
- To define the main characteristics of sludge
- To describe the process of thickening, dewatering and anaerobic digestion of sludge
- To solve exercises on sludge treatment systems

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

<table>
<thead>
<tr>
<th>Description:</th>
<th>Technical visit to a water or solid waste treatment plant</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Specific objectives:</strong></td>
<td>To describe water and municipal solid waste treatment processes</td>
</tr>
</tbody>
</table>

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

### 8. Municipal solid waste management and treatment

| Description: | Composting  
Anaerobic digestion  
Incineration  
Landfills  
Exercises on municipal solid waste treatment  
Incineration  
Landfilling |
|--------------|----------------------------------------------------------|
| **Specific objectives:** | To describe municipal solid waste composting, anaerobic digestion and incineration  
To compare the processes of composting and anaerobic digestion  
To describe the life cycle of landfills  
To solve exercises on municipal solid waste treatment  
To describe the process of incineration of municipal solid waste  
To describe the life cycle of landfills |

<table>
<thead>
<tr>
<th>Learning time:</th>
<th>19h 12m</th>
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</thead>
<tbody>
<tr>
<td>Theory classes:</td>
<td>6h</td>
</tr>
<tr>
<td>Practical classes:</td>
<td>2h</td>
</tr>
<tr>
<td>Self study:</td>
<td>11h 12m</td>
</tr>
</tbody>
</table>
The grade for the course is obtained from continuous assessment activities and exams. Continuous assessment includes activities such as exercises and a technical visit (30% of the grade for the course). Exams consist of theoretical questions with exercises. There are two exams (35% of the grade for the course each).

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 continuous assessment activity in the scheduled period will result in a mark of zero in that activity. To have access to the re-evaluation the minimum mark is 4.

**Bibliography**

**Basic:**

**Complementary:**
