Degree competences to which the subject contributes

Specific:

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

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 3 hours per week of classroom activity
2 hours per week are devoted to theoretical lectures, in which the teacher presents the basic concepts and topics of the subject, shows examples and solves exercises.
1 hour per week 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.
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 an understanding of environmental engineering, ecosystem functioning and environmental factors.
Hydrology pathway
Specialised knowledge of basic environmental-engineering concepts covered in an earlier subject on water technologies.

Study load

<table>
<thead>
<tr>
<th>Total learning time: 112h 30m</th>
<th>Theory classes:</th>
<th>27h</th>
<th>24.00%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Practical classes:</td>
<td>12h</td>
<td>10.67%</td>
<td></td>
</tr>
<tr>
<td>Laboratory classes:</td>
<td>6h</td>
<td>5.33%</td>
<td></td>
</tr>
<tr>
<td>Guided activities:</td>
<td>4h 30m</td>
<td>4.00%</td>
<td></td>
</tr>
<tr>
<td>Self study:</td>
<td>63h</td>
<td>56.00%</td>
<td></td>
</tr>
</tbody>
</table>

## Content

<table>
<thead>
<tr>
<th><strong>Autonomous treatment</strong></th>
<th><strong>Learning time:</strong> 7h 11m</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Theory classes: 2h</td>
</tr>
<tr>
<td></td>
<td>Practical classes: 1h</td>
</tr>
<tr>
<td></td>
<td>Self study: 4h 11m</td>
</tr>
</tbody>
</table>

**Description:**
Teoretical and practical basis of descentralized treatment systems.
Problems on septic tank design

**Specific objectives:**
- Adquire the basis for septic tank design
- Design of a septic tank

<table>
<thead>
<tr>
<th><strong>General basis</strong></th>
<th><strong>Learning time:</strong> 7h 11m</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Theory classes: 2h</td>
</tr>
<tr>
<td></td>
<td>Practical classes: 1h</td>
</tr>
<tr>
<td></td>
<td>Self study: 4h 11m</td>
</tr>
</tbody>
</table>

**Description:**
General basis of sanitary engineering
Flow assessment

**Specific objectives:**
- Learn general basis of sanitary engineering
- Calculate maximum and average flow rate

<table>
<thead>
<tr>
<th><strong>Sewer design</strong></th>
<th><strong>Learning time:</strong> 7h 11m</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Theory classes: 2h</td>
</tr>
<tr>
<td></td>
<td>Practical classes: 1h</td>
</tr>
<tr>
<td></td>
<td>Self study: 4h 11m</td>
</tr>
</tbody>
</table>

**Description:**
Basis on the sewarage design
Exercises on sewarage design

**Specific objectives:**
- Adquire basic concepts on the sewarage design
- Basic knowledge on sewarage design
## Secondary treatment

**Learning time:** 28h 47m  
Theory classes: 9h  
Practical classes: 3h  
Self study: 16h 47m

### Description:
Operationa concepts and design criteria for activated sludge systems  
Exercises on activated sludge systems

### Specific objectives:
Adquire the operation and design concepts of activated sludge systems  
Design an activated sludge system from a mass balance basis

## Oxygen consumption

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

### Description:
COD mass balance within the biological reactor in order to calculate the oxygen consumption  
Exercise to calculate the oxygen consumption within the biological reactor

### Specific objectives:
Apply the mass balance concept to COD in order to determine the oxygen consumption within the biological reactor  
Learn how to calculate the oxygen consumption within the biological reactor

## Biological nitrogen removal

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

### Description:
Concepts and design parameters to address nitrogen removal within biological reactors  
Calculate the biological nitrogen removal

### Specific objectives:
Learn the concepts and design parameters to address nitrogen removal within biological reactors  
Learn how to calculate the biological nitrogen removal
### Phosphorus removal

**Description:**
Basis on the biological and chemical phosphorus removal in activated sludge systems
Calculate biological phosphorus removal

**Specific objectives:**
- Learn the basis on the biological and chemical phosphorus removal in activated sludge systems
- Learn the process of how to calculate biological phosphorus removal

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

### Treatment wetlands design

**Description:**
Theory and concepts on the treatment wetlands design
Exercises on treatment wetlands design

**Specific objectives:**
- Learn theory and concepts on the treatment wetlands design
- Know how to address exercises on treatment wetlands design

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

### Evaluation

**Learning time:** 14h 23m
- Laboratory classes: 6h
- Self study: 8h 23m
Qualification system

Grades for the course are obtained from continuous assessment and final examination. Continuous assessment consists of a work and its public defense (40% of final the mark) and a partial examination. The partial test consists of two parts that need to be approved independently (some theory and some problems). The test part is not mandatory but those parts approved are excluded from the final exam. The structure of the final exam is the same as the partial exam.

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: