Course guide
250659 - CARGESTCA - Characterization, Management and Treatment of Water Pollution

Unit in charge: Barcelona School of Civil Engineering
Teaching unit: 751 - DECA - Department of Civil and Environmental Engineering.
Degree: MASTER'S DEGREE IN ENVIRONMENTAL ENGINEERING (Syllabus 2014). (Compulsory subject).
Academic year: 2022 ECTS Credits: 5.0 Languages: Spanish

LECTURER
Coordinating lecturer: MARTIN GULLON SANTOS
Others: MARTIN GULLON SANTOS

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
13340. Apply scientific concepts to environmental problems and their correlation with technological concepts.
13343. Identify, define and propose technological management and appropriate solution to an environmental problem.
13344. Dimension conventional treatment systems and raise their mass balance and energy.

Transversal:
8562. EFFECTIVE USE OF INFORMATION RESOURCES: Managing the acquisition, structuring, analysis and display of data and information in the chosen area of specialisation and critically assessing the results obtained.
8563. FOREIGN LANGUAGE: Achieving a level of spoken and written proficiency in a foreign language, preferably English, that meets the needs of the profession and the labour market.

TEACHING METHODOLOGY

The subject consists of 3.0 hours per week of classroom lessons in the classroom.

They are devoted to theoretical classes, 17.0 hours, in which the teacher exposes the concepts and basic materials of the subject, presents examples and carries out exercises.

9.0 hours are spent solving problems with a greater interaction with the students.

Practical exercises are carried out in order to consolidate the general and specific learning objectives. The rest of the weekly hours is dedicated to laboratory practices and a visit to a plant.

Support material is used in the format of a detailed teaching plan through the ATENEA virtual campus: contents, programming of assessment activities and directed learning and bibliography.

Although most of the sessions will be given in the language indicated, sessions supported by other occasional guest experts may be held in other languages.
LEARNING OBJECTIVES OF THE SUBJECT

CE01 - Apply scientific concepts to environmental problems and their correlation with technological concepts.
CE04 - Identify, define and propose technological management and appropriate solution to an environmental problem.
CE05 - Dimension conventional treatment systems and raise their mass balance and energy.

Explore scientific concepts and technical principles of quality management of the receiving environments, atmosphere, water and soil.
Explore scientific concepts and technical principles of management and treatment of gaseous emissions, water supply, sewage and waste and remediation techniques for groundwater and contaminated soils.
Sized systems for the treatment of major pollutants vectors.
Interprets rules, identifies goals, evaluates alternative techniques, proposes appropriate solutions and prioritize actions.

Parameters of water quality: Criteria and standards; Water supply and sewage; Sampling techniques. Simple and compound samples, flow measurement; physicochemical parameters and biological characterization and analytical techniques.
Pretreatment: Grids and sieves; Desanders and fat separation, regulation of flows and loads.
Sedimentation and flotation: Types of sedimentation; general theory of sedimentation of particles in a fluid; zonal Decanting. Kynch Theory of sedimentation based on a single batch experiment method, based on the solids flow analysis method; Constructional features of decanters; flotation separation systems.
Coagulation and flocculation: Stability of colloids and mechanisms of destabilization; Coagulants and associated reactions, chemical precipitation of phosphorus and constructive aspects of implementation.
Filtration and membrane processes: granular media filtration; Rating filtration systems, pressure drop and minimum fluidization velocity, classification and description of membrane processes.
Ion exchange.
Adsorption and disinfection: Sizing of a team of activated carbon; disinfection. Physical and chemical disinfectants, germicidal efficiency of chlorine. Dosing to the breaking point.
Suspended aerobic biological processes of biomass: activated sludge process, material balance, oxygen requirement; Aeration. Systems and efficiencies, design criteria and operational characteristics. Classification systems; Sizing activated sludge system. Aerobic processes of fixed biomass: trickling filters, submerged filters and bio-discs, characterization and design of trickling filters.
Anaerobic biological processes without biomass retention: Material Balance and classification systems, anaerobic contact reactor, activity assays, biodegradability and toxicity; Characterization of facilities and energy use of gas.
Anaerobic biological process with biomass retention Reactor anaerobic filter; sludge bed reactor, fluidized bed reactor.
Biological nutrient reduction: Plants nitrification, denitrification plants, combined nitrification - denitrification systems, plants for biological phosphorus reduction.
Impoundment and other systems: aerobic lagoons, facultative and anaerobic; treatment systems for small communities, natural treatment systems.

STUDY LOAD

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<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Hours medium group</td>
<td>10,0</td>
<td>8.00</td>
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<tr>
<td>Hours small group</td>
<td>10,0</td>
<td>8.00</td>
</tr>
<tr>
<td>Self study</td>
<td>80,0</td>
<td>64.00</td>
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<tr>
<td>Hours large group</td>
<td>15,0</td>
<td>12.00</td>
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<tr>
<td>Guided activities</td>
<td>10,0</td>
<td>8.00</td>
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Total learning time: 125 h
<table>
<thead>
<tr>
<th>CONTENTS</th>
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<tbody>
<tr>
<td><strong>Management of these water resources</strong></td>
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</tbody>
</table>
| **Description:**
| Basics.
| Influence of water treatment in integrated management. |
| **Full-or-part-time:** 7h 11m |
| Theory classes: 3h |
| Self study : 4h 11m |

| **Flow characteristics and water supply and wastewater** |
| **Description:**
| Water flows.
| Microbiological quality parameters.
| Physicochemical quality parameters. |
| **Full-or-part-time:** 14h 23m |
| Theory classes: 6h |
| Self study : 8h 23m |

| **Pretreatment and sedimentation** |
| **Description:**
| Pretreatment processes.
| Basics of sedimentation.
| Design of primary treatment. |
| **Full-or-part-time:** 7h 11m |
| Theory classes: 1h |
| Practical classes: 2h |
| Self study : 4h 11m |

| **Biological treatment. Facilities activated sludge** |
| **Description:**
| Kinetics of microbial growth.
| Facilities activated sludge.
| Type of activated sludge.
| Design of activated sludge. |
| **Full-or-part-time:** 9h 36m |
| Theory classes: 2h |
| Practical classes: 2h |
| Self study : 5h 36m |
## Drainage study: septic tanks and Imhoff tanks

**Description:**
- Independent Sanitation.
- Septic tanks and Imhoff tanks. Design.

**Full-or-part-time:** 4h 48m
- Theory classes: 1h
- Practical classes: 1h
- Self study: 2h 48m

## Lagoons and rotating biological contactor (RBC)

**Description:**
- Basic concepts.
- Type of lagoons.
- Types of RBC
- Design.

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

## Reclaimed water

**Description:**
- Basics.

**Full-or-part-time:** 4h 48m
- Theory classes: 2h
- Self study: 2h 48m

## Treatment and disposal of sludge

**Description:**
- Characteristics of sludge.
- Thickening.
- Dehydration.
- Anaerobic digestion.
- Final Destination sludge.
- Design.

**Full-or-part-time:** 7h 11m
- Theory classes: 1h
- Practical classes: 2h
- Self study: 4h 11m
**Treatment plant project**

**Description:**
Basic concepts
Visit

**Full-or-part-time:** 14h 23m
Laboratory classes: 6h
Self study : 8h 23m

**Evaluation**

**Full-or-part-time:** 7h 11m
Laboratory classes: 3h
Self study : 4h 11m

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**GRADING SYSTEM**

The mark of the course is obtained from the ratings of continuous assessment and their corresponding laboratories and/or classroom computers.

Continuous assessment consist in several activities, both individually and in group, of additive and training characteristics, carried out during the year (both in and out of the classroom).

The teachings of the laboratory grade is the average in such activities.

The evaluation tests consist of a part with questions about concepts associated with the learning objectives of the course with regard to knowledge or understanding, and a part with a set of application exercises.

Final Mark = 0,65 * Final Test + 0,20 * Test + 0,15 * Assessments

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**EXAMINATION RULES.**

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

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**BIBLIOGRAPHY**

**Basic:**

**Complementary:**