250659 - CARDESTCA - Characterization, Management and Treatment of Water Pollution

Coordinating unit: 250 - ETSECCPB - Barcelona School of Civil Engineering
Teaching unit: 751 - DECA - Department of Civil and Environmental Engineering
Academic year: 2015
Degree: MASTER'S DEGREE IN ENVIRONMENTAL ENGINEERING (Syllabus 2014). (Teaching unit Compulsory)
ECTS credits: 5

Teaching staff:
Coordinator: MARTIN GULLON SANTOS
Others: JOSE LUIS CORTINA PALLAS, MARTIN GULLON SANTOS

Opening hours:
Timetable:
- Martín Gullón
  Monday from 16:30 to 18:00.
  email: martin.gullon@upc.edu

- Jose Luis Cortina
  Friday i Thursday, de 15:00 a 18:00 and Wednesday de 12:00 a 13:30
  e-mail: jose.luis.cortina@upc.edu

Teaching methodology:
The course consists of 3,0 hours of classes a week in the classroom.

Lectures are devoted to 25.0 hours, when the teacher explains the concepts and basic raw materials, presents examples and exercises.

5.0 hours engaged in solving problems with greater interaction with students. Practical exercises are conducted in order to consolidate the learning objectives and general specifics.

The other weekly hours dedicated to practice laboratori.

It uses material support in the form of detailed syllabus through campus ATENEA: content programming and evaluation activities directed learning and literature.

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, gemicidal 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**

<table>
<thead>
<tr>
<th>Total learning time: 125h</th>
<th>Theory classes: 15h</th>
<th>12.00%</th>
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<tbody>
<tr>
<td></td>
<td>Practical classes: 10h</td>
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<tr>
<td></td>
<td>Laboratory classes: 10h</td>
<td>8.00%</td>
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<td></td>
<td>Guided activities: 10h</td>
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<td></td>
<td>Self study: 80h</td>
<td>64.00%</td>
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## Content

<table>
<thead>
<tr>
<th>Management of these water resources</th>
<th>Learning time: 7h 11m</th>
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<tbody>
<tr>
<td><strong>Description:</strong></td>
<td></td>
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<tr>
<td>Basics.</td>
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<td>Influence of water treatment in integrated management</td>
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<table>
<thead>
<tr>
<th>Flow characteristics and water supply and wastewater</th>
<th>Learning time: 14h 23m</th>
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<tbody>
<tr>
<td><strong>Description:</strong></td>
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<tr>
<td>Water flows.</td>
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<tr>
<td>Microbiological quality parameters.</td>
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<tr>
<td>Physicochemical quality parameters.</td>
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<table>
<thead>
<tr>
<th>Pretreatment and sedimentation</th>
<th>Learning time: 7h 11m</th>
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<tbody>
<tr>
<td><strong>Description:</strong></td>
<td></td>
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<tr>
<td>Pretreatment processes.</td>
<td></td>
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<tr>
<td>Basics of sedimentation.</td>
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<tr>
<td>Design of primary treatment</td>
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<table>
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<tr>
<th>Biological treatment. Facilities activated sludge</th>
<th>Learning time: 9h 36m</th>
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<tbody>
<tr>
<td><strong>Description:</strong></td>
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<tr>
<td>Kinetics of microbial growth.</td>
<td></td>
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<tr>
<td>Facilities activated sludge.</td>
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<tr>
<td>Type of activated sludge</td>
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<tr>
<td>Design of activated sludge</td>
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</table>
# Drainage study: septic tanks and Imhoff tanks

**Learning time:** 4h 48m  
Theory classes: 1h  
Practical classes: 1h  
Self study: 2h 48m

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

## Lagoons and wetlands

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

**Description:**  
Basic concepts.  
Type of lagoons.  
Types of wetlands.  
Design

## Treatment and disposal of sludge

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

**Description:**  
Characteristics of sludge.  
Thickening.  
Dehydration.  
Anaerobic digestion  
Final Destination sludge  
Design
## Reclaimed water

**Description:**
Basics.
Legislation.
Treatment Processes.

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

## Management of environmental impacts: odoriferous nuisance, mud and discharge

**Description:**
Basics

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

## Monitoring of wastewater treatment

**Description:**
Basics

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

## Monitoring of drinking water treatment and quality distribution networks

**Description:**
Basics

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

## Evaluation

**Learning time:** 7h 11m
- Laboratory classes: 3h
- Self study: 4h 11m
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 = 0,80 * Final Test + 0,10 * Test + 0,20 * Assessments

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