Learning objectives of the subject

CE01 - Apply scientific concepts to environmental problems and their correlation with technological concepts. CE08-Dimension unconventional systems and advanced treatment and raise their mass balance and energy.

Explore scientific concepts and technical principles of quality management of the receiving means, atmosphere, water and soil, and applied to problem solving. 
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 in specific sectors of activity.
Interprets rules, identifies goals, assesses technical alternatives proposed unconventional solutions and priority actions.


Familiarizing students with the scientific basis and technical principles of the water supply. Special attention is paid on treatment processes aimed at improving water quality.
### Study load

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

<table>
<thead>
<tr>
<th>Area</th>
<th>Learning time: 4h 48m</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Introduction on water quality, treatment and supply</strong></td>
<td>Theory classes: 2h</td>
</tr>
<tr>
<td></td>
<td>Self study: 2h 48m</td>
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</tbody>
</table>

**Description:**
Water quality parameters. National and European legislation and regulations on the water cycle.

**Specific objectives:**
To know the basics about drinking water quality, management and treatment.

<table>
<thead>
<tr>
<th>Area</th>
<th>Learning time: 2h 24m</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Water demand</strong></td>
<td>Theory classes: 1h</td>
</tr>
<tr>
<td></td>
<td>Self study: 1h 24m</td>
</tr>
</tbody>
</table>

**Description:**

**Specific objectives:**
To understand concepts related to water demand estimation.

<table>
<thead>
<tr>
<th>Area</th>
<th>Learning time: 12h</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Coagulation-flocculation</strong></td>
<td>Theory classes: 3h</td>
</tr>
<tr>
<td></td>
<td>Practical classes: 2h</td>
</tr>
<tr>
<td></td>
<td>Self study: 7h</td>
</tr>
</tbody>
</table>

**Description:**
Coagulation-flocculation: basic principles, reagents, reactors used and energy intake. Polyelectrolytes. Jar test. Design of coagulation-flocculation systems

**Specific objectives:**
To understand concepts related to the process of coagulation-flocculation
To develop the ability to identify and solve problems related to coagulation and flocculation system design.
<table>
<thead>
<tr>
<th>Gravity separation</th>
<th>Learning time: 9h 36m</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description:</strong></td>
<td></td>
</tr>
<tr>
<td>Basic principles, types of sedimentation basins, settling velocity, sludge cleaning and removal. Hazen's postulates. Surface loading rate. Strategies to improve gravity separation. Design of sedimentation basins</td>
<td></td>
</tr>
<tr>
<td><strong>Specific objectives:</strong></td>
<td></td>
</tr>
<tr>
<td>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.</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Filtration</th>
<th>Learning time: 7h 11m</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description:</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Specific objectives:</strong></td>
<td></td>
</tr>
<tr>
<td>To understand concepts related to filtration. To develop capacities to identify, formulate and solve problems for the calculation of pressure drop in filtration systems.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Adsorption. Activated carbon filters</th>
<th>Learning time: 4h 48m</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description:</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Specific objectives:</strong></td>
<td></td>
</tr>
<tr>
<td>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.</td>
<td></td>
</tr>
</tbody>
</table>
### Disinfection

**Description:**
Exercises on 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:** 12h
- Theory classes: 3h
- Practical classes: 2h
- Self study: 7h

### Sludge treatment and management

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

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

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

### Softening

**Description:**

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

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

**Description:**

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

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

### Catchment and pre-treatment

**Description:**

**Specific objectives:**
To understand concepts related to water catchments and pre-treatment in a drinking water treatment plant.

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

### Water distribution networks

**Description:**

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

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

### Design of a drinking water treatment plant

**Description:**
Design of a drinking water treatment plant.

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

**Learning time:** 4h 48m
- Practical classes: 2h
- Self study: 2h 48m
The mark of the course is obtained from the continuous assessment. Continuous assessment consist in several activities, both individually and in group carried out during the year (both in and out of the classroom).

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.

If student do not perform an evaluation activity in the scheduled period the mark will be zero.

### Bibliography

**Basic:**


**Complementary:**