The purpose of this course is to provide an introduction to the analysis and design of chemical processes applied to industrial engineering. The fundamentals of the unit operations involved in the industrial sector are provided, allowing students to perform basic engineering and design of industrial processes. The main goal is to provide students with:
- Knowledge and skills to analyze, plan and design chemical processes.
- Knowledge and skills to perform verification and control facilities of chemical processes.

Degree competences to which the subject contributes

Specific:
1. Capacity for analysis and design of chemical processes.
2. Knowledge and skills to perform verification and control facilities, processes and products.

Teaching methodology

- Lectures presenting the subject content.
- Sessions of applied work.
- Independent learning and exercises solving by the students.

In lectures teachers introduce fundamentals of the subject, concepts and methods, illustrated with suitable examples to facilitate their understanding.

The practical sessions involve the following activities: experimental practices in laboratory use of a process simulator and facilities visit.

Learning objectives of the subject

The purpose of this course is to provide an introduction to the analysis and design of chemical processes applied to industrial engineering. The fundamentals of the unit operations involved in the industrial sector are provided, allowing students to perform basic engineering and design of industrial processes.
### Study load

<table>
<thead>
<tr>
<th>Total learning time: 125h</th>
<th>Hours large group:</th>
<th>30h</th>
<th>24.00%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hours medium group:</td>
<td>0h</td>
<td>0.00%</td>
</tr>
<tr>
<td></td>
<td>Hours small group:</td>
<td>15h</td>
<td>12.00%</td>
</tr>
<tr>
<td></td>
<td>Guided activities:</td>
<td>0h</td>
<td>0.00%</td>
</tr>
<tr>
<td></td>
<td>Self study:</td>
<td>80h</td>
<td>64.00%</td>
</tr>
</tbody>
</table>
## Content

<table>
<thead>
<tr>
<th>1. Introduction to processes and unit operations</th>
<th>Learning time: 8h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description: Fundamentals and classification of unit operations. Physical unit operations controlled by momentum transfer. Physical unit operations controlled by energy transfer. Physical unit operations controlled by mass transfer.</td>
<td>Theory classes: 4h</td>
</tr>
<tr>
<td></td>
<td>Self study: 4h</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2. Coagulation and flocculation</th>
<th>Learning time: 20h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description: Classification of solid particles in water. Colloidal structure. Fundamentals of colloidal destabilization. Chemicals used in the flocculation and coagulation. Flocculation technology. Application to water treatment and facilities design.</td>
<td>Theory classes: 4h</td>
</tr>
<tr>
<td>Related activities: Laboratory work about coagulation wastewater: Destabilization by adsorption and charge neutralization. Zeta potential determination of colloidal particles. Destabilization by precipitation with metal coagulants; destabilization by adsorption and bridge formation between particles with different types of flocculants.</td>
<td>Laboratory classes: 2h</td>
</tr>
<tr>
<td></td>
<td>Self study: 14h</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3. Sedimentation</th>
<th>Learning time: 12h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description: Sedimentation fundamentals. Gravity sedimentation. Sedimentation technology. Centrifugal sedimentation. Basic skills for facilities design: Application to water treatment.</td>
<td>Theory classes: 4h</td>
</tr>
<tr>
<td></td>
<td>Self study: 8h</td>
</tr>
</tbody>
</table>
4. Flotation

**Description:**

**Related activities:**
Laboratory work about selective flotation I: Application to deinking of printed paper by using a laboratory flotation cell.

Laboratory work about selective flotation II: Deinking process evaluation by optical spectrophotometric technique.

5. Filtration and Membrane separation processes

**Description:**


**Related activities:**
Laboratory work: evaluation of water treatment process using membrane technology and ion exchange. Determining hardness, conductivity and other characteristics of water.

6. Simultaneous transmission of energy and matter

**Description:**
7. Chemical Reactors

**Learning time:** 37h  
Theory classes: 6h  
Laboratory classes: 7h  
Self study: 24h

**Description:**  

**Related activities:**  
Laboratory work about chemical reaction: Application to the delignification of cellulosic material.

Application in a CADSIM process simulator: Learning to use the simulator and case studies.

**Qualification system**

The final grade depends on the following evaluative acts:  
- Activity 1 (attendance at practice sessions and delivery of practical session reports): 20%  
- Activity 2 (proposals for questions related to course topics by students): 10%  
- Activity 3 (midterm exam): 35%  
- Activity 4 (final exam): 35%

The unsatisfactory result in the midterm exam (Activity 3) may be redirected by a written test on the day set for the final exam (Activity 4). Students who didn’t assist at the midterm exam (Activity 3) or with a grade lower than 5.0 in the midterm exam (Activity 3) can access this test. The grade obtained in the redirected test will replace the initial grade as long as it is higher.
220210 - Analysis and Design of Chemical Processes

Bibliography

Basic:

Professors de l’assignatura. Apunts lliurats pel professorat.

Complementary:


