220210 - Analysis and Design of Chemical Processes

Coordinating unit: 205 - ESEIAAT - Terrassa School of Industrial, Aerospace and Audiovisual Engineering
Teaching unit: 714 - ETP - Department of Textile and Paper Engineering
Academic year: 2018
Degree: MASTER'S DEGREE IN INDUSTRIAL ENGINEERING (Syllabus 2013). (Teaching unit Compulsory)
ECTS credits: 5
Teaching languages: Catalan, Spanish

Teaching staff
Coordinator: ANTONIO LUIS TORRES LOPEZ
Others: MARIA BLANCA RONCERO VIVERO
Galea Martinez, Silvia
CUSOLA AUMEDES, ORIOL
VALLS VIDAL, CRISTINA

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.

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.
# 220210 - Analysis and Design of Chemical Processes

## Study load

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

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Description</th>
<th>Learning time</th>
<th>Theory classes</th>
<th>Laboratory classes</th>
<th>Self study</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. <strong>Introduction to processes and unit operations</strong></td>
<td>Introduction. 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><strong>8h</strong></td>
<td>4h</td>
<td></td>
<td>4h</td>
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<tr>
<td>2. <strong>Coagulation and flocculation</strong></td>
<td>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><strong>20h</strong></td>
<td>4h</td>
<td>2h</td>
<td>14h</td>
</tr>
<tr>
<td>3. <strong>Sedimentation</strong></td>
<td>Sedimentation fundamentals. Gravity sedimentation. Sedimentation technology. Centrifugal sedimentation. Basic skills for facilities design: Application to water treatment.</td>
<td><strong>12h</strong></td>
<td>4h</td>
<td></td>
<td>8h</td>
</tr>
</tbody>
</table>
### 4. Flotation

**Learning time:** 19h  
Theory classes: 4h  
Laboratory classes: 4h  
Self study : 11h

**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

**Learning time:** 17h  
Theory classes: 4h  
Laboratory classes: 2h  
Self study : 11h

**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

**Learning time:** 12h  
Theory classes: 4h  
Self study : 8h

**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.

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**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.
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Bibliography

Basic:

Professors de l’assignatura. Apunts lliurats pel professorat.

Complementary:


