220210 - Analysis and Design of Chemical Processes

Coordinating unit: 205 - ESEIAAT - Terrassa School of Industrial, Aerospace and Audiovisual Engineering
Teaching unit: 717 - EGE - Department of Engineering Presentation
Academic year: 2019
Degree: MASTER'S DEGREE IN INDUSTRIAL ENGINEERING (Syllabus 2013). (Teaching unit Compulsory)
ECTS credits: 5
Teaching languages: Catalan, Spanish

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 staff

Coordinator: Cusola Aumedes, Oriol
Roncer Vivero, Maria Blanca

Others: Galea Martinez, Silvia
CUSOLA AUMEDES, ORIOL
VALLS VIDAL, CRISTINA

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 and the use of a process simulator.

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.
## Study load

<table>
<thead>
<tr>
<th></th>
<th>Hours large group:</th>
<th>Hours medium group:</th>
<th>Hours small group:</th>
<th>Guided activities:</th>
<th>Self study:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total learning time:</strong> 125h</td>
<td>30h</td>
<td>0h</td>
<td>15h</td>
<td>0h</td>
<td>80h</td>
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<tr>
<td></td>
<td>24.00%</td>
<td>0.00%</td>
<td>12.00%</td>
<td>0.00%</td>
<td>64.00%</td>
</tr>
</tbody>
</table>
# 220210 - Analysis and Design of Chemical Processes

## Content

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

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

### 5. Filtration and Membrane separation processes

**Description:**


**Learning time:** 15h
- Theory classes: 4h
- Self study: 11h

### 6. Simultaneous transmission of energy and matter

**Description:**

**Learning time:** 12h
- Theory classes: 4h
- Self study: 8h
The final grade depends on the following evaluative acts:

- Activity 1 (attendance to the practical sessions, delivery of the experimental practical reports, and one evaluative session of the knowledge acquired with the process simulator): 30%
- Activity 2 (midterm exam): 35%
- Activity 3 (final exam): 35%

The practical sessions will be done exclusively on the days established by the School without any possibility to do them in another day.

The unsatisfactory result in the midterm exam (Activity 2) may be redirected by a written test on the day set for the final exam (Activity 3). Students who didn't assist at the midterm exam (Activity 2) or with a grade lower than 5.0 in the midterm exam (Activity 2) can access this test. The grade obtained in the redirected test will replace the initial grade as long as it is higher.

### Qualification system

**7. Chemical Reactors**

<table>
<thead>
<tr>
<th>Learning time: 39h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory classes: 6h</td>
</tr>
<tr>
<td>Laboratory classes: 9h</td>
</tr>
<tr>
<td>Self study: 24h</td>
</tr>
</tbody>
</table>

**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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**Chemical Reactors**

Learning time: 39h

- Theory classes: 6h
- Laboratory classes: 9h
- 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.
Bibliography

Basic:

Professors de l’assignatura. Presentacions de classe a ATENEA.

Complementary:


