240655 - Basic Operations in the Chemical Industry

Coordinating unit: 240 - ETSEIB - Barcelona School of Industrial Engineering
Teaching unit: 713 - EQ - Department of Chemical Engineering
Academic year: 2017
Degree: BACHELOR'S DEGREE IN INDUSTRIAL TECHNOLOGY ENGINEERING (Syllabus 2010). (Teaching unit Optional)
ECTS credits: 4.5  
Teaching languages: Catalan, Spanish

Teaching staff
Coordinator: Perez Gonzalez, Juan Jesus
Others: Arnaldos Viger, Josep

Prior skills
Basic knowledge on thermodynamics. Mass balances.

Teaching methodology
Lectures and numerical applications.

Learning objectives of the subject
Ability to understand and apply basic principles of general chemistry, organic and inorganic chemistry and their applications in engineering.
Apply knowledge of mathematics, physics, chemistry, biology and other natural sciences, obtained through study, experience and practice using critical reasoning to establish workable solutions to technical problems.
Ability to design and analysis of chemical processes.
Integrate easily interdisciplinary and creative technical team of any company in the chemical industry or research center.
Design products, processes, systems and services for the chemical industry, as well as the optimization of those already developed on the basis of technological various areas of chemical engineering, comprehensive processes and transport phenomena, separation operations and engineering of chemical reactions, nuclear, electrochemical and biochemical.
Knowledge of mass and energy balances, biotechnology, mass transfer, separation operations, chemical reaction engineering, reactor design, and recovery of raw materials and energy resources.
Integrate easily indiscipline and creative technical team of any company in the chemical industry or research center.

Study load

<table>
<thead>
<tr>
<th>Total learning time: 112h 30m</th>
<th>Hours medium group: 45h 40.00%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self study: 67h 30m</td>
<td>60.00%</td>
</tr>
</tbody>
</table>
# Content

## Chemical potential

<table>
<thead>
<tr>
<th>Description:</th>
<th>The concept of chemical potential. Ideal gases, ideal gas mixtures. Real gases.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Related activities:</td>
<td>Lectures and exercises.</td>
</tr>
<tr>
<td>Specific objectives:</td>
<td>Tackling the study of open systems. Understand the concept of chemical potential.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Learning time:</th>
<th>4h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Practical classes:</td>
<td>4h</td>
</tr>
</tbody>
</table>

## One component phase equilibria

<table>
<thead>
<tr>
<th>Description:</th>
<th>Chemical potential of a liquid. Description of the vapor-liquid equilibrium. The Clausius-Clapeyron equation. The rule of phases.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Related activities:</td>
<td>Lectures and exercises</td>
</tr>
<tr>
<td>Specific objectives:</td>
<td>Using the concept of chemical potential to describe the phase equilibrium in one component systems.</td>
</tr>
</tbody>
</table>

<table>
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<tr>
<th>Learning time:</th>
<th>4h</th>
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<tr>
<td>Practical classes:</td>
<td>4h</td>
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</tbody>
</table>

## Solutions

<table>
<thead>
<tr>
<th>Description:</th>
<th>Chemical potential of an ideal solution. Raoult’s law. Colligatives properties.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Related activities:</td>
<td>Lectures and exercises</td>
</tr>
<tr>
<td>Specific objectives:</td>
<td>Applying the concept of chemical potential to describe ideal solutions. Description of property coligatives</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Learning time:</th>
<th>4h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory classes:</td>
<td>4h</td>
</tr>
</tbody>
</table>
### Vapor-liquid equilibrium in systems of more than one component

**Description:**
Vapor-liquid equilibrium in systems of more than one component. Vapor-liquid equilibrium in real systems of more than one component. Azeotropes.

**Related activities:**
- lectures and exercises

**Specific objectives:**
- Describe the vapor-liquid equilibrium in ideal and real systems of more than one component.

**Learning time:** 6h
- Theory classes: 6h

### Filtration

**Description:**
Description of the process. Darcy law. Types of filtration.

**Related activities:**
- Lectures and exercises

**Specific objectives:**
- Describe the process of filtration. Derive the equations of the process.

**Learning time:** 3h 30m
- Theory classes: 3h 30m

### Centrifugation

**Description:**
Description of the process. Equations that describe the process.

**Related activities:**
- Lectures and exercises.

**Specific objectives:**
- To familiarize students with the process of centrifugation. Derive the equations that describe it.

**Learning time:** 3h 30m
- Theory classes: 3h 30m
### 240655 - Basic Operations in the Chemical Industry

| **distillation** | **Learning time:** 8h  
| Theory classes: 8h |
| **Description:**  
Equip.  
| **Related activities:**  
Lectures and exercises.  
| **Specific objectives:**  
Describe the process of distillation. Equations that describe the process. |

| **Gas absorption** | **Learning time:** 8h  
| Theory classes: 8h |
| **Description:**  
Gas-liquid equilibrium. Absorption equilibrium stages. Absorption continuous contact with the phases of mass transfer rate, the number of transfer units, transfer unit height, mass transfer coefficients. Calculation and design of columns filling.  
| **Related activities:**  
Lectures and exercises.  
| **Specific objectives:**  
Describe the process of absorption of gases. Equations that describe regulate the process. |

| **Solid-liquid extraction** | **Learning time:** 4h  
| Theory classes: 4h |
| **Description:**  
| **Related activities:**  
Lectures and exercises.  
| **Specific objectives:**  
Describe qualitatively and quantitatively the solid-liquid extraction process. |
Qualification system

Mark = 0,25*AC + 0,25*EP + 0,5*EF  
AC = continuous evaluation  
EP = partial exam  
EF = final exam

Bibliography

Basic:


