240EQ211 - Equipment and Facilities Design

Coordinating unit: 295 - EEBE - Barcelona East School of Engineering
Teaching unit: 713 - EQ - Department of Chemical Engineering
Academic year: 2017
Degree: MASTER'S DEGREE IN CHEMICAL ENGINEERING (Syllabus 2012). (Teaching unit Optional)
MASTER'S DEGREE IN CHEMICAL ENGINEERING (Syllabus 2012). (Teaching unit Optional)
ECTS credits: 6
Teaching languages: Catalan, Spanish

Teaching staff
Coordinator: JOSE IGNACIO IRIBARREN LACO
Others: ELAINE ARMELIN DIGGROC

Requirements
Basics knowledges in chemical and chemical engineering

Degree competences to which the subject contributes

Specific:
1. Designing products, processes, systems and services for the chemical industry as well as the optimization of other already developed technology based on various areas of chemical engineering, understanding of processes and transport phenomena, separation operations and engineering chemical reactions, nuclear, electrochemical and biochemical.
2. The student will be able to analyze the economic feasibility of a chemical engineering project.

General:
3. Communicate and discuss proposals and conclusions in forums multilingual, skilled and unskilled, in a clear and unambiguous.
4. Lead and define multidisciplinary teams capable of solving technical and management needs changes in national and international contexts.
5. Possess independent learning skills to maintain and enhance the competencies of chemical engineering to enable the continued development of their profession.

Teaching methodology
Learning based in expositive lessons by using the resources available in Atenea campus and cooperative learning in practice sessions oriented to exercises resolution.

Learning objectives of the subject
Apply the knowledge of mathematics and electrochemistry to study the phenomenon of corrosion.
Comparison of different types of corrosion with the existent in chemical industry
Design equipment and installations with efficiency and economy criteria
# Study load

<table>
<thead>
<tr>
<th>Total learning time: 150h</th>
<th>Hours large group:</th>
<th>45h</th>
<th>30.00%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hours medium group:</td>
<td>0h</td>
<td>0.00%</td>
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<tr>
<td></td>
<td>Hours small group:</td>
<td>9h</td>
<td>6.00%</td>
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<tr>
<td></td>
<td>Guided activities:</td>
<td>0h</td>
<td>0.00%</td>
</tr>
<tr>
<td></td>
<td>Self study:</td>
<td>96h</td>
<td>64.00%</td>
</tr>
</tbody>
</table>
## Content

<table>
<thead>
<tr>
<th>Section</th>
<th>Learning time:</th>
<th>Description:</th>
<th>Related activities:</th>
<th>Specific objectives:</th>
</tr>
</thead>
<tbody>
<tr>
<td>3. Types of corrosion</td>
<td>10h</td>
<td>Corrosion types classification. Environmental, water, soils, stray current and microbiological corrosion. Galvanic, homogeneous, located (pitting), intergranular corrosion. Stress corrosion cracking.</td>
<td>Exercises session based in cooperative work and evaluation. Laboratory session.</td>
<td>To differentiate the different types of corrosion in basis to the knowledge of precedents units and additional contributions of materials science.</td>
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</table>
### 4. Cathodic protection

<table>
<thead>
<tr>
<th>Learning time: 10h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory classes: 2h</td>
</tr>
<tr>
<td>Practical classes: 2h</td>
</tr>
<tr>
<td>Self study: 6h</td>
</tr>
</tbody>
</table>

**Description:**

**Related activities:**
Exercises session based in cooperative work and evaluation. Laboratory session.

**Specific objectives:**
To apply correctly the cathodic protection against corrosion and calculate number of anodes or current necessary to overall protection.

### 5. Metallic coatings

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>Theory classes: 2h</td>
</tr>
<tr>
<td>Practical classes: 2h</td>
</tr>
<tr>
<td>Self study: 6h</td>
</tr>
</tbody>
</table>

**Description:**

**Related activities:**
Exercises session based in cooperative work and evaluation. Laboratory session.

**Specific objectives:**
Study the characteristics of electrolytic processes and metallic coatings by electrodeposition and immersion and additional processes in chemical industry.
## 6. Organic coatings

**Learning time:** 12h  
- Theory classes: 4h  
- Practical classes: 2h  
- Self study: 6h

**Description:**  

**Related activities:**  
Exercises session based in cooperative work and evaluation. Laboratory session.

**Specific objectives:**  
Study the characteristics, properties and applications of different types of organic coatings.

## 7. High temperature corrosion

**Learning time:** 10h  
- Theory classes: 2h  
- Practical classes: 2h  
- Self study: 6h

**Description:**  

**Related activities:**  
Exercises session based in cooperative work and evaluation. Laboratory session.

**Specific objectives:**  
Study the characteristics of high temperature corrosion processes and the differences with electrochemical corrosion.
### 8. Materials selection for the chemical industry

**Learning time:** 12h  
- Theory classes: 4h  
- Practical classes: 2h  
- Self study: 6h

**Description:**  

**Related activities:**  
Exercises session based in cooperative work and evaluation. Laboratory session.

**Specific objectives:**  
Study properties of metallic and plastic materials and their application in chemical industry and the appropriated criteria in the selection processes.

### 9. Costing and project evaluation

**Learning time:** 10h  
- Theory classes: 2h  
- Practical classes: 2h  
- Self study: 6h

**Description:**  
Investment analysis. Economic evaluation of projects. Factorial methods of cost estimation and application to chemical industry. Bombes and compressors, heat exchangers, vessels, packing and plates, furnace and boilers, other equipment of the chemical industry. Exemples.

**Related activities:**  
Exercises session based in cooperative work and evaluation. Laboratory session.

**Specific objectives:**  
Study preliminarily the investment analysis and associated costing in chemical industry.
### 10. Mechanical design

**Description:**

**Related activities:**
Exercises session based in cooperative work and evaluation. Laboratory session.

**Specific objectives:**
Study of the mechanical design bases in pressure vessels under pressure and liquid storage tanks.

<table>
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<tbody>
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<tr>
<td>Practical classes:</td>
<td>2h</td>
</tr>
<tr>
<td>Self study:</td>
<td>6h</td>
</tr>
</tbody>
</table>
## Planning of activities

| LABORATORY SESSION Nº 1 | Hours: 4h  
| Laboratory classes: 2h  
| Self study: 2h |
| --- | --- |
| **Description:** | Corrosion rate determination |
| **Support materials:** | Laboratory notebook |
| **Descriptions of the assignments due and their relation to the assessment:** | The results must be delivered when the session is finished |
| **Specific objectives:** | Application of the gravimetric method to obtain the corrosion rate in galvanized steel. |

| LABORATORY SESIÓN Nº 2. | Hours: 4h  
| Laboratory classes: 2h  
| Self study: 2h |
| --- | --- |
| **Description:** | Rheological properties of paints and lubricants |
| **Support materials:** | Laboratory notebook |
| **Descriptions of the assignments due and their relation to the assessment:** | The results must be delivered when the session is finished |
| **Specific objectives:** | Study the rheological behavior in quality control for paints and lubricants |

| LABORATORY SESIÓN Nº 3. | Hours: 4h  
| Laboratory classes: 2h  
| Self study: 2h |
| --- | --- |
| **Description:** | Corrosion inhibitors |
| **Support materials:** | Laboratory notebook |
| **Descriptions of the assignments due and their relation to the assessment:** | The results must be delivered when the session is finished |
| **Specific objectives:** | Study the influence of inhibitors in corrosion rate |
| LABORATORY SESIÓN Nº 4. | Hours: 4h  
Laboratory classes: 2h  
Self study: 2h |
| --- | --- |
| **Description:**  
Metal electrodeposition |
| **Support materials:**  
Laboratory notebook |
| **Descriptions of the assignments due and their relation to the assessment:**  
Study the Faraday laws in electrochemical deposition |
| **Specific objectives:**  
Study the Faraday laws in electrochemical deposition |

| LABORATORY SESIÓN Nº 5. | Hours: 4h  
Laboratory classes: 2h  
Self study: 2h |
| --- | --- |
| **Description:**  
Batteries properties |
| **Support materials:**  
Laboratory notebook |
| **Descriptions of the assignments due and their relation to the assessment:**  
Study the composition and basis of batteries running |
| **Specific objectives:**  
Study the composition and basis of batteries running |

| LABORATORY SESIÓN Nº 6. | Hours: 4h  
Laboratory classes: 2h  
Self study: 2h |
| --- | --- |
| **Description:**  
Acid and iodine index in paints and oils |
| **Support materials:**  
Laboratory notebook |
| **Descriptions of the assignments due and their relation to the assessment:**  
The results must be delivered when the session is finished |
| **Specific objectives:**  
Calculate the acid and iodine index as quality parameter in paints and oils |

| VISIT TO INDUSTRIAL SOLVAY PLANT | Hours: 5h  
Theory classes: 5h |
VISIT TO INDUSTRIAL GALVANI ZADOS
TENAS PLANT

**Hours:** 2h
Theory classes: 2h

**Qualification system**

Exercises resolution in continuous evaluation (40%) and final examination when the course is finished.

**Regulations for carrying out activities**

Additional material is allowed in examination in accordance with the criteria of the professor.

**Bibliography**

**Basic:**


**Complementary:**


