295901 - EII - Industrial Equipments and Installations

Coordinating unit: 295 - EEBE - Barcelona East School of Engineering
Teaching unit: 713 - EQ - Department of Chemical Engineering
Academic year: 2019
Degree: BACHELOR’S DEGREE IN CHEMICAL ENGINEERING (Syllabus 2009). (Teaching unit Optional)
BACHELOR’S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2009). (Teaching unit Optional)
BACHELOR’S DEGREE IN ELECTRICAL ENGINEERING (Syllabus 2009). (Teaching unit Optional)
BACHELOR’S DEGREE IN INDUSTRIAL ELECTRONICS AND AUTOMATIC CONTROL ENGINEERING (Syllabus 2009). (Teaching unit Optional)
BACHELOR’S DEGREE IN MATERIALS ENGINEERING (Syllabus 2010). (Teaching unit Optional)
ECTS credits: 6

Teaching languages: Catalan, Spanish

Teaching staff
Coordinator: José Ignacio Iribarren Laco
Others: Primer quadrimestre:
ELAINE APARECIDA ARMELIN DIGGROC - M11, M12
GEORGINA FABREGAT JOVÉ - M11, M12
JOSE IGNACIO IRIBARREN LACO - M11, M12

Degree competences to which the subject contributes
Specific:
1. Capacity to understand and apply basic knowledge principles of general chemistry, organic and inorganic chemistry and their engineering applications.

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 corrosion. Design equipment and plants in chemical industry with efficiency and economic criteria.

Study load

<table>
<thead>
<tr>
<th>Total learning time: 150h</th>
<th>Hours large group: 50h</th>
<th>33.33%</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Hours medium group: 0h</td>
<td>0.00%</td>
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<tr>
<td></td>
<td>Hours small group: 10h</td>
<td>6.67%</td>
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<tr>
<td></td>
<td>Guided activities: 0h</td>
<td>0.00%</td>
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<tr>
<td></td>
<td>Self study: 90h</td>
<td>60.00%</td>
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</table>
## Content

<table>
<thead>
<tr>
<th>Title</th>
<th>Learning time</th>
<th>Description</th>
<th>Specific objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Introduction. Chemical industry characteristics.</strong></td>
<td>3h</td>
<td>General characteristics of chemical industry. Equipment and general installations. Associated problematic to chemical plant.</td>
<td>Knowledge of general characteristics of chemical industry.</td>
</tr>
<tr>
<td><strong>Thermodynamic basis of corrosion.</strong></td>
<td>10h</td>
<td>Electrochemical cells. Nernst equation. Galvanic, concentration and differential aeration cells. Pourbaix diagrams and applications.</td>
<td>To obtain the thermodynamic basis of corrosion and apply the Pourbaix diagrams to predict the possibility of corrosion.</td>
</tr>
<tr>
<td><strong>Corrosion kinetics.</strong></td>
<td>7h</td>
<td>Polarization. Evans diagrams and Tafel equations. Passivity. Flade potential.</td>
<td>To obtain the kinetics implications in corrosion processes and apply different factors affecting to corrosion rate.</td>
</tr>
</tbody>
</table>

**Related activities:**
- Exercises session.

**Self study:**
- Theory classes: 2h
- Practice classes: 1h
- Self study: 1h

**Learning time:**
- Theory classes: 4h
- Practice classes: 4h
- Self study: 2h

**Related activities:**
- Exercise session.
### Types of corrosion. Protection against corrosion.

**Description:**
Environmental, water, soils and microbiological corrosion. Galvanic, homogeneous and located (pitting) corrosion. Stress corrosion cracking. Cathodic protection, metallic and plastic coatings.

**Related activities:**
Exercise session.

**Specific objectives:**
To distinguish the different types of corrosion related with the morphology and properties of metals and alloys.

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

### Materials properties.

**Description:**

**Related activities:**
Exercise session.

**Specific objectives:**
To study the main properties of materials which can be used in chemical industry.

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

### Materials selection.

**Description:**
Materials selection criteria. Application to apparatus and equipment of chemical industry.

**Related activities:**
Exercise session.

**Specific objectives:**
To establish the basis of materials selection criteria in chemical industry.

**Learning time:** 6h
- Theory classes: 2h
- Practical classes: 2h
- Self study: 2h
### Costing and project evaluation.

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

**Description:**  

**Related activities:**  
Exercise session.

**Specific objectives:**  
To study preliminarily the investment analysis and associated costing in chemical industry.

### Mechanical design.

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

**Description:**  

**Related activities:**  
Exercise session.

**Specific objectives:**  
To study the basis of mechanical design of vessels under pressure and storage tanks.
## Planning of activities

| VISIT TO INDUSTRIAL SOLVAY PLANT | Hours: 3h  
Self study: 2h  
Self study: 1h |
<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td><strong>Specific objectives:</strong></td>
<td>Knowledge in situ of materials selection and associated problematic to a chemical industry.</td>
</tr>
</tbody>
</table>

| VISIT TO INDUSTRIAL GALVANIZADOS TENAS PLANT | Hours: 3h  
Theory classes: 2h  
Self study: 1h |
<table>
<thead>
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</thead>
<tbody>
<tr>
<td><strong>Specific objectives:</strong></td>
<td>Watch in situ the hot immersion galvanization process.</td>
</tr>
</tbody>
</table>

| LABORATORY SESSION 1 | Hours: 3h  
Laboratory classes: 2h  
Self study: 1h |
<table>
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<tbody>
<tr>
<td><strong>Description:</strong></td>
<td>Corrosion rate determination.</td>
</tr>
<tr>
<td><strong>Support materials:</strong></td>
<td>Laboratory notebook.</td>
</tr>
<tr>
<td><strong>Descriptions of the assignments due and their relation to the assessment:</strong></td>
<td>Delivery when the session is finished.</td>
</tr>
<tr>
<td><strong>Specific objectives:</strong></td>
<td>Application of gravimetric methodology to obtain corrosion rate.</td>
</tr>
</tbody>
</table>

| LABORATORY SESSION 2 | Hours: 3h  
Laboratory classes: 2h  
Self study: 1h |
<table>
<thead>
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<tbody>
<tr>
<td><strong>Description:</strong></td>
<td>Corrosion inhibitors.</td>
</tr>
<tr>
<td><strong>Support materials:</strong></td>
<td>Laboratory notebook.</td>
</tr>
<tr>
<td><strong>Descriptions of the assignments due and their relation to the assessment:</strong></td>
<td>Delivery when the session is finished.</td>
</tr>
<tr>
<td><strong>Specific objectives:</strong></td>
<td>Study the efficiency of inhibitors in corrosion rate.</td>
</tr>
</tbody>
</table>
## LABORATORY SESSION 3

**Hours:** 3h  
Laboratory classes: 2h  
Self study: 1h

**Description:**  
Rheological properties of paints and lubricants.

**Support materials:**  
Laboratory notebook.

**Descriptions of the assignments due and their relation to the assessment:**  
Delivery when the session is finished.

**Specific objectives:**  
Knowledge of the rheological behaviour in quality control for paints and lubricants.

## LABORATORY SESSION 4

**Hours:** 3h  
Laboratory classes: 2h  
Self study: 1h

**Description:**  
Metal electrodeposition and batteries properties.

**Support materials:**  
Laboratory notebook

**Descriptions of the assignments due and their relation to the assessment:**  
Delivery when the session is finished.

**Specific objectives:**  
Study the Faraday's law and the basis of batteries composition.

## LABORATORY SESSION 5

**Hours:** 3h  
Laboratory classes: 2h  
Self study: 1h

**Description:**  
Iodine index in paints and oils.

**Support materials:**  
Laboratory notebook.

**Descriptions of the assignments due and their relation to the assessment:**  
Delivery when the session is finished.

**Specific objectives:**  
Calculate the iodine index as a quality parameter in paints and oils.
Evaluation system includes:

a) Exercises resolution in continuous evaluation (25% of final qualification)

b) Laboratory sessions evaluation (10% of final qualification).

c) Complementary activities like seminars, expositions and guided works (15% of final qualification).

d) Final examination (50% of final qualification).

Reevaluation will replace the qualification of final examination, remaining unchanged the continuous evaluation.

Regulations for carrying out activities

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

Bibliography

**Basic:**


**Complementary:**
