

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:	2018		
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

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

Total learning time: 150h	Hours large group:	50h	33.33%
	Hours medium group:	0h	0.00%
	Hours small group:	10h	6.67%
	Guided activities:	0h	0.00%
	Self study:	90h	60.00%

295901 - EII - Industrial Equipments and Installations

Content

<p>Introduction. Chemical industry characteristics.</p>	<p>Learning time: 3h Theory classes: 2h Self study : 1h</p>
<p>Description: General characteristics of chemical industry. Equipment and general installations. Associated problematic to chemical plant.</p> <p>Specific objectives: Knowledge of general characteristics of chemical industry.</p>	
<p>Thermodynamic basis of corrosion.</p>	<p>Learning time: 10h Theory classes: 4h Practical classes: 4h Self study : 2h</p>
<p>Description: Electrochemical cells. Nernst equation. Galvanic, concentration and differential aeration cells. Pourbaix diagrams and applications.</p> <p>Related activities: Exercices session.</p> <p>Specific objectives: To obtain the thermodynamic basis of corrosion and apply the Pourbaix diagrams to predict the possibility of corrosion.</p>	
<p>Corrosion kinetics.</p>	<p>Learning time: 7h Theory classes: 3h Practical classes: 2h Self study : 2h</p>
<p>Description: Polarization. Evans diagramasn and Tafel equations. Passivity. Flade potential.</p> <p>Related activities: Exercise session.</p> <p>Specific objectives: To obtain the kinetics implications in corrosion processes and apply to different factors afectting to corrosion rate.</p>	

295901 - EII - Industrial Equipments and Installations

Types of corrosion. Protection against corrosion.	Learning time: 6h Theory classes: 2h Practical classes: 2h Self study : 2h
<p>Description: Environmental, water, soils and microbiological corrosion. Galvanic, homogeneous and located (pitting) corrosion. Stress corrosion cracking. Cathodic protection, metallic and plastic coatings. Applications to Chemical Industry.</p> <p>Related activities: Exercice session.</p> <p>Specific objectives: To distinguish the differents types of corrosion related with the morphology and properties of metals and alloys.</p>	
Materials properties.	Learning time: 6h Theory classes: 2h Practical classes: 2h Self study : 2h
<p>Description: Metals and alloys. Mechanical and thermal properties. Carbon steels and stainless steels. Non ferrous metals. Specaial alloys. Plastics materials. Reinforced plastics.</p> <p>Related activities: Exercice session.</p> <p>Specific objectives: To study the main properties of materials which can be used in chemical industry.</p>	
Materials selection.	Learning time: 6h Theory classes: 2h Practical classes: 2h Self study : 2h
<p>Description: Materials selection criteria. Application to apparatus and equipment of chemical industry.</p> <p>Related activities: Exercise session</p> <p>Specific objectives: To establish the basis of materials selection criteria in chemical industry.</p>	

295901 - EII - Industrial Equipments and Installations

<p>Costing and project evaluation.</p>	<p>Learning time: 6h Theory classes: 2h Practical classes: 2h Self study : 2h</p>
<p>Description: Investment analysis. Economic evaluation of projects. Total investment cost. Net present worth. Pay back time. Rate of return. Factorial methods of cost estimation applied to chemical equipment.</p> <p>Related activities: Exercise session.</p> <p>Specific objectives: To study preliminarily the investment analysis and associated costing in chemical industry.</p>	
<p>Mechanical design.</p>	<p>Learning time: 6h Theory classes: 2h Practical classes: 2h Self study : 2h</p>
<p>Description: Pressure vessels under internal and external pressure. Design parameters.. Cylinders and spherical shells. Head and closure design. Liquid storage tanks. Piping and instrumentation.</p> <p>Related activities: Exercise session.</p> <p>Specific objectives: To study the basis of mechanical design of vessels under pressure and storage tanks.</p>	

295901 - EII - Industrial Equipments and Installations

Planning of activities

VISIT TO INDUSTRIAL SOLVAY PLANT	Hours: 3h Self study: 2h Self study: 1h
Specific objectives: Knowledge in situ of materials selection and associated problematic to a chemical industry.	
VISIT TO INDUSTRIAL GALVANIZADOS TENAS PLANT	Hours: 3h Theory classes: 2h Self study: 1h
Specific objectives: Watch in situ the hot immersion galvanization process.	
LABORATORY SESSION 1	Hours: 3h Laboratory classes: 2h Self study: 1h
<p>Description: Corrosion rate determination.</p> <p>Support materials: Laboratory notebook.</p> <p>Descriptions of the assignments due and their relation to the assessment: Delivery when the session is finished.</p> <p>Specific objectives: Application of gravimetric methodology to obtain corrosion rate.</p>	
LABORATORY SESSION 2	Hours: 3h Laboratory classes: 2h Self study: 1h
<p>Description: Corrosion inhibitors.</p> <p>Support materials: Laboratory notebook.</p> <p>Descriptions of the assignments due and their relation to the assessment: Delivery when the session is finished.</p> <p>Specific objectives: Study the efficiency of inhibitors in corrosion rate.</p>	

295901 - EII - Industrial Equipments and Installations

LABORATORY SESSION 3	Hours: 3h Laboratory classes: 2h Self study: 1h
<p>Description: Rheological properties of paints and lubricants.</p> <p>Support materials: Laboratory notebook.</p> <p>Descriptions of the assignments due and their relation to the assessment: Delivery when the session is finished.</p> <p>Specific objectives: Knowledge of the rheological behaviour in quality control for paints and lubricants.</p>	
LABORATORY SESSION 4	Hours: 3h Laboratory classes: 2h Self study: 1h
<p>Description: Metal electrodeposition and batteries properties.</p> <p>Support materials: Laboratory notebook</p> <p>Descriptions of the assignments due and their relation to the assessment: Delivery when the session is finished.</p> <p>Specific objectives: Study the Faraday's law and the basis of batteries composition.</p>	
LABORATORY SESSION 5	Hours: 3h Laboratory classes: 2h Self study: 1h
<p>Description: Iodine index in paints and oils.</p> <p>Support materials: Laboratory notebook.</p> <p>Descriptions of the assignments due and their relation to the assessment: Delivery when the session is finished.</p> <p>Specific objectives: Calculate the iodine index as a quality parameter in paints an oils.</p>	

295901 - EII - Industrial Equipments and Installations

Qualification system

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 to seminars, expositions and guided works (15% of final qualification).
- d) Final examination (50% of final qualification).

Reevaluation will replace the qualification of final examen, 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:

Bilurbina, L., Liesa, F., Iribarren, J.I.. Corrosión y Protección [on line]. Barcelona: Edicions UPC, 2003 [Consultation: 22/04/2016]. Available on: <<http://hdl.handle.net/2099.3/36748>>. ISBN 8483017113.

Uhlig, Herbert H.. Corrosión y Control de la Corrosión. Bilbao: Urmo, 1970. ISBN 8431401494.

Sinnott, R. K. Coulson & Richardson's chemical engineering. Vol. 6.. 5th ed. Oxford: Elsevier Butterworth-Heinemann, 2009. ISBN 9780750685511.

Complementary:

Talbot, D.; Talbot, J.. Corrosion Science and Technology. Boca Raton: CRC Press, 1998. ISBN 0849382246.

Peters, Max S.; Timmerhaus, Klaus D. Plant design and economics for chemical engineers. 5th ed. New York: Mc Graw Hill International Editions, 2003. ISBN 9780071240444.