Course guide
205226 - SCIAD - Surface Chemistry for Industrial Applications Design

Last modified: 11/04/2025

Unit in charge: Terrassa School of Industrial, Aerospace and Audiovisual Engineering
Teaching unit: 713 - EQ - Department of Chemical Engineering.

Degree: BACHELOR'S DEGREE IN AUDIOVISUAL SYSTEMS ENGINEERING (Syllabus 2009). (Optional subject).
BACHELOR'S DEGREE IN CHEMICAL ENGINEERING (Syllabus 2009). (Optional subject).
BACHELOR'S DEGREE IN ELECTRICAL ENGINEERING (Syllabus 2009). (Optional subject).
BACHELOR'S DEGREE IN INDUSTRIAL ELECTRONICS AND AUTOMATIC CONTROL ENGINEERING (Syllabus 2009). (Optional subject).
BACHELOR'S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2009). (Optional subject).
BACHELOR'S DEGREE IN TEXTILE TECHNOLOGY AND DESIGN ENGINEERING (Syllabus 2009). (Optional subject).
BACHELOR'S DEGREE IN AEROSPACE TECHNOLOGY ENGINEERING (Syllabus 2010). (Optional subject).
BACHELOR'S DEGREE IN AEROSPACE VEHICLE ENGINEERING (Syllabus 2010). (Optional subject).
BACHELOR'S DEGREE IN INDUSTRIAL DESIGN AND PRODUCT DEVELOPMENT ENGINEERING (Syllabus 2010). (Optional subject).
BACHELOR'S DEGREE IN INDUSTRIAL TECHNOLOGY ENGINEERING (Syllabus 2010). (Optional subject).

Academic year: 2025 **ECTS Credits:** 3.0 **Languages:** English

LECTURER

Coordinating lecturer: MANUEL-JOSE LIS ARIAS

Others: SIDDANTH SAXENA

PRIOR SKILLS

Multidisciplinar approach of the subject makes that the competences aquired until third curs should be enough.
Advanced studies in third curs and totally passed the second course would be recommended. This condition is not a way to exclude students.

TEACHING METHODOLOGY

Some activities that correspond to the six groups of items in which subject has been divided. After summarized theoretical approach to each group, there will be some real problems to be solved

LEARNING OBJECTIVES OF THE SUBJECT

Real industrial systems require, for their modification or for new design of a transversal vision about the phenomena involved in the whole process. The majority of industrial applications involve heterogeneous systems that act just depending on the chemical characteristics of the components in contact.
The main objective of this subject is to define every phenomenology involved in this type of industrial systems

STUDY LOAD

Type	Hours	Percentage
Self study	45,0	60.00
Hours medium group	8,0	10.67
Hours small group	8,0	10.67
Hours large group	14,0	18.67

Total learning time: 75 h

CONTENTS

Interfaces in industrial systems

Description:
Chemical characteristics of heterogeneous systems. Electric potential and diffusional layers. Colloidal systems. Amfotheric molecules and surface activity molecules: micelles, mixed micelles, biological membranes
Relationship between chemical structure and properties depending on (viscosity, dipolar moment,...) Interfacial tension. Couy-Chapman Theory for different interfaces

Specific objectives:
To establish the relationship between chemical structure and surface properties

Related activities:
Case 1: For an specific system, detect and study the relationship between interfaces

Full-or-part-time: 12h 30m
Theory classes: 1h
Practical classes: 2h
Laboratory classes: 2h
Self study : 7h 30m

Gas-liquid

Description:
Bubbles. Interfaces generated by the formation of bubbles. Foams. Final density control for foams. Antifoaming agents

Specific objectives:
To establish the basic phenomena involved in the contact between bubbles and liquids

Full-or-part-time: 12h 30m
Theory classes: 1h
Practical classes: 2h
Laboratory classes: 2h
Self study : 7h 30m

Non-miscible liquid systems

Description:
Emulsions and dispersions. Continuous and dispersed phases. Characteristics of emulsifying and dispersing systems. Mechanisms involved in the formation of emulsions and dispersions. Applications: Cosmetics, coating, finishing, detergents.

Specific objectives:
To become familiar with two non-miscible liquids and know how to manage to mix them

Related activities:
Case 2: For an specific case, to establish and define the methodology to follow to make a disperse system

Full-or-part-time: 11h 30m
Theory classes: 4h
Self study : 7h 30m

Non porous solids-liquids

Description:
Adhesion, concepts involved in the adhesion between non-porous solids . Solid-liquid interfacial tension. Wetting phenomena. Langmuir-Blodget systems. Diffusional limiting layer. Vapour phase deposition. Surface modification with enzymatic treatments

Specific objectives:
To define the chemical interactions between non porous solids and liquids

Full-or-part-time: 11h 30m
Theory classes: 4h
Self study : 7h 30m

Porous solids-liquids

Description:
Permeability, porosity. Capillarity effect. Porous diffusion. Catalytic systems in the adhesion in porous surfaces. Swelling effect in polymers. Chemical dependence between absorbate and absorbent.

Specific objectives:
To differenciate the behaviour of the solid interface when the solid is porous

Related activities:
Case 3: For specific cases, define the strategy to improve the adhesion phenomena

Full-or-part-time: 13h 30m
Theory classes: 2h
Practical classes: 2h
Laboratory classes: 2h
Self study : 7h 30m

Gas-solid systems

Description:
Porosity effects on solid-gas systems. Membrane effect. Filtration. Retention capability of gases by membranes, depending on their chemical characteristics.

Specific objectives:
To establish the interactions between solid and gases

Related activities:
Case 4: For an specific system, define and determine the interactions between solid and gas

Full-or-part-time: 13h 30m
Theory classes: 2h
Practical classes: 2h
Laboratory classes: 2h
Self study : 7h 30m

GRADING SYSTEM

Developed that will weigh 25% each. Written delivery and oral presentation

EXAMINATION RULES.

The written report for each case and the oral presentations will be scheduled

BIBLIOGRAPHY

Basic:
- Hiemenz, Paul C.; Rajagopalan, Raj. Principles of colloid and surface chemistry. 3th. Boca Raton: CRC Press, 1997. ISBN 9780824793975.
- Grumezescu, Alexandru. Surface chemistry of nanobiomaterials: applications of nanobiomaterials. New York: William Andrew, 2016. ISBN 9780323428613.

RESOURCES

Other resources:
For every case, some articles and specific bibliography will be delivered