PERSONA CIÈNCIA EMPRESA
UNIVERSITAT RAMON LLULL

SUBJECT: SURFACE CHEMISTRY

SUBJECT MATTER: Elective
MODULE: Professional Supplements
STUDIES: Degree in Chemical Engineering

GENERAL CHARACTERISTICS

Type: ☐ Basic formation, ☐ Compulsory, ☑ Elective
☐ Final Degree Project, ☐ Internship

Duration: Semestral **Semester / s** 8
Number of ECTS credits: 3
Languages: Spanish, Catalan, English

DESCRIPTION

SHORT DESCRIPTION AND JUSTIFICATION

Surfaces play a key role in many chemical processes. The course aims to complement the knowledge acquired in previous courses, by reviewing the classical models and introducing modern techniques of characterization and analysis. The main models and theories for surface phenomena are presented, pointing out differences between surface and bulk. Moreover, the different types of colloidal systems are presented, whose stability is based on surface phenomena.

A number of applications, new materials and *state-of-the-art* systems are described, and their functionalities are explained from the models presented. These chemical systems are the result of the constant evolution and new requirements of society and industry.

COMPETENCES

- Be able to understand and apply general safety knowledge for application in the field of Chemical Engineering. (CB1, E3)
- Be able to identify, formulate and solve problems in the field of chemical engineering. (CB2, E7)
- Be able to analyze, integrate and interpret data and information in the field of Chemical Engineering. (CB3, E8)
- Be able to assess the risks in the use of chemical and biological substances and processes in which they are involved. (E11)
- Ability to identify hazards, assess risks and establish prevention measures in industrial environments. (CP4)

PREREQUISITES

According to the program planning and academic regulations.

CONTENTS

1. *Introduction to Surface chemistry.* Energy surfaces. surface properties vs. continuous medium. Surface characterization: microscopies and other techniques.
2. *Liquid surfaces*. Surface tension: curved surfaces and capillarity. Adsorption on liquids and surface films. Contact angle and wettability.
3. *Solid surfaces*. Adsorption of gases and liquids on solids. Physisorption and chemisorption. Dissociative chemisorption. Heterogeneous catalysis. Langmuir isotherm. Other isotherms. Multilayer Adsorption: BET isotherm. Surface modification techniques.
4. *Colloidal systems*. Definition, classification and uses. Preparation. Stability: DLVO theory. Destruction. Detergents and self-aggregating systems: micelles, liposomes, vesicles and membranes. Industrial applications.

METHODOLOGY

LEARNING ACTIVITIES

Learning activities	Hours	ECTS credits	Competences
Lectures	24	0,9	CB1, E3, CB2, E7, CB3, E8, E11, CP4
Case and Problem-Solving Sessions	3	0,1	CB1, E3, CB2, E7, CB3, E8, E11, CP4
Seminars	3	0,1	CB1, E3, CB2, E7, CB3, E8, E11, CP4
Presentations	5	0,2	CB1, E3, CB2, E7, CB3, E8, E11, CP4
Personal study	43	1,6	
Assessment Tasks (Exams, Continuous Assessment...)	3	0,1	CB1, E3, CB2, E7, CB3, E8, E11, CP4
TOTAL	**81**	**3**	

TEACHING METHODOLOGY

The teaching methodology used in the course is based on lectures and case and problem-solving sessions. Seminars are also scheduled to solve doubts and problems. The student is provided with the complete course documentation with theory and case documents for personal study.

The students prepare presentations in groups or individually on specific issues, which become part of the study material.

ASSESSMENT

ASSESSMENT METHODS

Assessment methods	Weight (%)	Competences
Final exam	40	CB1, E3, CB2, E7, CB3, E8, CP4
Follow-up activities	30	CB1, E3, CB2, E7, CB3, E8, E11, CP4
Papers and presentations	25	CB1, E3, CB2, E7, CB3, E8, E11, CP4
Participation	5	CB1, E3, CB2, E7, CB3, E8, CP4

LEARNING OUTCOMES

- The student must demonstrate the ability to acquire knowledge and understand the fundamentals of technology and surface chemistry. (CB1, E3, E11, CP4)
- The student must demonstrate the ability to apply knowledge in problem solving and discussion of the results. (CB2, E7, CB3, E8, CP4)

QUALIFICATION

The grading of this course is obtained as follows:

Final exam	40%
Follow-up activities	30%
Papers and presentations	25%
Participation	5%

Follow-up activities include problems delivered by the student.

The papers and presentations include short papers and oral presentation.

Participation includes attitude, attendance and initiative shown by the student.

If the final exam grade is less than 4 points the first call of the subject (usually June) will be failed. In ordeer to pass, complementary activities (practical and/ or exams) will be necessary. In any case, the grades of other elements of assessment will be taken into account.

ASSESSMENT OF COMPETENCES

For evaluation of competences **CB1/E3** and **E11** various questions of the final exam will be used.

For the evaluation of competences **CB2/E7** various questions of the final exam and follow-up activities will be used.

For the evaluation of competence **CB3/E8**, the mean between follow-up activities and participation will be used.

For the evaluation of competence **CP4**, the final grade for the course will be used.

BIBLIOGRAPHY

- *Physical Chemistry*T. Engel, P. Reid, Pearson Education, 2005.
- *Principles of Colloid and Surface Science*, PC Hiemenz, R. Rajagopalan, 3a. Ed., Marcel Dekker, New York, 1997.
- *Physical Chemistry of Surfaces*AW Adamson, AP Gast, 6a. Ed., Wiley-Interscience, New York, 1997.
- *Nanoscale Science and Technology*, Eds. RW Kelsall, IW Hamley, M. Geoghegan, Wiley, West Sussex (England), 2005.
- Dedicated material and scientific articles.

DOCUMENT HISTORY

PREVIOUS CHANGES
July 2012 (Dr. Carles Colominas)

CURRENT REVISION
December 2018 (Dr. Carles Colominas)