PERSONA CIÈNCIA EMPRESA
UNIVERSITAT RAMON LLULL

COURSE: PHYSICAL CHEMISTRY II

SUBJECT MATTER: Physical Chemistry
MODULE: Specific Technology
PROGRAM: Degree in Chemical Engineering

GENERAL CHARACTERISTICS

Kind: ☐ Basic Formation, ☑ Compulsory ☐ Optional

☐ Final Degree Project, ☐ Internship

Duration: 1 Semester **Semester**: 4
Number of ECTS credits: 6
Language/s: Catalan, Spanish, English

DESCRIPTION

SHORT DESCRIPTION AND JUSTIFICATION

Physical Chemistry is the area of chemistry that is concerned with understanding the universe from a molecular perspective: understanding the structure of matter at the atomic and molecular levels, understanding the relationships between the structure of molecules and materials and their properties, understanding how interactions take place between molecules, and ultimately how and why chemical reactions occur.

Achieving what Professor Atkins calls a "chemical understanding" of the world in which we live is valuable by itself and provides a deep intellectual satisfaction. Yet it must be borne in mind that our endeavor as scientists takes place in the context of a world with large deficits and challenges. At IQS we seek understanding as a means to do things: understanding the principles of thermodynamics enables the design of more environmental-friendly chemical processes; understanding the molecular basis of a disease enables the development of more effective drugs; understanding the mechanism of a reaction facilitates the design of better catalysts; understanding structure-property relationships enables the design of better functional materials, etc.

Physical Chemistry includes many diverse areas. Some are classics, such as thermodynamics, kinetics, quantum chemistry, spectroscopy, macromolecules, materials, surface chemistry, electrochemistry, photochemistry... Others are more recent: nanotechnology, computational chemistry, molecular biology, photobiology ... all are good representatives of the areas in which physical chemists work today.

The course **Physical Chemistry II** is the second of the two compulsory courses on Physical Chemistry for the degree in Chemical Engineering. After completing this course, the student will have reached a functional level in the recognition, use, practice and implementation of the principles and methods of Chemical Thermodynamics and Kinetics.

COMPETENCES

- Be able to understand and apply knowledge of physical chemistry in the practice of Chemical Engineering (CB1, E2).
- Be able to perform experiments to meet the requirements thereof (CB2, E5).
- Be able to identify, formulate and solve problems in the field of Physical Chemistry (CB2, E7).
- Be able to analyse, integrate and interpret data and information in the field of Physical Chemistry (CB3, E8).
- Be able to communicate effectively both orally and in writing (CB4).
- Be knowledgeable about energy and matter balances, biotechnology, matter transfer, separation operations, reactor design, valuation and transformation of raw materials and energy resources (TE1).

PREREQUISITES

According to the program planning and academic regulations

CONTENTS

Ideal and real solutions. Colligative properties. Phase equilibria. Chemical equilibrium. Ionic equilibrium. Electrochemical equilibrium. Transport and surface phenomena. Electrolytic conductivity. Chemical kinetics: formal and molecular kinetics. Mechanisms. Catalysis

Experimentation in chemical thermodynamics, electrochemistry and chemical kinetics.

METHODOLOGY

TRAINING ACTIVITIES

Training Activities	ECTS	Hours	Competences
Lectures	1.4	39	CB1, E2, TE1
Problem sessions	0.3	9	CB2, E7, TE1
Tutorials	0.3	8	CB1, E2, CB2, E7
Experimental work / laboratory	1.0	28	CB1, E2, CB2, E5, CB3. E8, CB4, TE1
Discussions and presentations	0.1	2	CB1, E2, CB2. E7, CB3. E8, CB4, TE1
Personal and group study	2.7	72	CB1, E2, CB2, E7, CB3. E8, CB4, TE1
Assessment	0.2	4	CB1, E2, CB2, E5, E7, CB3, E8, CB4, TE1
TOTAL	**6**	**162**	

EXPLANATION OF TEACHING METHODOLOGY

- **Lectures** are used to introduce the concepts included in the program, supporting them with projections, application examples, animations, virtual laboratories and demonstrations. Participation and discussion among students is encouraged.
- **Problems sessions** are used to help students understand the scope of the concepts presented in the lectures and identify, formulate and solve problems in the field of Physical Chemistry. Emphasis on solving problems requiring analysis of large collections of data is made.
- **Tutorial sessions** are used to review key theoretical and practical topics that pose the greatest learning difficulties. Laboratory results are discussed and examinations are prepared are reviewed.
- The **experimental / laboratory work** aims to familiarize students with the techniques and methodologies used in experimental Physical Chemistry. Both the ability of performing an experiment and of analysing its results to draw conclusions are developed.
- Through **discussions and presentations** it is intended that students learn to communicate effectively. Throughout the course cases and complex problems for the students to work in groups are proposed.
- Finally, for **personal and group study**, the students are provided with collections of problems, supplementary information, self-assessment tests and bibliographic resources through the online learning support system,.

ASSESSMENT

ASSESSMENT METHODS

Assessment Methods	Weight	Competences
Exams	55%	CB2, E7, TE1
Monitoring activities	10%	CB1, E2
Homework and presentations	10%	CB1, E2, CB2, E7, CB3, E8, CB4, TE1
Experimental or field work	20%	CB2, E5, TE1
Projects	-	
Internships	-	
Participation	5%	CB3, E8, CB4

LEARNING OUTCOMES

- The student must demonstrate a sound knowledge and understanding of the meaning and scope of the main concepts in physical chemistry (CB1, E2, TE1).
- The student must demonstrate the ability to perform experiments using physical chemistry techniques and methods (CB2, E5, TE1).
- The student must demonstrate the ability to identify, formulate and solve problems in the field of physical chemistry (CB2, E7, TE1).

- The student must demonstrate the ability to analyse, integrate and interpret data and information in the field of physical chemistry (CB3, E8, TE1).
- The student must demonstrate the ability to communicate effectively both orally and in writing (CB4).

GRADING

Calculation of the final grade will be derived from the individual marks obtained by the assessment methods described above. The marks are in the range 0-10 and have a maximum value of 10. To pass the course the overall grade must be equal to or greater than 5.

- During the course a **mid-term examination** and a **final examination** are performed that contribute 55% to the subject final grade. The grade is the best between that of the final examination and the average of those of the mid-term and final exams, with respective weights 30% and 70%. A value of at least 4 must be earned to pass the course.
- During the course **monitoring activities** are performed that contribute 10% to the subject final grade. The grade is calculated as the average of the top ten results. To pass the course, you must have performed at least 70% of the proposed activities and earned a mark of at least 6.
- During the course **homework and presentations** are performed that contribute 10% to the subject final grade. The grade is calculated as the average of the top ten results. To pass the course, you must have performed at least 70% of the proposed activities and earned a mark of at least 6.
- During the course of **experimental work** is performed that contributes 20% to the subject final grade. The grade is calculated as the average of all results. To pass the course, you must have performed at least 70% of the proposed activities and earned a mark of at least 6.
- Active **participation** in class and interest in the subject throughout the course contribute 5% of the final grade.

Failure to achieve the threshold value for any of the individual items above will result in a final grade of 4 (No Pass).

ASSESSMENT OF THE COMPETENCES

For the evaluation of the CB1 and E2 skills, the marks earned for the monitoring activities and for the homework and presentations will be used as indicators.

For the evaluation of CB2 and E5 skills, the marks earned for the experimental work a will be used as indicator.

For the evaluation of the E7 skill, the marks earned for the examinations and for the homework and presentations will be used as indicators.

For the evaluation of the CB3, CB4 and E8 skills, the marks earned for the homework and presentations and for the participation will be used as indicators.

For the evaluation of the TE1 skill, the subject final grade will be used as indicator.

BIBLIOGRAPHY

- Principios de Fisicoquímica, I.N. Levine, McGraw-Hill, 6th edition, Madrid 2014.
- Physical chemistry, T. Engel and P. Reid, Pearson Addison-Wesley, Madrid 2006.
- Physical Chemistry, PW Atkins Oxford University Press, 10th edition, Oxford, 2014
- Problemas de Físicoquímica, I.N. Levine, McGraw-Hill, 5th edition, Madrid 2005.

DOCUMENT HISTORY

PREVIOUS CHANGES
January 24, 2018, Dr. Santi Nonell
January 30, 2017, Dr. Santi Nonell

LAST UPDATE
January 24, 2019, Dr. Santi Nonell