PERSONA CIÈNCIA EMPRESA
UNIVERSITAT RAMON LLULL

COURSE: ANALITYCAL CHEMISTRY

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

GENERAL CHARACTERISTICS

Type: ☐ Basic Formation, ☑ Compulsory, ☐ Elective

☐ Final Degree Project, ☐ Internship

Duration: Annual **Semester/s**: 3 and 4
Number of ECTS credits: 10
Language/s: Spanish

DESCRIPTION

SHORT DESCRIPTION AND JUSTIFICATION

The general and fundamental concepts of analytical chemistry are presented, including the description of any analytical process: from the taking of sample and its preparation, the scales of work, the concepts that define the quality of a method.

The Conventional Methods of Quantitative Analysis (Volumetric and Gravimetric) and Instrumental Analysis Methods (Electrochemical, Spectrophotometric and Chromatographic) and their main applications are presented.

After this subject, students will be able to recognize Analytical Chemistry as the science that develops, optimizes and applies measurement processes aimed at obtaining quality chemical information.

COMPETENCES

Be able to understand and apply the knowledge about the chemical reaction and the physical and chemical-physical properties of the substances to the identification and quantification of inorganic products present as major or traces (CB1, E2)

Be able to identify, formulate and solve problems in the field of Analytical Chemistry (CB2, E7).

Be able to analyze, integrate and interpret data and information from the field of Analytical Chemistry (CB3, E8):

Be able to assess the risks in the use of chemical and biological substances (E11).

Be able to assess the impact of Analytical Chemistry on the sustainable development of society (T3)

Capacity for the design and optimization of analytical procedures (TE2, for Degree in Chemical Engineering).

PREREQUISITES

According to the program planning and academic regulations.

CONTENTS

1. INTRODUCTION. THE ANALYTICAL PROCESS
2. SAMPLE AND SAMPLING
3. IDENTIFICATION METHODS IN A SOLID STATE AND IN SOLUTION.
4. PRECIPITATION REACTIONS. GRAVIMETRIES
5. TITRATION METHODS
    - Precipitation
    - Acid-base
    - complex formation
    - Redox
6. ELECTROMETRIC METHODS
    - Potentiometrics
    - Conductimetry
    - Electrogravimetries
7. SPECTROPHOTOMETRIC METHODS
    - Molecular Absorption Spectrophotometry
    - Atomic Absorption Spectrophotometry
    - Emission Spectrophotometry
    - Fluorescence
8. CHROMATOGRAPHIC METHODS
    - Thin-layer chromatography (TLC)
    - Liquid chromatography (LC)
    - Gas Chromatography (GC)
9. QUALITY PARAMETERS
    - Selectivity, Linearity, Range, Accuracy, Accuracy, Limit of Detection (LOD) / Limit of Quantification (LOQ), Robustness
10. APPLICATIONS TO INDUSTRIAL AND ENVIRONMENTAL SAMPLES

METHODOLOGY

Learning Activities	Hours	ECTS Credits	Competences
Lectures (A1)	73	2,7	CB1, E2, E11, T3, TE2
Case and Problem-Solving Sessions (A2)	19	0,7	CB2, E7, CB3, E8, TE2
Seminars	11	0,4	CB3, E8, E11, T3, TE2
Practical & Lab Work	-	-	-
Oral Presentations	-	-	-
Personal Study	159	5,9	CB1, E2, CB2, E7, CB3, E8, E11, T3, TE2
Assessment Tasks (Exams, Continuous Assessment, etc.)	8	0,3	CB1, E2, CB2, E7, CB3, E8, E11, T3, TE2
TOTAL	**270**	**10**	

In the sessions of exposition of concepts, the professor introduces the basic points of each subject taking care that relationships are established with the chemical knowledge that the student already knows about other subjects, thus integrating concepts of General Chemistry, Physical Chemistry, Inorganic Chemistry, etc. Likewise, the concepts corresponding to aspects of safety in the handling of reagents and analytical instruments are introduced. The classes are developed in a participatory manner, maintaining a constant dialogue with the students and working hard on all the topics with the discussion of practical cases mentioning the influence of analytical chemistry on many aspects of the sustainable development of society. The students have the transparencies that the professor uses in the classes.

In the sessions of resolution of exercises and problems the type problems of each one of the subjects of the subject arise and the difficulties that the students have found in the personal resolution of the collections of problems that have been delivered to them are discussed. In this way students can self-assess their level of learning.

In the seminars various topics will be worked on. It is intended that, based on questions posed by the students or the professor, a dialogue be established in the group that allows both to solve specific doubts, as well as to contribute to the integration of knowledge and to the discussions of current aspects related to analytical chemistry.

Students can make their queries to the professor individually or in small groups, once the agenda is agreed with the professor.

ASSESSMENT

ASSESSMENT METHODS

Assessment Methods	Weight	Competences
Final Exam	40%	CB1, E2, CB2, E7, CB3, E8, TE2
Midterm Exams	40%	CB1, E2, CB2, E7, CB3, E8, TE2
Continuous Assessment Activities	15%	CB1, E2, CB2, E7, TE2
Reports and Presentations	-	-
Lab or Field Work	-	-
Projects	-	-
Host Student Evaluation	-	-
Participation	5%	CB3, E8, E11, T3

LEARNING OUTCOMES

- The student must demonstrate ability to understand / solve / discuss the analytical problem in light of the principles of General Chemistry, Inorganic Chemistry and Chemistry-Physics (→ E2, CB1).
- The student must demonstrate that he is able to plan and assess the importance of the different phases of a chemical analysis and the peculiarities of each type of analysis depending on the matrix, the analytes to be determined and their concentration. (→ E2, CB1).
- The student has to show that he knows, understands the meaning and appropriately uses the terminology proper to the analytical methods (→ E2, CB1). [
- The student must demonstrate knowledge of the Instrumental Methods of Analysis (→ E2, CB1).
- The student must demonstrate that he knows the chemical properties of the most common ions, their reactivity of identifying interest. Special emphasis will be placed on acid-base, redox, precipitation-dissolution reactions. (→ E7, CB2).
- The student must demonstrate ability to interpret the problem statement (→ E7, CB2).
- The student must demonstrate ability to develop chemical and mathematical equations and calculate the results (→ E7, CB2).
- The student must be able to explain in a comprehensible way phenomena and processes related to analytical chemistry (→ E8, CB3).
- The student must demonstrate ability to interpret the results (→ E8, CB3).
- The student must demonstrate ability to apply statistical treatments to evaluate the quality of the results (→ E8, CB3).
- The student must be able to expose in a rigorous manner the possible impact of Analytical Chemistry on the sustainable development of society (→ T3).
- The student must demonstrate the ability to prevent risks in safety and environmental aspects and the knowledge to establish the necessary control and monitoring measures (→ E11).

- The student must demonstrate ability to design and optimize analytical processes (→ TE2, for Degree in Chemical Engineering).

QUALIFICATION

First call:

40% partial exam
Final exam 40%
Follow-up activities 15%
Participation 5%

Next calls:

80% exam
Follow-up activities 15%
Participation 5%

First call:

- There are two exams, each of them represents 40% of the grade of the subject. To pass the subject, the grade of each of the partial exams must be equal to or greater than 4.
- The follow-up activities represent 15% of the grade of the subject. To pass the subject, the grade of these activities must be equal to or greater than 4.
- Participation in the face-to-face sessions represents 5% of the grade of the subject.

If in any of the evaluation methods the established criteria are not met, the student's grade will not exceed 4.

Following calls:

- The exams of the first call can be replaced by a single final exam. In this case, said final exam will represent 80% of the grade of the subject.
- The rest of the evaluation criteria are those of the first call.

ASSESSMENT OF THE COMPETENCES

Competencies	Assessment
Be able to understand and apply the knowledge about the chemical reaction and the physical and chemical-physical properties of the substances to the identification and quantification of inorganic products present as major or traces (CB1, E2)	Exam Follow up Activities
Be able to identify, formulate and solve problems in the field of Analytical Chemistry (CB2, E7).	Exam Follow up Activities
Be able to analyze, integrate and interpret data and information from the field of Analytical Chemistry (CB3, E8):	Exam Follow up Activities
Be able to assess the risks in the use of chemical and biological substances (E11).	Exam Follow up Activities Participation
Be able to assess the impact of Analytical Chemistry on the sustainable development of society (T3)	Exam Follow up Activities Participation
Capacity for the design and optimization of analytical procedures (TE2, for Degree in Chemical Engineering).	Exam Follow up Activities Participation

BIBLIOGRAPHY

Douglas A.Skoog, Donald M. West, James Holler, Estanley R. Croch. Fundamentos de Química Analítica. 8ª Edición. Ed. THOMSON. Madrid. 2005

Gary D. Christian, Química Analítica. 6ª Edición. Mc Graw Hill. Madrid. 2009.

DOCUMENT HISTORY

PREVIOUS REVISIONS

September 2017: Blanco
September 2012, 2015 y 2016: Comellas-Blanco
June 2010: Comellas-Blanco-Báguena

CURRENT REVISION
September 2018: Blanco