PERSONA CIÈNCIA EMPRESA
Universitat Ramon Llull

COURSE: SPECTROPHOTOMETRY AND ELECTROANALYSIS

SUBJECT: Advanced Analytical Chemistry
MODULE: TECHNOLOGICAL
PROGRAM: University Master's Degree in Analytical Chemistry

GENERAL FEATURES *

Type: ☐ Basic Training ☑ Compulsory ☐ Elective
☐ Master's thesis work, ☐ Practicum

Duration: Semester **Semester / s:** 1
Number of ECTS credits: 5
Language / s: English, Spanish, Catalan

DESCRIPTION

BRIEF DESCRIPTION AND JUSTIFICATION (The meaning of the course in relation to the program. Between 100 and 200 words.)

This subject provides knowledge and skills needed to understand, choose and use analytical methods required for advanced work and research in the area of specialization of the Master (Analytical Chemistry). Emphasis will be placed not only in the description of the analytical techniques, but especially on the parameters that define the quality of the methods and results (including examples of validation procedures, uncertainty calculation, etc.). Similarly, issues related to the economic cost of the equipment and methods, safety requirements, maintenance and calibration are included.

COMPETENCES (Of course you put in relation to the skills pre-assigned in the field.)

Basic competences
CB6 - Have and understand knowledge which provides the ground or opportunity to be innovative in the development and/or application of ideas, often in a research context
CB7 - Apply their knowledge and their ability to solve problems in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their field of study
CB8 - Integrate knowledge and deal with the complexity of formulating judgments based on information which, being incomplete or limited, includes reflections on social and ethical responsibilities related to the application of their knowledge and judgments
CB9 - Communicate conclusions, and the reasons that sustain them, to specialized and non-specialized audiences in a clear and unambiguous way.

General competences
CG2 - Ability to perform a responsible practice of the profession

Specific competences
E5- Demonstrate advanced knowledge of atomic and molecular spectroscopies, voltamperometry, voltammetry and other advanced electrochemical techniques for designing, applying and interpreting analytical methods.

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E6 - Ability to interpret the results obtained with advanced techniques of atomic and molecular spectroscopies, voltamperometry, voltammetry and other advanced electrochemical techniques in the quantitative determination of chemical compounds detected in samples.

Transversal competences
T3 - Ability to assess the impact of the use of chemistry in the sustainable development of the society

PREREQUISITES * (Modules, materials, disciplines or expertise needed to track the subject. Contain subjects that must have been completed can be made.)

Applicants to the Master's Degree Program in possession of a degree or bachelor's degree in Chemistry do not need bridging courses. Applicants in possession of other degrees must previously studied subjects that included basic contents of Instrumental Analysis, Structural Determination (including Mass Spectrometry) and statistics. If not, bridging courses will be required.

CONTENTS (Sections that make up the syllabus, to a second level of detail.)

1. ELECTROANALYSIS
    - 1.0. PREVIOUS CONCEPTS; POTENTIOMETRY, CONDUCTOMETRY, AMPEROMETRIC TITRATIONS. POLAROGRAPHY (DME).
    - 1.1. THEORETICAL CONSIDERATIONS.
    - 1.2. PRACTICAL CONSIDERATIONS.
        - 1.2.1. ENERGY SOURCES.
        - 1.2.2. ELECTROCHEMICAL CELLS.
        - 1.2.3. INSTRUMENTATION.
    - 1.3. KINETIC ELECTROCHEMISTRY AND INTERFACIAL REACTIONS
        - 1.3.1. BUTLER-VOLMER EQUATION.
        - 1.3.2. SHAPE ANALYSIS.
        - 1.3.3. CORROSION.
        - 1.3.4. STRIPPING ANALYSIS.
    - 1.4. ELECTROCHEMICAL SENSORS
        - 1.4.1. SELECTIVE ELECTRODE.
        - 1.4.2. GAS SENSORS.
        - 1.4.3. BIOSENSORES.
2. SPECTROPHOTOMETRY
    - 2.1. GRAPHITE FURNACE - ATOMIC ABSORPTION SPECTROPHOTOMETRY (GFAAS)
    - 2.2. PLAMSA TECHNOLOGIES
        - 2.2.1. ICP-OES
        - 2.2.2. ICP-MS
        - 2.2.3. HYPHENATED TECHNIQUES

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METHODOLOGY

TRAINING ACTIVITIES * (Complete the table relating activities, workload in ECTS credits, and skills.)

Training Activities	ECTS	Competences
Sessions of exposition of concepts	1.15	E5, E6, T3, CG2
Sessions solving exercises, problems and cases	0.15	E5, E6, T3, CG2
Seminars	0.07	E5, E6, T3, CG2
Presentations	0.1	E5, E6, T3, CG2
Activities of personal study by students	3.33	E5, E6
Evaluation activities (exams, monitoring controls ...)	0.15	E5, E6, T3, CG2
TOTAL	**5**	

TEACHING METHODOLOGY (Justifying the teaching methods used in relation to the competences and contents of the course. Between 100 and 200 words.)

Sessions of exposition of concepts: Exposition of contents through presentation or explanation (possibly including demonstrations) by a professor.

Sessions solving exercises, problems and cases: Solving exercises, approach / problem solving and presentation / discussion of cases by a professor with the active participation of students.

Seminars: Statement made by a teacher in order to review, discuss and answer questions about materials and topics presented in the sessions of exposure sessions concepts and solving exercises, problems and cases.

If students have difficulties during the resolution of the given problems and exercises, consultation will be provided individually or in groups at the professor office.

EVALUATION

ASSESSMENT SYSTEM * (Complete the table relating evaluation methods, competences and weight in the course grade.)

Evaluation Methods	%	Competences
Final Exam	50%	E5, E6, T3, CG2
Monitoring activities	25%	E5, E6, T3, CG2
Projects and presentations	20%	E5, E6, T3, CG2
Participation	5%	E5, E6, T3, CG2

LEARNING OUTCOMES (Explanation of the embodiments that allow the student skills assessment, relating them to the skills and methods of assessment.)

- The student must demonstrate his/her knowledge in the application of absorption and emission techniques in the quantitative determination of chemical compounds. (E5, E6) Final exam, Monitoring activities, Projects and presentations, and Participation.
- The student must demonstrate his/her knowledge in the application of electrochemical techniques in the quantitative determination and properties of chemical compounds. (E5, E6) Final exam, Monitoring activities, projects and presentations, and Participation.
- The student must demonstrate his/her ability to apply the appropriate analytical techniques based on the concentration of the chemical compounds present in the samples. (E5, E6) Final exam, Monitoring activities, projects and presentations, and Participation.
- The student must be able to interpret the results obtained with the different analytical techniques to determine the concentration of the chemical compounds present in the samples. (E5, E6) Final exam, Monitoring activities, projects and presentations, and Participation.
- The student must demonstrate knowledge of the main chemical properties of the most important chemical products, as well as the repercussions derived from their incorrect use (CG2, T3). Final exam, Monitoring activities, projects and presentations, and Participation.

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QUALIFICATION (Explanation of the computer system of the course grade.)

The grade of this course is obtained:

Final exam	50%
Monitoring activities	25%
Projects and presentations	20%
Participation	5%

- **Monitoring activities** include works (exercises, problems and cases) that perform and deliver the students during the course.
- Students do group **Projects** of 2-3 people. Some of these works include presenting it to other peers.
- The **participation** includes attendance, initiative and the attitude shown by the student in relation to the teacher and their peers.

Final exam grade must be equal or greater than 4 points to pass the course.

ASSESSMENT OF THE COMPETENCES (Define calculation expressions for each competence and the relevant evaluation methods.)

All competences will be evaluated using the final grade of the course.

BIBLIOGRAPHY (Recommended and accessible to students.)

- A.J. Bard, Electrochemical Methods, John Wiley & Sons, 1980.
- J. Wang, Analytical electrochemistry, Wiley-VCH, 2006.
- Mars G. Fontana. Corrosion Engineering. Ed. McGraw Hill (1980)
- R, Thomas, Practical Guide to ICP-MS, CRC Press, 2008.

DOCUMENT HISTORY

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17th September 2014, Sergi Colominas
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21st July 2016, Sergi Colominas

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