GENERAL FEATURES *

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

Duration: Semestral Semester / s: 7
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.)

In this subject different techniques of instrumental analysis are studied. To understand how the instrumentation operates and what information can be obtained, it requires knowledge of electrochemistry, spectrophotometry and chromatography.

In particular:

- Students are trained analytical techniques based on electrochemistry. It is also intended to provide students with general knowledge in this field. The goal of this point is that students should be able to apply these techniques in their professional life and to critically judge the obtained results.
- Students are also trained in analytical techniques based on spectrophotometry. These techniques are applied to different types of samples.
- The basis of chromatography is studied in terms of their capacity to retain / separate substances. The different modules constituting the chromatographic systems are studied: mobile phase, propulsion system, sample injection, separation, detection of components and information treatment.

The concepts studied are applied to the analysis of different types of samples.
COMPTENECES (Of course you put in relation to the skills pre-assigned in the field.)

- Be able to understand and apply knowledge about chemical reactions, physical and physicochemical properties of substances to the identification and quantification of inorganic/organic products present as major or traces in the sample (CB1, E4).
- 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 in the field of Analytical Chemistry (CB3, E8).
- Be able to perform experiments related to instrumental analysis and to be able to satisfy the requirements established in them (CB2, E5).
- Be able to design processes and experiments to achieve the requirements established in them (E10).
- Be able to communicate effectively orally and writing (CB4).

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

According to the program planning and academic regulations.

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

1. Introduction
2. Chromatographic and electrophoretic methods.
   2.1. Introduction to chromatographic techniques.
   2.2. Chromatography in gas phase.
   2.3. Chromatography in liquid phase.
   3.1. Introduction to electroanalysis.
   3.2. Polarography
4. Spectrophotometric methods.
   4.1. Introduction to Spectrophotometric Methods
   4.2. Molecular absorption in the ultraviolet-visible
   4.3. Methods of atomization of liquid samples
5. Applications of Instrumental Analysis
   5.1. Sample preparation
   5.2. Qualitative and quantitative considerations.

* These features should not be modified without the approval of the bodies responsible for academic higher-level structures (field, module and/or system).
TRAINING ACTIVITIES * (Complete the table relating activities, workload in ECTS credits, and skills.)

<table>
<thead>
<tr>
<th>Training Activities</th>
<th>Hours</th>
<th>ECTS</th>
<th>Competences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sessions of exposition of concepts</td>
<td>27</td>
<td>1,0</td>
<td>CB1, E4</td>
</tr>
<tr>
<td>Sessions solving exercises, problems and cases</td>
<td>8</td>
<td>0,3</td>
<td>CB2, E7, CB3, E8</td>
</tr>
<tr>
<td>Seminars</td>
<td>8</td>
<td>0,3</td>
<td>CB3, E8</td>
</tr>
<tr>
<td>Practical work / laboratory</td>
<td>41</td>
<td>1,5</td>
<td>CB2, E5, CB3, E8, E10, CB4</td>
</tr>
<tr>
<td>Presentations</td>
<td>3</td>
<td>0,1</td>
<td>CB4</td>
</tr>
<tr>
<td>Activities of personal study by students</td>
<td>43</td>
<td>1,6</td>
<td>CB1, E4, CB2, E5, CB3, E8, E10, CB4</td>
</tr>
<tr>
<td>Evaluation activities (exams, monitoring controls ...)</td>
<td>5</td>
<td>0,2</td>
<td>CB1, E4, CB2, E5, CB3, E8, E10, CB4</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>135</strong></td>
<td><strong>5</strong></td>
<td></td>
</tr>
</tbody>
</table>

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

During lessons at class, the concepts included in the program are be presented using classical teaching techniques: chalk-blackboard and PowerPoint presentations. In some cases, practical demonstrations are used to facilitate the understanding of specific concepts and to push the participation of the students. Dynamic lessons are encouraged in which the question-answer game will benefit not only the student (who asked the question), but also his/her classmates.

Problem solving sessions and exercises. There are collections of exercises and problems that are provided to the students throughout the course. The exercises are intended to help the student to understand, deepen and relate concepts taught during the lessons. Solving the provided problems by the students, help them to learn how to use the theoretical concepts with agility and reinforce their understanding. At class, common problems and classical exercises are solved.

Laboratory demonstrations. Students have established deadline for the completion of each laboratory demonstration. A brief description of the method to be followed is provided for all demonstrations. These documents are available at the Virtual Campus and the student must complete the suggested reading in the bibliography. Experimental results and observations must be included in the laboratory diary. The laboratory diary must be available to the

* These features should not be modified without the approval of the bodies responsible for academic higher-level structures (field, module and / or system).
collaborators and to the professor for its audit. Students must prepare a report of each performed laboratory demonstration and must perform an oral presentation during the course.

Seminars are taught on a specific topic or as a part of the subject, to reinforce it or, simply, to address the doubts that have arisen to the student studied the subject at home.

Individual or group consultations in the teacher's office: Students can ask their queries to the teacher individually or in groups of two to five people.

<table>
<thead>
<tr>
<th>Assessment Methods</th>
<th>%</th>
<th>Competences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Final Exam</td>
<td>40</td>
<td>CB1, E4, CB2, E7, CB3, E8, E10</td>
</tr>
<tr>
<td>Monitoring activities</td>
<td>10</td>
<td>CB1, E2, CB2, E7</td>
</tr>
<tr>
<td>Projects and presentations</td>
<td>15</td>
<td>E10, CB4</td>
</tr>
<tr>
<td>Practical work / laboratory</td>
<td>30</td>
<td>CB2, E5, CB3, E8, CB4</td>
</tr>
<tr>
<td>Participation</td>
<td>5</td>
<td>CB3, E8</td>
</tr>
</tbody>
</table>

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

- Students must demonstrate that they have understood the basic concepts of the subject. They must be able to explain these concepts correctly and demonstrate competence in differentiating, relating and using these concepts (CB1, E4).
- Students must demonstrate ability to interpret results and observations made individually or in group (CB2, E7).
- Students must demonstrate ability to perform calculations and statistical treatment to evaluate the quality of the obtained results (CB3, E8).
- Students must demonstrate ability to prepare reports of the performed laboratory demonstrations, as well as maintain a complete, traceable and detailed laboratory diary (CB4).
- Students must demonstrate ability to orally communicate the performed experimental work (CB4).
- Students must demonstrate ability to apply the provided experimental methods (CB2, E5).
- Students must demonstrate ability to design experiments in the laboratory (E10).

* These features should not be modified without the approval of the bodies responsible for academic higher-level structures (field, module and / or system).
QUALIFICATION (Explanation of the computer system of the course grade.)

The grade of this course is obtained:

- **Final exam** 40%
- **Monitoring activities** 10%
- **Projects and presentations** 15%
- **Practical work / laboratory** 30%
- **Participation** 5%

**Monitoring activities** include works (exercises, problems and cases) that perform and deliver the students during the course.

**Projects and presentations** include tasks proposed during the course and an oral presentation of a laboratory demonstration.

The **practical work / laboratory** includes the laboratory diary and reports of the performed laboratory demonstrations. The attitude and initiative shown by the student in the laboratory is also evaluated.

If the grade of the final exam is less than 4 or the practical work / laboratory is less than 5, the final grade of the subject will be the lowest of the two. To pass the same in the following calls, complementary activities of the practical work / laboratory and/or the final exam must be performed.
ASSESSMENT OF THE COMPETENCES (Define calculation expressions for each competence and the relevant evaluation methods.)

<table>
<thead>
<tr>
<th>Competences</th>
<th>Qualification</th>
<th>Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Be able to understand and apply knowledge about chemical reactions, physical and physicochemical properties of substances to the identification and quantification of inorganic / organic products present as major or traces (CB1, E4).</td>
<td>Final exam Monitoring activities</td>
<td>Theoretical questions</td>
</tr>
<tr>
<td>Be able to identify, formulate and solve problems in the field of Analytical Chemistry (CB2, E7).</td>
<td>Final exam Monitoring activities</td>
<td>Practical questions Attitude and initiative</td>
</tr>
<tr>
<td>Be able to analyze, integrate and interpret data and information in the field of Analytical Chemistry (CB3, E8).</td>
<td>Final exam Practical work / laboratory</td>
<td>Questions to justify approaches or interpret results Conclusions in the laboratory reports</td>
</tr>
<tr>
<td>Be able to perform experiments related to instrumental analysis and to be able to satisfy the requirements established in them (CB2, E5).</td>
<td>Practical work / laboratory</td>
<td>Laboratory results and reports</td>
</tr>
<tr>
<td>Be able to design processes and experiments to achieve the requirements established in them (E10).</td>
<td>Final exam Projects and presentations</td>
<td>Final exam Laboratory diary</td>
</tr>
<tr>
<td>Be able to communicate effectively orally and writing (CB4).</td>
<td>Practical work / laboratory Projects and presentations</td>
<td>Laboratory reports Oral presentations</td>
</tr>
</tbody>
</table>

BIBLIOGRAPHY (Recommended and accessible to students.)

- D.A. Skoog, Principios de Análisis Instrumental (5ª edició). McGraw-Hill.

* These features should not be modified without the approval of the bodies responsible for academic higher-level structures (field, module and / or system).
These features should not be modified without the approval of the bodies responsible for academic higher-level structures (field, module and / or system).