Instrumental Methods of Analysis

Calendar: 3rd semester

Contact Hours: T: 30,0; PL: 15,0; OT: 7,5

Intended learning outcomes of the curricular unit:
The competence acquisition by the student can be measured on the basis of the following objectives: To use effectively an important number of experimental techniques, namely, Optical, Electroanalytical, Chromatographic, etc.; To be able to identify advantages and limitations for each technique; To describe effectively and with some detail the functioning of the devices used for each technique; To be able to use some of these devices knowing the best way of profiting from his potentialities; To determine in which circumstances these studied techniques must be used, knowing the best technique to use in each situation, considering the expected results, as well as the cost associated; To be able to apply for each technique the appropriated preliminary steps that allowed an efficient use.

Syllabus:
1. Qualitative and Quantitative analyses. 2. Optical Methods (atomic and molecular absorption – UV/VIS; flame photometry; atomic absorption, FTIR, ICP; Fluorescence, Phosphorescence). 3. Mass Spectroscopy. 4. Eletroanalytical Methods (Potentiometric methods, Voltammetric, Coulometric and Eletrogravimetric methods). 5. RX Diffraction. 6. RMN. 7. Chromatographic Methods (HPLC, GC, SEC, etc.)

Demonstration of the syllabus coherence with the curricular unit's intended learning outcomes.
The fundament goal for this curricular unit is that student acquires competences for commonly used laboratorial techniques and methods. Thus, students should acquire knowledge about the study methods and techniques, knowing its limitation, potentiality and how to use it. It is also expected that student acquires competences that allow them to correctly select the most appropriated techniques and methods for each situation. Consequently, the curricular unit is structured by chapters, in which each one is dedicated to the study of individual methods and groups of techniques. Thus, the curricular unit starts with generically basic concepts (1st Chapter). 2nd chapter subjects refers to optical methods, in which more insightful knowledge about atomic and molecular absorption techniques are lecture, namely the IV, UV/Visible, atomic absorption, ICP, fluorescence, phosphorescence, etc.. The mass spectroscopy is the focus of 3rd chapter, while 4th chapter subjects is about the electroanalytical methods, namely, potentiometric, coulometric, Voltammetric and electrogravimetric methods, etc.. X-ray diffraction is a very important method for solid state structure analyzes and it is lecture in 5th chapter. Finally, the chromatographic methods, widely used in commercial and industrial laboratories, are lectured in 6th chapter. The study techniques are the HPLC, GC, SEC, etc..

Teaching methodologies (including evaluation):
Lecture or applied theory classes will be administered, using a lecture-based approach, using for that purpose slide or overhead projetor presentations. The classes will be planning with the aim to stimulate interest, reasoning and critical spirit of the students. In the applied theory classes the students will autonomous resolve the exercises. The laboratory classes will be executed by groups of students with the aim of developing laboratorial skills, using acquired competences. Weekly, there will be tutorials periods for discussion, doubts explanation and analysis of the problem resolutions made by the students.
Evaluation: Laboratorial works, with a minimum of 9.5 values (0 to 20 values) and 40% weight in the final evaluation. Final examination with a minimum of 9.5 values (0 to 20 values) and 60% weight in the final evaluation.

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For these basic contents to be correctly acquired by the students, it must be teaches in a solid and consistent approach. For that purpose it is necessary that basic concepts and mathematical developments be properly explained. Consequently, it is essential that in theoretical classes the fundamental concepts are exposed.
The acquired knowledge can be consolidate by solving relevant amount of exercises and practical problems, either by the teacher or by the student, which is a very important reason for the presence of significant number of practical classes. Finally, the concepts consolidation can be made through laboratorial experiments, results analyses and reports. This fundamental part is achieved in this curricular unity and also in laboratory curricular unit occurring in the same semester.