

25255 - Chemical analysis in the environment

Syllabus Information

Academic Year: 2020/21

Subject: 25255 - Chemical analysis in the environment

Faculty / School: 201 - Escuela Politécnica Superior

Degree: 277 - Degree in Environmental Sciences
571 - Degree in Environmental Sciences

ECTS: 6.0

Year: 1

Semester: Second Four-month period

Subject Type: 277 - Optional

571 - Compulsory

Module: ---

1.General information

1.1.Aims of the course

1.2.Context and importance of this course in the degree

1.3.Recommendations to take this course

2.Learning goals

2.1.Competences

2.2.Learning goals

2.3.Importance of learning goals

3.Assessment (1st and 2nd call)

3.1.Assessment tasks (description of tasks, marking system and assessment criteria)

4.Methodology, learning tasks, syllabus and resources

4.1.Methodological overview

The methodology followed in this course is oriented towards the achievement of the learning objectives. A wide range of teaching and learning tasks are implemented, such as lectures, problem-solving sessions, laboratory sessions, tutorials and autonomous work and study.

4.2.Learning tasks

This course is organized as follows:

- **Lectures** (25 hours) that consist of lectures aimed at students to acquire theoretical knowledge and basic principles of Instrumental Analysis in the environment. Sessions will be held interactively with students, discussing with them the aspects that are more difficult or especially interesting for each topic. "Case studies" that allow students to consolidate the theoretical concepts and establish the applicability of chemical analysis in solving environmental problems will be presented. All necessary documentation to track the subject will be available on the Moodle platform.
- **Problem-solving sessions** (5 hours) which will be inserted in the calendar as progress is made in the content of the course to be seen in the lectures. Analytical numerical problems and environmental problems related to sampling, sample treatment, etc., to be solved by the students: two types of problems will arise. Class will resolve

some of the problems raised type, the rest of the student must solve the non-contact hours.

- **Laboratory sessions** (30 hours). According to academic calendar 15 sessions of two hours each will be made. various practices on determination of pollutants in real samples that favor the consolidation of theoretical knowledge will be developed. Depending on the number of students and depending on the type of practice, it will work in pairs or in groups of 4-5 students. Each student must have its own laboratory notebook and also must go to the laboratory with the script of practices studied and resolved some preliminary questions. All practice sessions attendance is recommended. At the end of each session, students will present the results for the teacher to deliver it fixed in the next practice session. To achieve the goals of the ODS, the following complementary activity is proposed: The practice script will provide an annex with a list of the most important chemical reagents to be used in the laboratory practices together with the link to download the safety data sheets of these reagents for the prevention of risks during their handling. In each of the practices, emphasis will be placed on the importance of handling each reagent correctly, its hazardousness (toxicity) to health and the environment, and therefore having basic knowledge of how to manage the waste generated in the teaching laboratory (for example: differentiating between reagents that can be poured directly down the drain from those that require collection in carafes, minimising the amount of reagents to be used).
- **Tutorials** . Attendance at tutorials to clarify any doubts of more individualized students is recommended. In them, the teacher can do a better and closer monitoring of the student work orientating the most appropriate methods.
- **Autonomous work and study**. They consist of reading and understanding the material of theoretical knowledge and resolution of exercises during sessions of theory and practice. These activities will be conducted with full freedom time.

4.3.Syllabus

This course will address the following topics:

Lectures

- SECTION 1. INTRODUCTION TO ENVIRONMENTAL ANALYTICAL CHEMISTRY
 - General Concepts of analytical chemistry. Stages of the analytical process. Introduction to Volumetric Analysis. Problems.
- SECTION 2. SAMPLE TAKING AND SAMPLE TREATMENT
 - Methods and techniques of water, soil and air sampling. Methods of extraction and break down.
- SECTION 3. QUANTIFICATION AND TREATING DATA
 - Calibration. Evaluating results. Errors in analytical chemistry. Problems.
- SECTION 4- OPTICAL METHODS OF ANALYSIS
 - Introduction to Spectroscopic techniques. Molecular Spectroscopy UV-VIS. Atomic Spectroscopic
- SECTION 5- CHROMATOGRAPHIC METHODS
 - Introduction to Instrumental Chromatography. Gas Chromatography. Liquid Chromatography.
- METHODS 6- ELECTROCHEMISTRY
 - Potentiometric Techniques. Ion-Selective Electrodes

Practice sessions

- Practice 1. Presentation and introduction to work in a laboratory of Analytical Chemical
- Practice 2-4. Determination of physicochemical parameters in drinking water Determining the alkalinity, chloride, hardness and conductivity
 - Applying acid base volumetrics, of precipitations and complexometrics
- Practice 5. Determining organic matter in soils
 - Applying Redox titration
- Practice 6. Determining nitrates in samples of drinking water
 - Applying Spectrometry of Molecular Absorption in the UV Practice 7.-Determining phosphorous in urban sewage
 - Applying Spectrometry of Molecular Absorption in the Visible Range
- Practice 8-9. Determinación de metales en lodos de depuradora
 - Optimizing the method of acid digestion
 - Applying Spectrometry of Atomic Absorption
- Practice 10-12. Determining pesticides present in water samples
 - Extracting with organic solvents
 - Applying Gas Chromatography

- Practice 13. Separating polar organic compounds using HPLC

4.4. Course planning and calendar

The subject consists of 30 hours of lectures and 30 hours dedicated to practice sessions in the laboratory that will be held regularly during the 15-week semester (2 hours theory and 2 hours of practice / week).

Further information concerning the timetable, classroom, office hours, assessment dates and other details regarding this course will be provided on the first day of class or please refer to the Faculty of Sciences website and Moodle.

Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
<i>Activity</i>																
Theory	2	2	1	1	1	2	2		2	2	2	1	1	2	2	2
Problems			1	1	1							1	1			
Laboratory classes	2	2	2	2	2	2	2		2	2	2	2	2	2	2	2
Group work																
Visits																
Tutorial																
Evaluation							1									1
<i>Independent learning</i>																
Independent learning	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Group work																
TOTAL	8	8	8	8	8	8	9	4	8	8	8	8	8	8	8	9

4.5. Bibliography and recommended resources

- BB** Harris, Daniel C. Análisis químico cuantitativo / Daniel C. Harris. 2a ed. Barcelona [etc.] : Reverté, D.L. 2001
- BB** Skoog, Douglas A. Química analítica / Douglas A. Skoog...[et al.] ; traducción María del Carmen Ramírez Medeles ; revisión técnica Luz Beatriz Santos Aquino. 7a. ed. México [etc.] : McGraw-Hill, cop. 2000
- BC** Aguas / PANREAC. Barcelona [etc.] : Montplet & Esteban, 1983
- BC** Análisis químico de aguas residuales / Jesús Beltrán de Heredia Alonso ... [et al.]. [Badajoz] : Universidad de Extremadura, Instituto de Ciencias de la Educación : Abecedario, 2004
- BC** Faithfull, Nigel T. Métodos [de] análisis químico agrícola : manual práctico / Nigel T. Faithfull ; traducción de Ana Cristina Ferrando Navarro ; revisión de Miguel Ángel Usón Finkenzeller. Zaragoza : Acribia, 2005
- BC** Jackson, M.L. Análisis químico de suelos / M.L. Jackson ; traducido del inglés americano por José Beltrán Martínez. [4a. ed.] Barcelona : Omega, 1982
- BC** Marr, Iain L. Química analítica del medio ambiente / Iain L. Marr, Malcolm S. Cresser, José L. Gómez Ariza ; [versión española, José Luis Gómez Ariza]. Sevilla : Universidad, D.L. 1989
- BC** Métodos normalizados : para el análisis de aguas potables y residuales / preparado y publicado conjuntamente por American Public Health Association, American Water Works Association, Water Pollution control Federation ; directora de edición Mary Ann H. Franson. Madrid : Díaz de Santos, D.L. 1992
- BC** Métodos oficiales de análisis / [publicados por el] Ministerio de Agricultura, Pesca y Alimentación, Dirección General de Política Alimentaria. Madrid : Secretaría General Técnica, Ministerio de Agricultura, Pesca y Alimentación, 1993-1994

BC Warner, Peter O. Análisis de los contaminantes del aire / Peter O. Warner ; [traducido por E. Cadenas].
Madrid : Paraninfo, 1981

The updated recommended bibliography can be consulted in:
<http://psfunizar10.unizar.es/br13/egAsignaturas.php?codigo=25255>