COURSE DATA

Data Subject	
Code	33118
Name	Analysis techniques in environmental chemistry
Cycle	Grade
ECTS Credits	6.0
Academic year	2022 - 2023

Study (s)

Degree	Center	Acad. year	Period
1104 - Degree in Environmental Sciences	Faculty of Biological Sciences	4	First term

Subject-matter

Degree	Subject-matter	Character
1104 - Degree in Environmental Sciences	186 - Analysis techniques in environmental chemistry	Optional

Coordination

Name	Department
PERIS VICENTE, JUAN	310 - Analytical Chemistry

SUMMARY

Chemical contamination is one of the main problems affecting the environment. This course examines the analytical techniques for common chemical contaminants. The contents are "Sampling of contaminants. Analytical techniques for the quantification of contaminants. Control networks" The aims is to provide a comprehensive overview of the analytical process of chemical pollutants and the factors affecting the quality and reliability of results. The sampling procedures of pollutants in the atmosphere, water and soil is studied. The treatment methods of the sample and separation of interference are also explained. The most common analytical techniques for monitoring chemical contaminants and their most significant applications are reviewed. Finally, The analytical underpinnings for the “in situ” control and monitoring of pollutants are studied. In the laboratory different analytical techniques for determining chemical contaminants are applied. Emphasis is also placed in the writing and presenting analytical reports.

The primary objective of the course is to acquire basic knowledge about the different analytical techniques, classical and instrumental, usually used in environmental analysis. In addition, this course complements other subjects such as "Assessment of Environmental Pollution", "Environmental Pollution" and "Management and industrial effluent treatment."

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

There are no specified enrollment restrictions with other subjects of the curriculum.

Other requirements

Although not specified enrollment restrictions with other subjects of the curriculum, to successfully address the subject, it is necessary that the student knows the basics of nomenclature and chemical formula, set of chemical reactions, stoichiometric calculations elementary math and algebra logarithms and exponentials management

OUTCOMES

1104 - Degree in Environmental Sciences

- Saber manejar técnicas instrumentales de análisis y cuantificación de contaminantes.
- Saber diseñar planes de muestreo de contaminantes y redes de control.

LEARNING OUTCOMES

- Work involving practical problem solving, data analysis and critical interpretation.
- Preparation and presentation of short seminars, individual and small group, involving searches, integrating information in Spanish and English, analysis and synthesis of it, in public oral presentation and defense of it.
- Use of bibliographic databases in electronic form, access to magazines and other printed and electronic format, and use of at least one presentation software.
- Resolution of problems involving data collection in qualitative and quantitative laboratory analysis of these data and their interpretation in a theoretical context.
- Knowledge of principles and methodology of the major analytical techniques applied in environmental chemistry, including its practical application in the laboratory.
- Knowledge of the procedures associated with network design and operation of pollution control.

Regarding the Sustainable Development Goals (SDGs), it is expected that students will be able to know in this subject how to apply the knowledge learned to guarantee an inclusive, equitable, and quality education and promote learning opportunities for everyone (SDG 4), to acquire a special sensitivity for sustainable management of water (SDG 6), raw materials and energy sources (SDG 7), as well as for an environmentally friendly and sustainable development (SDGs 11 , 12, 13, 14 and 15), in addition to being able to design, select and/or develop efficient chemical products, processes and/or analytical methodologies (SDG 7) that minimize their impact on the environment (SDGs 14 and 15), using alternative raw materials and reducing wastes (SDG 11).

DESCRIPTION OF CONTENTS

1. The analytical process

Characteristics and importance of analytical chemistry. Classification analytical techniques. Stages of chemical analysis. Traceability of results. Calibration and reference materials. Quality control, standardization and accreditation of analytical laboratories Choice and validation of the method of analysis.

2. Collection and processing of the sample

Sampling and sampling plan. Gas samples. Liquid samples. Solid samples. Preliminary operations in the treatment of the sample. Subsampling. Reagents for the treatment of the sample. Sample treatments for the determination of inorganic substances. Sample treatments for determining organic substances

3. Titrimetric and gravimetric analysis

Introduction to titrimetry: calculations at the point of equivalence. Standard solutions and standard substances parent type. Detection of the equivalence point: indicators, endpoint assessment and error, instrumental detection. Volumetric glassware. Classification of titrations. Applications in environmental analysis. Introduction to gravimetric analysis

4. Introduction to instrumental analysis

Introduction. General characteristics of analytical instrumentation. Classification of instrumental techniques. Measurement of the observable signal: linear calibration. Calibration using the standard addition method. Internal standard method.

5. Molecular Spectroscopy

Electromagnetic radiation. Theory of absorption of radiation transmittance, absorbance and the Beer-Lambert law. Molecular species that absorb UV-VIS. Instrumentation. Fluorescence spectroscopy. Infrared spectroscopy.

6. Atomic spectroscopy

Absorption, emission and atomic fluorescence. Absorption and emission spectra of atoms. Atomization techniques. Interference. Instrumentation. Applications.

7. Introduction to the electroanalytical methods

Electrochemical cells. Nernst equation. Liquid junction potential. Current in the electrochemical cell. Classification of electroanalytical techniques. Basic instrumentation. Potentiometric methods. Voltamperometric techniques. Applications.

8. Introduction to chromatographic methods

Basic Principles. Classification of chromatographic methods. Equilibrium distribution and migration velocity. Chromatographic parameters. Principles of gas chromatography. Types of columns. Basic instrumentation. Fundamentals of liquid chromatography. Instrumentation for HPLC. Mobile phase and separation control. Methods and applications of liquid chromatography. Coupling with mass spectrometry: mass spectrometry, mass spectra, instrumental components, applications.

9. Chemical contaminant monitoring

Control networks. Control of air pollution: Valencian network monitoring and control of air pollution. Network control and monitoring of water quality. Network control of radioactive contamination: environmental monitoring system in Spain. This topic will be replaced by the performance of a work, which will be evaluated in the part of Tutorials.

10. Environmental Chemical Analysis Laboratory

- Sampling of soil, water and leaves.
- Volumetric determination of the permanganate index of water (ISO 8467).
- Determination of phosphorus in soil.
- Determination of potassium in leaves.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	36,00	100
Laboratory practices	15,00	100
Computer classroom practice	6,00	100
Tutorials	3,00	100
Development of group work	10,00	0
Development of individual work	10,00	0
Study and independent work	20,00	0
Readings supplementary material	6,00	0
Preparation of evaluation activities	4,00	0
Preparing lectures	16,00	0

Preparation of practical classes and problem	12,00	0
Resolution of case studies	12,00	0
TOTAL	**150,00**	

TEACHING METHODOLOGY

In the lectures the teacher will teach the key concepts of each topic and solve problems on issues related. Students will have the necessary material previously in the virtual classroom. Also taught seminars in which students solve exercises of each topic.

Studens will perform data processing in the dry-lab, and a memory will be presented and evaluated.

Tutorials will serve to track personally the students progress

In the labs will be held and supervised practical work related to the experimental techniques applied to major environmental pollutants. Students will present a report of each practice describing the activity and results. This report will be evaluated.

Non attendance activities may include the resolution of problems and issues that require bibliographic information on Analytical Chemistry Applied to the Environment.

EVALUATION

FIRST ROUND

The evaluation will be performed by weighting the different sections:

Theory (50%): There will be a written examination that may consist of theoretical questions and numerical exercises similar to those carried out in class.

Computer lab (10%): The memory presented by the students and the work in the classroom will be evaluated.

Tutorials (15%): The proposed issues and problems submitted will be evaluated, and the alternative work for Item 9.

Laboratory (25%): An evaluation of the report submitted by the students, working in the laboratory and an oral examination. The percentages of each section are: Memory (15%), laboratory work (3.7%) and examination (6.3%).

The minimum score of the theory exam must be 4.5.

The final score needed to pass the course will be 5.0.

On the other hand, to request the advance of the examination of this course the student should keep in mind that it is mandatory having attended the laboratory activities.

SECOND ROUND

The evaluation will be performed by weighting the different sections as in the first evaluation:

The grades obtained in computer lab, tutoring and laboratory will be conserved for the second announcement. The minimum score of the theory exam must be 4.5.

REFERENCES

Basic

- Apuntes y material de la asignatura en el Aula Virtual
- M. A. Sogorb, E. Vilanova, Técnicas analíticas de contaminantes químicos, Ed. Díaz de Santos, 2004

Additional

- Skoog, D.A., West, D.M.,Holler, F.J., Crouch, S.R. Fundamentos de Química Analítica, Editorial Thomson. Octava Edición (2005).
- G. D. Christian, QUIMICA ANALITICA, 6ª ed., McGraw-Hill, 2010
- C. Camara, et al., Toma y tratamiento de muestras. Ed. Síntesis, Madrid 2002
- S.E. Manahan, Introducción a la Química Ambiental. Ed. Reverté, 2007.
- VV.AA., Química Analítica de los contaminantes medioambientales, CIEMAT, 2003.
- Analytical Chemistry 2.0 D. Harvey http://academic.depauw.edu/harvey_web/eText%20Project/AnalyticalChemistry2.0.html