COURSE DATA

DATA SUBJECT

Code: 36460
Name: Environmental Analytical Chemistry
Cycle: Undergraduate Studies
ECTS Credits: 4.5
Academic year: 2026-27

STUDY (S)

Degree	Center	Acad. year	Period
1110 - Degree in Chemistry	Facultat de Química	4	Second quarter

SUBJECT-MATTER

Degree	Subject-matter	Character
1110 - Degree in Chemistry	Analytic Chemistry Applied	ELECTIVES

COORDINATION

MORALES RUBIO ANGEL ENRIQUE

SUMMARY

The Analytical Environmental Chemistry course has been structured in twelve lessons that aim to provide an integrated view of the parameters of interest and contaminants present in the atmospheric, aquatic environment and in solid samples.

The first four lessons of the subject are an introduction to the basic aspects of analytical chemistry in environmental analysis, with special emphasis on the most dangerous organic and inorganic compounds and their effects on the environment.

The following 8 lessons focus on pollutants and their analysis depending on the environment in which they are located: i) Analysis of gases and aerosols in the atmosphere, ii) Physical-chemical characterization of waters and determination of specific compounds and iii) Analysis of solid samples, both soil and sediment and biota.

Regarding the Sustainable Development Goals (SDGs) in this course, students are expected to be able to apply the knowledge they have learned to contribute to ensuring inclusive, equitable, and quality education and to promote lifelong learning opportunities for all (SDG 4), to acquire a special sensitivity for the sustainable management of water (SDG 6), raw materials, and energy sources (SDG 7), as well as for sustainable and environmentally compatible development (SDGs 11, 12, 13, 14, and 15). Furthermore, they

are expected to be able to design, select, and/or develop efficient products, chemical processes, and/or analytical methodologies (SDG 7) that minimize their impact on the environment (SDGs 14 and 15), make use of alternative raw materials, and generate a smaller amount of waste (SDG 11).

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 enrollment restrictions have not been specified with other subjects of the curriculum, to successfully address the subject, it is necessary that the student knows, both the basis of the Analytical Chemistry courses and associated laboratories, and general concepts such as: i) Nomenclature and chemical formulation, ii) Adjustment of chemical reactions, iii) Elementary stoichiometric calculations, iv) Mathematical and statistical algebra applied to chemical analysis.

COMPETENCES / LEARNING OUTCOMES

1110 - Degree in Chemistry

Act autonomously in learning, making informed decisions in different contexts, forming judgements based on experimentation and analysis, and transferring knowledge to new situations.

At the end of the course, the student will be able to address new problems and develop strategies to solve them.

At the end of the course, the student will be able to apply metrology in chemical processes, including quality management.

At the end of the course, the student will be able to assess risks in the use of chemical substances and laboratory procedures.

At the end of the course, the student will be able to distinguish between qualitative and quantitative aspects of chemical problems.

At the end of the course, the student will be able to distinguish the principles, procedures and techniques used for the determination, separation, identification and characterisation of chemical compounds.

At the end of the course, the student will be able to identify chemical elements and compounds, including their production, structure, reactivity, properties and applications.

At the end of the course, the student will be able to identify the main types of chemical reactions and their key characteristics.

At the end of the course, the student will be able to implement sustainable and environmentally friendly methodologies.

At the end of the course, the student will be able to relate theory and experimentation.

At the end of the course, the student will be able to solve problems effectively.

At the end of the course, the student will demonstrate inductive and deductive reasoning skills.

At the end of the course, the student will demonstrate the ability to analyse, synthesise and apply critical reasoning.

At the end of the course, the student will interpret the data from observations and measurements in the laboratory in terms of their significance and the theories that support them.

At the end of the course, the student will relate chemistry to other disciplines.

Capacidad de análisis, síntesis y razonamiento crítico en la aplicación del método científico.

Collaborate effectively in teams, assuming responsibilities and leadership roles and contributing to collective improvement and development.

Communicate effectively, both orally and in writing, adapting to the characteristics of the situation and the audience.

Comprender las particularidades contables que presenta la regulación jurídico-mercantil de las empresas, relacionando la legislación mercantil aplicable a los distintos tipos operaciones societarias con la contabilidad de los hechos económicos que se regulan. Aprender a relacionar las leyes mercantiles que se ocupan de los concursos de acreedores con la contabilidad, adquiriendo práctica en el manejo de determinados textos legales vigentes.

Contribute to the design, development and implementation of solutions that address social needs, taking the Sustainable Development Goals as a reference.

Demonstrate critical and self-critical reasoning within the field of study, considering aspects such as professional ethics, moral values and the social implications of the different activities undertaken.

Express oneself correctly, both orally and in writing, in any of the official languages of the Valencian Community.

Handle the instrumentation used in the different areas of chemistry.

Understand and recognise, from within the discipline, inequalities based on sex and gender in society; integrate different needs and preferences related to sex and gender into problem-solving and solution design.

DESCRIPTION OF CONTENTS

Contamination. Environmental patterns Environmental analysis: Objectives. Types of analysis, problems in

1. Analytical Chemistry and environment.

environmental analysis, global analytical procedure. Sampling and storage. Sample treatment Analysis methods. Analytical results

2. Environmental pollution.

Sources of contamination: Air pollution, water, soil and living beings. Classification of pollutants. Biogeochemical cycles. Bioaccumulation and biomagnification. Bioindicators of contamination and biomarkers.

3. Organic microcontaminants.

Introduction. Insecticides: organo-chlorinated, -phosphorus, carbamates. Herbicides: triazinics, phenoxy and others. Phenols Dioxins, PCBs and Furans. Polynuclear aromatic hydrocarbons (PAH's).

4. Inorganic contaminants. Metals

Introduction. Essential and toxic elements. Micronutrients: presence, sources, uses, levels, essentiality and toxicity. Trace elements: presence, sources, uses, levels, essentiality and toxicity.

5. The atmosphere.

Composition and characteristics of the atmosphere. Units of concentration. Types of atmospheric pollutants. Passive and active samplers. Determination of instantaneous concentrations and average concentrations.

6. Analysis of atmospheric gases.

Determination of CO, CO2, oxides of nitrogen, oxides of sulfur, ozone, ammonia, volatile organic compounds (hydrocarbons, CFC, ...).

7. Analysis of atmospheric aerosols.

Sources of contamination and sampling. Particle size (PM2.5, PM10). Determination of heavy metals. Determination of asbestos.

8. The hydrosphere.

Hydrological cycle and contamination. Types of waters. Quality parameters. Sample taking, storage and conservation.

9. Physical-chemical characterization I.

Organoleptic properties. Decantable and suspended material. Turbidity Redox potential. Electric conductivity. pH. Salinity. Hardness. Acidity. Alkalinity. Determination of major cationic (Na, K, Ca and Mg) and anionic compounds (Cl-, SO42-, NO3-, HCO3-)

10. Physical-chemical characterization II.

Determination of dissolved gases (Cl2, NH3, O2, Cl2). Determination of non-specific organic compounds: Total organic carbon (TOC), chemical oxygen demand (COD), biochemical oxygen demand (BOD), total oxygen demand (DOT).

11. Determination of specific compounds.

Non-toxic metals (Fe, Mn, Cu, Zn). Toxic metals (Cd, Cr, Pb, Hg, As). Organic compounds (Hydrocarbons, PAHs, pesticides, phenols, halomethanes, ...).

12. Analysis of solid samples.

Profile and classification of soils. Sources of contamination. Sample taking and preparation. Dissolution and extraction. Physical parameters. Nutrients Pollutants Analysis of plants. Analysis of animal tissues.

WORKLOAD

PRESENCIAL ACTIVITIES

Activity	Hours
Tutorials	7,00
Theory	38,00
Total hours	**45,00**

NON PRESENCIAL ACTIVITIES

Activity	Hours
Attendance at other activities	0,00
Individual or group project	19,00
Independent study and work	16,00

Preparation of lessons	18,50
Preparation for assessment activities	14,00
Resolution of case studies	0,00
Total hours	**67,50**

TEACHING METHODOLOGY

In theory classes the teacher will teach the key concepts of each subject and solve problems type in those subjects that require it. Students will have the necessary material previously in the virtual classroom.

In the seminars students will solve exercises and questions representative of each topic.

In the tutorials a personalized follow-up of the work and the progress of each student will be carried out.

The exercises and questions proposed to be carried out in a non-contact manner will be reviewed and resolved doubts about the subject taught or the preparation of group or individual work.

Non-contact activities may include the resolution of problems and issues that require search of bibliographic information about issues / aspects / topics related to the subject..

EVALUATION

The evaluation of student learning will take into account all the aspects exposed in the methodology section of this teaching guide.

FIRST CALL

Final score:

Part 1 - Activities proposed in the seminars: 20%

(Active participation: 10%, critical reports 5%, solving case studies: 5%)

Part 2 - Activities proposed in the tutorials: 15%

(Issues and problems proposed will be evaluated)

Part 3 - Written exam: 65%

(Theoretical questions and numerical exercises similar to those made in class)

The final grade will be the weighted average of the three parts. To be able to average, the minimum qualification in each of these three parts must be equal to or greater than 4.5. The minimum global grade to pass the subject is 5.0.

NOTE: The student may request in writing to be evaluated only with an exam.

This examination will be composed, in this case, of three parts. One of them will be identical to the exam that the rest of the students will take, it will be carried out simultaneously and will contribute 65% to the overall mark. The other two parts will be composed of a series of questions with which the competences that the rest of the students will have demonstrated will be evaluated through the realization of the activities proposed in seminars and tutorials.

SECOND CALL

In the second call the qualification will be obtained applying the same criteria as in the first call.

Students who failed any of the three parts of the evaluation in the first call must complete an examination of the part (s) not passed.

Final warning

Copying or plagiarism of any assignment that is part of the evaluation will make it impossible to pass the course, and the student will be subject to the appropriate disciplinary procedures.

Please note that, according to Article 13 d) of the University Student Statute (RD 1791/2010, December 30), "*it is the duty of a student to refrain from using or cooperating in fraudulent procedures in evaluation tests, in the work performed or in official University documents*".

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