Universidad de Navarra

Environmental chemistry (F. Ciencias)

Guía docente 2026-27

General information

This course applies chemical principles to the study of the different environmental spheres. The main objective is to highlight the role these principles play in the environment cycling of natural and man-made substances, in the proper functioning of ecosystems and in determining the impact of humanity's actions on natural processes. The course will cover a number of case studies to illustrate these principles, including climate change and carbon cycling, toxic chemicals and their impact on ecosystem and human health, and ozone and air pollution chemistry. It will be process-oriented, emphasizing the chemical tools needed to understand environmental problems and will have a strong quantitative component.

The main objectives of this subject are:

· To provide students with the knowledge necessary to understand the complex interactions that occur among the terrestrial, atmospheric, aquatic, living and anthropological systems that compose the Earth.

· To introduce students to the general concepts and fundamentals of environmental chemistry, including an understanding of chemicals and their effects on the environmental spheres.

· To provide students with the necessary tools for the proper assessment of environmental quality, showing them the most widely used sampling techniques and analysis methods.

· To raise student awareness of methods for the prevention and treatment of environmental pollution.

· To transmit an integrative view of environment pollution, showing it as a global problem that affects all us and in which each person is an active part in minimizing its losses.

- **Course title**: Environmental Chemistry
- **Module:** Environmental Technology
- **Year/Degree:** 1st, 3rd, 4th / Environmental Sciences'14, Biology'09, Chemistry'09
- **Semester:** 2nd
- **ECTS:** 6 ECTS (150 h)
- **Character:** Compulsory (Environmental Sciences and Bio/EnvSci), Optional (Biology and Chemistry)
- **Professor:** David Elustondo
- **Department:** Chemistry
- **Language:** English
- **Classroom / Timetable:** Room 35 / Monday 10:00-11:00 h; Thursday 12:00-14:00 h

LEARNING OUTCOMES (Competencies)

Competences of the Environmental Sciences Degree:

Specific competences:

CE1 Know the scientific basis needed to address the specific environmental training.

CE3 Describe the structure, physicochemical properties and reactivity of elements and compounds involved in biogeochemical processes.

CE4 Using laboratory techniques and instruments of scientific experimentation.

General and basic competences:

CB1 That students have demonstrated knowledge and understanding in a field of study that is on the basis of general secondary education, and is typically at a level which, although it is supported by advanced textbooks, includes some aspects that imply knowledge of the forefront of their field of study

CG2 Think in an integrated way and approach problems from different perspectives.

CG3 Having critical thinking.

Competences of the Biology Degree:

Specific competences:

CE6 Autonomously and permanently update the knowledge and integrate new discoveries in its proper context.

CE7 Understand, critically analyze, discuss, write and present scientific arguments, both in Spanish and English, as the language of reference in the scientific field.

CE17 Delve into issues related to the environment, in the field of biodiversity, functioning and management of ecosystems; biomedicine, at level of clinical and cytogenetic analyses; or other issues related to biology.

General and basic competences:

CG1 Plan and organize the time and manage the continuous training itself, updating the knowledge of innovations from science and know how to analyze future trends.

CG2 Think in an integrated way and approach problems from different perspectives. Have critical thinking. Provide solutions to problems in science.

CG3 Work in teams, select and choose the work methodology and the distribution of functions. Know how to listen and to speak with positive and constructive interventions.

CG4 Foster a sense of responsibility towards life, the environment and the ecosystem, with ethical sense. Search information, evaluate and analyze it, synthesize, summarize, communicate, cite and present papers.

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CB3 That students have the ability to gather and interpret relevant data (usually within their field of study) to issue judgments that include reflection on relevant social, scientific or ethical topics.

CB4 That students can transmit information, ideas and solutions to both specialist and non-specialist public.

PROGRAM

1. Introduction to Environmental Chemistry:

o Chemistry and the environment

o Human impact and pollution

2. Chemistry and the Anthrosphere:

o Matter and Cycles of Matter

o Anthrosphere and environmental chemistry

o Components of the anthrosphere

o Green Chemistry

3. Aquatic Chemistry:

o Water Acidity and water alkalinity

o Gases in Water

o Metals in Water

o Complexation and Chelation

o Solubility

o The Significance of Oxidation–Reduction

o Phase Interactions in Aquatic Chemistry

o Water Pollution

4. Atmospheric Chemistry:

o Importance of the Atmosphere

o Physical Characteristics of the Atmosphere

o Energy Transfer in the Atmosphere

o Global Climate and Microclimate

o Chemical and Photochemical Reactions in the Atmosphere

o Acid–Base Reactions in the Atmosphere

o Chemical Fate and Transport in the Atmosphere

o The endangered global atmosphere

5. Geochemistry:

o Geochemistry

o Groundwater in the geosphere

o Environmental aspects of the geosphere

o Effects of human activities

o Soil and agricultural environmental chemistry

o Acid#Base and Ion-Exchange reactions in soils

o Wastes and pollutants in soil

6. Chemical analysis:

o Chemical Analysis of Water and Wastewater

o Analysis of Wastes and Solids

o Analysis of the Atmosphere and Air Pollutants

o Analysis of Biological Materials and Xenobiotics

TEACHING ACTIVITIES

Face-to-face activities:

- Teaching throuhg lectures and seminars (45 h)
- Field trips (10 h): students will visit and experimental site where several environmental studies are being developed. Moreover, students will visit an environmental factory.
- Written exam (5 h)

Individual work:

- Homework exercises (15 h)
- Study of lectures (75 h)

ASSESSMENT

CONVOCATORIA ORDINARIA

The student's academic performance and overall quality of the course will be calculated on a weighted basis, taking into account the following criteria:

· Carrying out exercises and tests: 20%

· Theoretical part (70%): a final exam will be performed. It will include multiple-choice questions and problems

· Field work/answering questions (10%)

CONVOCATORIA EXTRAORDINARIA

HORARIOS DE ATENCIÓN

Dr David Elustondo (delusto@unav.es)

- Despacho 1100 Edificio Investigación Planta 1

Dr Yasser Morera (**ymorera@unav.es**)

- Despacho 1050 Edificio Investigación Planta 1

Dra Carolina Santamaría (**csanta@unav.es**)

- Despacho 0050 Edificio Investigación Planta 0

RECOMMENDED LITERATURE

· Teacher Notes: ADI

· "Química ambiental". Ed. Reverté, 2009. Find it in the Library y Localízalo en la Biblioteca (recurso electrónico)

· Cunnningham, W.P. and Woodworth Saigo, B. “Environmental Science and Global Concern”. Dubuque, I.A.: Wm. C. Brown Publishers, 2006. Find it in the Library

· Manahan, S.E. “Environmental Chemistry” (ninth edition). CR, Press, 2010. Find it in the Library y Localízalo en la Biblioteca

· Martín, A. y Santamaría, J.M. “Diccionario terminológico de Contaminación Ambiental”. Newbook ediciones, 1999. Find it in the Library (printed version) // Find it in the Library (electronic version)