# Course guide
# 2500214 - GEA0214 - Principles of Ecotoxicology and Environmental Analysis

**Last modified:** 01/10/2023

**Unit in charge:** Barcelona School of Civil Engineering
**Teaching unit:** 751 - DECA - Department of Civil and Environmental Engineering.

**Degree:** BACHELOR'S DEGREE IN ENVIRONMENTAL ENGINEERING (Syllabus 2020). (Compulsory subject).

**Academic year:** 2023 **ECTS Credits:** 6.0 **Languages:** Catalan

## LECTURER

**Coordinating lecturer:** PAULA FELICIDAD RODRIGUEZ ESCALES

**Others:** PAULA FELICIDAD RODRIGUEZ ESCALES

## DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

**Specific:**
14445. Recognize the biological bases and foundations of the plant and animal field in engineering: notions of genetics, biochemistry and metabolism, physiology, organisms and environment, population dynamics, flows of matter and energy and changes in ecosystems, biodiversity, principles of the kinetics of microbial growth and reactor theory.
14447. Obtain basic knowledge about the use and programming of computers, operating systems, databases and basic numerical calculation and applied to engineering.
14451. Apply the fundamental concepts of statistics and randomness of physical, social and economic phenomena, as well as uncertainty and decision-making techniques.
14452. Enhance the capacity of spatial vision and identify the techniques of graphic representation, topography, photogrammetry, cartography, remote sensing and Geographic Information systems.
14453. Describe and apply the techniques of analysis of physical, chemical and biological parameters; Integrate the experimental evidence found in field and / or laboratory data with the theoretical knowledge and interpret its results.
14454. Formulate the principles of fluid mechanics and the fundamentals of continuous medium mechanics.
14455. Identify the concepts and technical aspects linked to the conduit systems, both in pressure and in free sheet and apply them to the water supply transport networks; pumping systems; unit networks; separative networks; Avenues prevention systems in urban areas and analysis of tools for the recovery of altered river and coastal spaces.
14456. Describe the processes linked to the water cycle: atmospheric circulation and rain formation; rain transformation into runoff; and apply them to surface and underground hydrology associated with avenues risk, surface water pollution, aquifer management and groundwater pollution.

**Generical:**
14440. Identify, formulate and solve problems related to environmental engineering.
14441. Apply the functions of consulting, analysis, design, calculation, project, construction, maintenance, conservation and exploitation of any action in the territory in the field of environmental engineering.
14442. To use in any action in the territory proven methods and accredited technologies, in order to achieve the greatest efficiency respect for the environment and the protection of the safety and health of workers and users.

## TEACHING METHODOLOGY

The course consists of 2.3 hours per week of classroom activity (large size group) and 1.2 hours weekly with half the students (medium size group).

The 2.3 hours in the large size groups are devoted to theoretical lectures, in which the teacher presents the basic concepts and topics of the subject, shows examples and solves exercises.

The 1.2 hours in the medium size groups is devoted to solving practical problems with greater interaction with the students. The objective of these practical exercises is to consolidate the general and specific learning objectives.

The rest of weekly hours devoted to laboratory practice.

Support material in the form of a detailed teaching plan is provided using the virtual campus ATENEA: content, program of learning and assessment activities conducted and literature.

Although most of the sessions will be given in the language indicated, sessions supported by other occasional guest experts may be held in other languages.

## LEARNING OBJECTIVES OF THE SUBJECT

In this subject fundamental concepts of ecotoxicology or environmental toxicology, sources of contamination and main contaminants in urban and natural ecosystems and the destination of the contaminants will be addressed: excretion, transport, transfer (absorption, adsorption, mineralization ...) with emphasis on the environmental impact on the receiving ecosystem. The toxicity of different types of chemical and biological contaminants will be shown, as well as toxicokinetics and bioavailability. It will be taught how to monitor chemical and biological contaminants (bioindicators). Finally, aspects related to bioremediation, ecotoxicological risk assessment, toxicity tests, public health and epidemiology of analysis of physical-chemical and microbiological parameters of environmental qualitywill be shown.

1. Know the main classes of pollutants and their transfer in ecosystems: long-range movements and global transport.
2. Study metals and radioactive isotopes in contaminated ecosystems and organic pollutants in individuals and ecosystems.
3. Study the effects of pollutants on individual organisms: toxicity tests and biomarkers.

Principles of Ecotoxicology and Environmental Analysis. The main classes of pollutants and how they are transferred in ecosystems will be studied. Will be introduced students to organic pollutants in individuals and ecosystems and their effects on individual organisms.

## STUDY LOAD

| Type | Hours | Percentage |
|---|---|---|
| Self study | 90,0 | 60.00 |
| Hours medium group | 15,0 | 10.00 |
| Hours large group | 30,0 | 20.00 |
| Hours small group | 15,0 | 10.00 |

**Total learning time:** 150 h

## CONTENTS

### T1. Introduction to ecotoxicology and pollution

**Description:**
Introduction to the principles of ecotoxicology. Show students the importance of ecotoxicology and its application to their training. Differentiate the types of pollutants that can enter the environment. The different physicochemical properties that govern the fate of pollutants will be described. Different "emblematic" pollution cases will be explained, taking into account the different nature of the pollutants.
Describe the fate of the pollutant in an environmental system. The tools of environmental chemistry will be given to be able to understand and predict the fate of a pollutant in an environmental system.
Solving numerical problems that allow ava
These

**Specific objectives:**
- Understanding the importance of ecotoxicology.
- Know the most common pollutants - Know what their physical and chemical properties are - Understand how their properties can condition their fate
- Know the fate of the pollutant in an environmental system - Understand the distribution of pollution in systems in equilibrium - Know the patterns of fugacity
- Provide students with numerical tools for solving environmental pollution problems.
- Provide practical tools to calculate the fate of a compartment in the environment. - Know the most common pollutants. - Apply knowledge to a realistic practice. - Share and discuss the results with classmates.

**Full-or-part-time:** 43h 12m
Theory classes: 10h 30m
Practical classes: 3h 30m
Laboratory classes: 4h
Self study : 25h 12m

### T2. Toxicology of the individual

**Description:**
The basic concepts of toxicology will be described.
Describe the
Understand the bioaccumulation of pollutants. Understand the effects of bioaccumulation. Bioaccumulation models.
Quantitatively solve toxicology problems. Dose-response models, bioaccumulation models.

**Specific objectives:**
- To know the fundamentals of the toxicology of individuals. - Know the acute and chronic effects on individuals and how they are measured.
- Know how to measure the acute and serious effects on the individual
- Understand the processes of bioaccumulation. - Know how to quantify the processes of bioaccumulation.
- Provide students with quantitative tools to be able to solve toxicology problems.

**Full-or-part-time:** 28h 47m
Theory classes: 6h
Practical classes: 4h
Laboratory classes: 2h
Self study : 16h 47m

### T3. Ecotoxicology

**Description:**
Know the effect of a pollutant on the rate of degradation of a population.
Effects on populations and metapopulations
Problems of effects on populations and metapopulations
Effects on the community
Problems of effects in the community
The main biomarkers that can be monitored in a population will be described

**Specific objectives:**
- To know the effect of pollutants in a population. - Understand the impact of pollutants on population dynamics.
- Know the main biomarkers - Know how to implement and monitor the main biomarkers

**Full-or-part-time:** 33h 36m
Theory classes: 10h
Practical classes: 4h
Self study : 19h 36m

### T4. Methods for assessing ecotoxicological impacts

**Description:**
C
The tools to measure toxicological impacts on populations will be presented
Know how to assess the risk in the ecosystem and what are the legal tools to do so.

**Specific objectives:**
- To know the methodologies that allow to characterize the toxicological impacts in the individual
- To know how to implement the tools to be able to measure the toxicological impact in populations
- Know how to implement the correct methodology to determine the risk in the ecosystem - Know the existing legal resources

**Full-or-part-time:** 14h 23m
Theory classes: 6h
Self study : 8h 23m

### Research project

**Description:**
Evaluate the last two topics of the subject

**Specific objectives:**
- Provide students with methodological tools to assess an ecotoxicological risk

**Full-or-part-time:** 9h 36m
Practical classes: 2h
Laboratory classes: 2h
Self study : 5h 36m

### Assessment

**Full-or-part-time:** 9h 36m
Laboratory classes: 4h
Self study : 5h 36m

**Practices**

**Description:**
We will visit the facilities of an ecotechnological research center in Spain (CSIC-IDAEA). Students will interact with researchers and see the direct application of many of the knowledge acquired during the course.

**Specific objectives:**
- Know a research center - See the applicability of the knowledge acquired

**Full-or-part-time:** 4h 48m
Laboratory classes: 2h
Self study : 2h 48m

## GRADING SYSTEM

The subject's grade is obtained from the average of the different assessable activities within the continuous assessment: exams (65%), continuous delivery of exercises (5%), practice (15%) and final work the subject (15%). The continuous assessment will consist of doing the different activities and the partial exams. There will be two exams throughout the course (partial 1 and final exam). If the grade in part 1 is higher than 3.0, the final exam will only include the topics not included in part 1. If you have less than a 3.0, the final exam will be for the entire subject. The assessment tests (exams) consist of a part with questions about concepts associated with the learning objectives of the subject in terms of knowledge or understanding, and a set of application exercises. Each part will be worth 50%. Re-evaluation (RE) Criteria for qualification and admission to the re-evaluation (Re): Students suspended in the ordinary evaluation who have regularly submitted to the evaluation tests of the suspended subject will have the option to take a re-evaluation test in the period set in the calendar academic Students who have already passed or students classified as not present or who have not submitted all the exercises/problems (Pr) and assignments and reports (Tr) will not be able to take the revaluation test of a subject The re-evaluation (RE) will consist of a single exam that covers the entire content of the course. The maximum grade for the reassessment will be five (5.0) and the final grade for the course will be the highest grade between the continuous assessment and the reassessment exam, i.e. MAX(EO/RE). The non-attendance of a student called to the re-evaluation test, held in the fixed period, cannot give rise to the completion of another test with a later date. Extraordinary assessments will be carried out for those students who, due to accredited force majeure, have not been able to take any of the continuous assessment tests. These tests must be authorized by the corresponding head of studies, at the request of the teacher responsible for the subject, and will be carried out within the corresponding teaching period.

## EXAMINATION RULES.

If any of the laboratory or continuous assessment activities are not completed in the scheduled period, it will be considered as a zero score. The tests will be carried out individually, with test-type questions that can be theoretical or problem-type questions. The exams may include short questions to be developed by the students and exercises to be solved. The first part takes away subject matter as long as the score is above 3. In case of re-evaluation, the final grade will be a maximum of 5.0, if the exam grade is lower than 5.0, the final grade will be the value maximum between the course mark and the re-evaluation mark.

## BIBLIOGRAPHY

**Basic:**
- Newman, M.C. Fundamentals of ecotoxicology: the science of pollution. 5th ed. Boca Raton: CRC Press, 2020. ISBN 9780815354024.
- Walker, C.H.; Hopkin, S.P.; Sibly, R.M.; Peakball, D.B.. Principels of ecotoxicology. 4th ed. Boca Raton, FL: CRC Press, 2012. ISBN 9781439862667.
- Schwarzenbach, R.P.; Gschwend, P.M.; Imboden, D.M. Environmental organic chemistry. Third edition. Hoboken, New Jersey: Published by John Wiley & Sons, 2017. ISBN 9781118767238.