

# Laboratory of Environmental Engineering (250681)

## General Information

|                    |  |
|--------------------|--|
| <b>School</b>      | ETSECCPB   |
| <b>Departments</b> | Institut de Tècniques Energètiques (INTE)              |
| <b>Credits</b>     | 5.0 ECTS   |
| <b>Programs</b>    | MÀSTER UNIVERSITARI EN ENGINYERIA AMBIENTAL (pla 2014) |
| <b>Course</b>      | 2024/25  |

## Main teaching language at each group

- Group 10ES2 Spanish (Q2)

## Faculty

Responsible Faculty: Mònica Reig I Amat  
Faculty: Adriana Farran Marsa, Mònica Reig I Amat

## Objectives of Education

CE01 - Apply scientific concepts to environmental problems and their correlation with technological concepts.

CE02 - Analyze systems, environmental problems and their resolution using models and evaluate them.

CE03 - Acquire basic skills of laboratory work and identify the methods and instrumentation for the determination of parameters relevant to the analysis of environmental problems.

Very aware of the structure of land, water and artificial ecosystems and their interactions.

Meet the ecology and the cycling of elements.

Meet the major environmental problems globally.

Analyzes energy bases, stoichiometric and kinetic of different processes.

Modeling process and quantifies the performance and efficiency of systems.

Determines the basis of environmental hazards to human health and ecosystems.

Apply material balances and energy to environmental problems.

Interprets water-rock and water - air interactions using thermodynamic and kinetic methods.

Meet the pollutants and identify their impact.

Learn the basics of how the atmosphere and applies them in maintaining air quality.

Learn the basics of climate and discusses the implications of current climate change.

Conceptualized an environmental problem described by equations and poses analytical or numerical solution.

Identifies the codes you need to solve a problem as conceptualized.

Recognizes the spatial and temporal scales required to resolve the problem.

Is familiar with solutions to problems relating to dynamical systems.

Learn about simple solutions to problems advection- dispersion - reaction.

Recognizes the existence of uncertainty in the parameters of the equations and is capable of performing an uncertainty analysis and sensitivity.

Learn methods for information and action on various parameters or variables.

Understand that any measure inherently carries an associated error and is able to work with them.

It is critical to the values reported by others when the measurement method is not specified.

He has worked in the laboratory measurement of some parameters of environmental interest.

Measuring environmental data:

Methods of measurement "in situ".

Sampling, instrumentation.

Top Measures in Environmental Engineering.

Escola de Camins

Data processing:

Orders of magnitude.

Measures usual statistics.

Errors.

Transmission of measurement errors.

Determination of parameters:

Quality of water supply.

Engineering of wastewater and sanitation systems.

Contamination of soil and groundwater.

Air pollution.

Emission / absorption.

Noise pollution.

CE01 - Apply scientific concepts to environmental problems and their correlation with technological concepts. CE02 - Analyze systems, environmental problems and their resolution through models, as well as evaluate them. CE03 - Acquire basic skills in laboratory work and identify the methods and instrumentation for the determination of relevant parameters for the analysis of environmental problems. Get to know the great environmental problems at the global level. Get to know the pollutants and identify their impacts. Conceptualize an environmental problem, describe it by means of equations and raise its analytical or numerical resolution. Identify the codes you need to solve an already conceptual problem. Recognize the spatial and temporal scales necessary to solve the problem. Recognize the existence of uncertainty in the parameters of the equations and is able to perform an analysis of uncertainty and sensitivity. Get to know the methods to obtain information and measurements on various parameters or variables. He understands that every measure inherently involves an associated error and is able to work with the same. It is critical to the values brought by others when the measurement method is not specified. He has worked in the laboratory to measure some parameters of environmental interest. Measurement

## Total hours of student work

|                     |                    | Hours  | Percentage |
|---------------------|--------------------|--------|------------|
| Supervised Learning | Large group        | 25.5 h | 56.67 %    |
|                     | Medium group       | 9.75 h | 21.67 %    |
|                     | Laboratory classes | 9.75 h | 21.67 %    |
|                     | Guided Activities  | 0.0 h  | 0.00 %     |
| Self Study          |                    | 80.0 h |            |

## Contents

### Introduction

Theoretical session explaining the organization of the course, the basic safety rules in a laboratory chemical and precautions in handling reagents and use of the material volume. It also explains the treatment of laboratory waste for proper environmental management.

### Basic concepts on chemical analysis

Sessions theoretical consolidation and review of basic concepts of chemical analysis: \* Definition and classification of different chemical analysis techniques. Quality parameters of methods and instruments. Calibration methods. External calibration pattern. Adding standard. \* classic analysis techniques. Theoretical basis of volumes and acid-base complexométriques. Logarithmic diagrams and titration curves. \* instrumental analysis techniques. Fundamentals of optical absorption methods: molecular absorption spectrometry UV-Vis; atomic absorption spectrometry. Electrochemical methods: potentiometry. Introduction to Chromatography: Liquid Chromatography.

### Laboratory of chemical environmental analysis

Determination: \* Alkalinity by acid-base titration. \* pH and conductivity by electrochemical methods.

\* Hardness determinations by complexometric titration.

\* Determination of organic compounds (phenols) by molecular absorption spectrometry.  
Determination: \* Metals by atomic absorption spectrometry.  
Determination: Inorganic anions by liquid chromatography  
- Determination of sulphates by visible spectrophotometry

## **Presentation and discussion of results**

Each group presents the results obtained, their meaning is discussed among all and the results of the different groups are compared

## **Visit companies in the sector**

Visit to the Besòs WWTP  
Visit Ecoparc

## **Assessment test**

## **Activities**

### **Laboratory reports**

Each group must deliver a report of the work done after each session. All members of the same group will have the same qualification. There are enhancement option: reports deemed deficient will be returned to students for correction. The evaluation of these reports represents 75% of the final grade.

### **Dedication**

6h

## **Teaching Methodology**

The course is highly experimental and is based on a methodology focusing on active learning by students.

The course is planned for which it is performed in sessions of three hours, in which combine theory and practice. In lectures expose the concepts, methods and fundamentals necessary to perform laboratory work. In the practice sessions are performed experiments related to water treatment processes and other related to the application of the most common methods of environmental analysis laboratories controlling inorganic and organic compounds.

The sessions dedicated to water treatment systems consist of one hour of lecture and two hours of practice. In the case of dedicated methods of analysis are two lectures in the classroom and five initial sessions totally experimental laboratory.

At the beginning of the course will be given a script of practices. The practical classes arise in groups but for that student participation is active. During these sessions, teachers will promote the approach of issues, situations or differential discussions by the teacher. At the end of the session each group will make a technical report and practice must answer a series of questions concerning the data and experimental results, which will allow reflecting on what did and lay knowledge.

It is obligatory to attend the practical classes with lab coat. Laboratory work will be provided with appropriate security measures.

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.

To do the laboratory practices you need the following personal protective equipment (PPE):

- \* White lab coat UPC Chemical
- \* Safety glasses

## Grading Rules

*(\*) The evaluation calendar and grading rules will be approved before the start of the course.*

The rating will be obtained from the ratings of lab activities (75%) and the assessment of theoretical knowledge (25%)

The rating is the average teaching laboratory reports made by each laboratory sessions.

The evaluation tests of knowledge consist on issues concepts associated with learning objectives regarding subject knowledge and understanding, and a set of application exercises.

## Test Rules

To pass the course must have attended all the laboratory sessions have been completed and have submitted all the reports of practices, and must have passed the exam.

## Office Hours

By appointment

## Bibliography

### Basic

- AWWA-APHA-WEF. [Standard methods for the examination of water and wastewater](#). 23rd ed. Washington, D.C.: American Public Health Association, 2017. ISBN 9780875532875.
- Manahan, S.E. [Environmental chemistry](#). 9th ed. Boca Raton: Taylor & Francis, 2010. ISBN 9781420059205.
- Droste, R.L. [Theory and practice of water and wastewater treatment](#). 2nd ed. New York: J. Wiley, 2019. ISBN 9781119312376.
- Harris, D.C. [Quantitative chemical analysis](#). 9th ed. New York: W. H. Freeman, 2015. ISBN 9781464135385.

## Resources

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You can buy them at UPC Shop ([upc-shop.com](http://upc-shop.com)) or any specialty store."

Escola de Camins

