

Degree programme	Type	Course
Environmental Sciences	OP	4

Contact lecturer

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Teaching staff

Muntsa Roca Marti

Group languages

You can consult this information at the [end](#) of the document.

Prerequisites

None.

Objectives

Environmental tracers are isotopes, elements, or compounds-natural or artificial-widely distributed in the environment and used to model or quantify various environmental processes. The aim of this course is to provide a foundational understanding of the use of environmental tracers, whether stable or radioactive, and their application in fields such as hydrology, geology, ecology, and oceanography. It will be explained how variations in the distribution of these elements and their isotopic composition in various materials can be used to determine sources (origin), timescales (dating), transformations, and transport linked to environmental processes.

Environmental tracers will be presented as essential tools for understanding how different environmental compartments (atmosphere, biosphere, hydrosphere, etc.) function-both today and for reconstructing past conditions. The course will also highlight the importance of tracers in the development of sustainable management policies aimed at understanding, managing, and protecting various ecosystems.

Learning outcomes

- CM36 (Incorporate the use of environmental tracers or basic analytical techniques into the characterisation of specific processes of hydrology, oceanography, or pollutant dispersion.) Incorporate the use of environmental tracers or basic analytical techniques into the characterisation of specific processes of hydrology, oceanography, or pollutant dispersion.
- CM39 (Transmit general scientific information associated with an environmental problem to a general audience appropriately.) Transmit general scientific information associated with an environmental problem to a general audience appropriately.

- KM46 (Identify the most important chemical and geological processes in the different environmental compartments (hydrosphere, soil and atmosphere).) Identify the most important chemical and geological processes in the different environmental compartments (hydrosphere, soil and atmosphere).
- KM47 (Recognise the way in which human activity has an impact on the function of physical vectors (water, soil, oceans, atmosphere) in the natural environment.) Recognise the way in which human activity has an impact on the function of physical vectors (water, soil, oceans, atmosphere) in the natural environment.
- KM49 (Recognise the techniques and tools for sampling, analysis and environmental tracers.) Recognise the techniques and tools for sampling, analysis and environmental tracers.
- SM47 (Analyse changes in the physical environment caused by natural or anthropogenic action based on the data available.) Analyse changes in the physical environment caused by natural or anthropogenic action based on the data available.
- SM48 (Apply the main stages of the analytical procedure, including the collection and analysis of samples, for the study of the physical environment.) Apply the main stages of the analytical procedure, including the collection and analysis of samples, for the study of the physical environment.

Contents

Part 1: Introduction to Environmental Tracers

- Nuclear and atomic structure
- Isotopic fractionation and equilibrium
- Radioactive decay and secular equilibrium
- Types of tracers (radioactive, stable, biomarkers, etc.)
- Archives (sediments, ice, corals, trees, pollen, etc.)

Part 2: Environmental Applications of Tracers

- Hydrology: characterization of groundwater ages and sources
- Paleoclimatology: dating and climate reconstruction
- Oceanography: ocean circulation, biological carbon pump
- Ecology: food webs and nutrient origins
- Forensics: identification of contaminant sources in the environment

Learning activities and methodology

Title	Hours	ECTS	Learning outcomes
Preparation of work, resolution of cases, reading and study of received information	95	3.8	CM36, KM46, KM47, KM49, SM47, SM48
Tutoring sessions	2	0.08	CM36, KM46, KM47
Lectures	35	1.4	CM36, CM39, KM46, KM47, KM49, SM47
Practical sessions	7	0.28	CM36, SM47, SM48
Laboratory practices	6	0.24	CM36, KM49, SM47, SM48

The course consists of theoretical classes (lectures), practical problem-solving sessions, and laboratory exercises.

The theoretical program will be delivered mainly by the teaching staff, complemented by animations and videos related to the topics covered in class. All materials used by instructors will be available on the virtual platform.

The theoretical part will also include seminars by expert professionals in environmental tracers from various disciplines. Through these sessions, students acquire the foundational knowledge of the course, which they must reinforce with personal study of the topics presented.

In the problem-solving sessions, classroom exercises on the application of environmental tracers will be tackled, encouraging active participation and experiential learning. The course also includes mandatory laboratory practicals where students will identify the basic characteristics of environmental tracers.

Finally, the course will involve a group project on the specific application of an environmental tracer, to be delivered as an oral presentation.

Annotation: within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Assessment

Continuous assessment activities

Title	Weight	Hours	ECTS	Learning outcomes
Midterm exam 1	35	2	0.08	CM36, KM46, KM47, KM49, SM47, SM48
Midterm exam 2	35	2	0.08	CM36, KM46, KM47, KM49, SM47, SM48
Communication of group work	30	1	0.04	CM36, CM39, KM46, KM47, SM47, SM48

70 % of the final grade is calculated based on the average of the scores from two independent midterm exams. Each exam will include theoretical and practical questions.

The remaining 30 % of the final grade corresponds to the grade for the group presentation on the application of environmental tracers.

To pass the course, the overall average must be at least 5 out of 10, and each midterm exam score must be at least 4 out of 10. To be eligible for evaluation, the student must have attended the laboratory sessions and submitted the group project.

Retake: Students who do not reach the minimum passing score may take a make-up exam for one or both midterms, depending on which scores need improvement. The group project grade is not eligible for retake.

Students who do not attend any assessment components (midterm exams and group project) will receive a final grade of NOT ASSESSABLE.

Single evaluation option: Students wishing to opt for the single-evaluation scheme must inform the instructor before the first midterm. This option consists of a comprehensive final exam covering the entire course syllabus, weighted at 70 % of the final grade, to be held on the same day as the second midterm. The same retake policy applies as in continuous assessment.

Students choosing the single evaluation option must attend all in-person laboratory sessions and submit the group project (the remaining 30 % of the grade).

Use of AI: In this course, the use of Artificial Intelligence (AI) technologies is permitted as an integral part of the development of coursework, provided that the final submission reflects a significant contribution by the student in terms of analysis and personal reflection. Students must clearly identify which parts have been generated using AI, specify the tools used, and include a critical reflection on how these tools have influenced both the

process and the final outcome of the activity. Failure to disclose the use of AI will be considered a breach of academic integrity and may result in a penalty to the activity grade or more severe disciplinary measures in serious cases.

Bibliography

It will be made available at the beginning of the course.

Software

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Course groups and languages

The information provided is provisional until November 30. After this date, you will be able to consult the language of each group through this [link](#). To access the information, you will need to enter the course CODE

Type of teaching	Group	Language	Semester	Shift
(TE) Theory	1	Catalan	first semester	morning-mixed
(PAUL) Classroom practices	1	Catalan	first semester	morning-mixed
(PLAB) Practical laboratories	1	Catalan	first semester	afternoon