Advanced Environmental Microbiology

Code: 42937
ECTS Credits: 9

2025/2026

Degree	Type	Year
Applied Microbiology	OB	0

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Teachers

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Teaching groups languages

You can view this information at the end of this document.

Prerequisites

Students are advised to carry out a review of basic microbiology concepts as well as aspects related to microbial ecology, environmental microbiology, and the use of molecular techniques in these disciplines.

Objectives and Contextualisation

In this module the student will be provided of theoretical and practical knowledge on advanced methodologies for the study of microorganisms in natural and artificial environments. The learning and understanding of these methodologies will allow him/her to acquire the necessary baggage for the use of microorganisms in the resolution of environmental problems.

Competences

- Apply the appropriate methodologies for sample collection, characterisation and analysis of microbial populations and communities.
- Design tools and strategies based on microorganisms to optimise industrial processes, assess the environmental impact of human activity and recover polluted environments.

- Solve problems in new or little-known situations within broader (or multidisciplinary) contexts related to the field of study.
- Use acquired knowledge as a basis for originality in the application of ideas, often in a research context.
- Use and manage bibliographic information and computer resources related to microbiology and related sciences.
- Use scientific terminology to account for research results and present these orally and in writing.

Learning Outcomes

1. Apply appropriate sampling strategies and techniques for microbial communities in natural and artificial ecosystems.
2. Characterise microorganism populations and communities from environmental samples.
3. Design bioremediation and biorecovery strategies based on microorganisms.
4. Know procedures and strategies based on microorganisms for pest and disease control.
5. Know the different bioindicators and bioassays based on microorganisms that help to assess environmental impacts.
6. Recognise microorganisms' role as causal agents of decay.
7. Solve problems in new or little-known situations within broader (or multidisciplinary) contexts related to the field of study.
8. Use acquired knowledge as a basis for originality in the application of ideas, often in a research context.
9. Use and manage bibliographic information and computer resources related to microbiology and related sciences.
10. Use scientific terminology to account for research results and present these orally and in writing.

Content

1. Basic concepts of experimental design for the study of microbial communities

2. Analysis of biotope and biocenosis

3. Experimental laboratory models for the study of microbial communities

4. Optical and electron microscopy applied to environmental microbiology

5. Molecular microbial ecology

6. Analysis of the impact of human activity on natural environments

7. Environmental pollution and bioremediation

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Experimental laboratory and computer practices	16	0.64	1, 7, 8, 9, 10
Expert seminars	6	0.24	5, 8
Practical classes	21	0.84	5, 7, 9, 10
Theoretical lectures	12	0.48	5, 8

Type: Supervised			
Tutorials of the practical classes	12	0.48	1, 4, 7, 9, 10
Type: Autonomous			
Preparation of case studies	30	1.2	1, 2, 5, 4, 3, 6, 9
Preparation of experimental and computer practices lab exercices	15	0.6	7, 8, 9, 10
Preparation of oral presentations	25	1	7, 9, 10
Search and management of information	30	1.2	9, 10
Study	25	1	1, 5, 4, 7, 6, 10
Text reading	30	1.2	5, 4, 8, 9, 10

The teaching methodology includes three types of activities, which have been programmed in an integrated way so that at the end the student acquires the skills indicated in this guide.

Theory block

Expositive theoretical lectures will be given where the basic contents of the module will be explained.

Specialized Seminars

There will also be seminars, given by experts in the different fields of environmental microbiology.

Block of practical classes

It includes:

Experimental laboratory practices: different sessions will be held on high resolution microscopy techniques, both optical and electronic, to determine changes in biodiversity and the uptake of metals by microorganisms in bioreparation processes of contaminated environments.

Classroom practices:There will be several sessions on experimental design for environmental sampling and characterization of microbial diversity in environmental samples, as well as various classes in which different real or hypothetical environmental problems will be solved. An ABP (problem-based learning) methodology will be used, in which students will address the cases raised by working in small groups in the classroom.

Finally, there will be different oral presentations in class to solve the problems posed.

Computer practices: several sessions will be held in the computer room to introduce the student in the treatment and computer analysis of molecular data to study the diversity of microbial communities and the changes they experience in response to different environmental factors or human performances. The following aspects will be addressed:

1. Selection of primers by an *in silico* study to carry out a study ofmicrobial diversity of a given environment.

2. Statistical analysis of genetic profiles obtained through fingerprinting techniques.

3. Detection of diversity indexes based on the genetic profile of the microbial community.

4. Edition of sequences and determination of their phylogenetic affiliation.

In these practical activities the use of Artificial Intelligence (AI) is permitted but in a restricted manner. Therefore, for this subject, the use of AI technologies is allowed exclusively in support tasks, such as bibliographic or information searches, text correction or translations. The student must clearly identify which parts have been generated with this technology, specify the tools used and include a critical reflection on how these have influenced the process and the final result of the activity. The absence of transparency in the use of AI in this assessable activity will be considered a lack of academic honesty and may lead to a partial or total penalty in the grade of the activity, or greater sanctions in serious cases.

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

Continous Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Assessment of computer practices	15	0	0	9, 10
Assessment of experimental laboratory practices	10	0	0	2, 10
Assessment of practical classes in the classroom	35	0	0	1, 5, 4, 3, 7, 6, 8, 9, 10
Theoretical-practical assessment	40	3	0.12	5, 4, 7, 6, 9, 10

Continuous evaluation

The specific and transversal skills will be evaluated through different activities:

1. Written test (40%): There will be a written examination of the theoretical-practical contents. This exam will include short questions and / or test questions.

2. Assessment of the block of practical classes (60%). Laboratory and classroom work, as well as the resolution of the exercises raised during practices accomplishment, will be assessed.

Final considerations:

Practical classes are not eligible for the retake process. Students who do not pass the theoretical-practical assessment will be able to retake it on the date scheduled for that purpose. To be eligible for the retake process, the student should have been previously evaluated in a set of activities equaling at least two thirds of the final score of the course. Thus, the student will be graded as "No Avaluable"if the weighthin of all conducted evaluation activities is less than 67% of the final score.

In order to pass the subject it is mandatory to attend all theoretical and practical classes, as well as oral defense sessions of case studies.

Single evaluation

The single evaluation consists of a single synthesis test in which the theoretical and practical contents of the subject will be evaluated. The test will consist of short-answer questions aimed at assessing whether the

conceptual objectives of the subject have been achieved, as well as multiple-choice and/or true/false test-type questions. The grade obtained in this summary test will account for 40% of the final grade for the subject. The single assessment will be done on the same day as the written exam of the subject.

The evaluation of the module of practical classes (classroom and laboratory) will follow the same process as the continuous evaluation. The obtained grade will account for 60% of the final mark of the subject. The practical module attendance is compulsory at all sessions.

Bibliography

It will be the student's responsibility to search and consult the bibliography necessary for the follow-up and completion of the subject.

The teachers will give adequate advice to the students in this regard.

Software

The usual Microsoft environment programs will be used. It is possible to use some more specific free access software that the students will look for according to their needs to solve the exercises in the computer room.

Groups and Languages

Please note that this information is provisional until 30 November 2025. You can check it through this link. To consult the language you will need to enter the CODE of the subject.

Name	Group	Language	Semester	Turn
(PAULm) Classroom practices (master)	1	Catalan/Spanish	second semester	morning-mixed
(PLABm) Practical laboratories (master)	1	Catalan/Spanish	second semester	morning-mixed
(SEMm) Seminars (master)	1	Catalan/Spanish	second semester	morning-mixed
(TEm) Theory (master)	1	Spanish	second semester	morning-mixed