UAB
Universitat Autònoma de Barcelona

Biotechnology and Environment

2026/2027

Code: 107537
Credits: 6

Degree programme	Type	Course
Biotechnology	OP	4

Contact lecturer

Name : Antoni Sanchez Ferrer

Email : antoni.sanchez@uab.cat

Teaching staff

Antoni Sanchez Ferrer

Maira Martinez Alonso

Group languages

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

Prerequisites

Although there is no official prerequisite, students are advised to review previously studied concepts in the subjects of Microbiology and Fundamentals of Bioprocess Engineering.

Objectives

- Understand the role of microorganisms as agents of environmental change.

- Know the microorganisms involved in environmental bioremediation processes.

- Apply the general bases of Bioprocess Engineering to complete environmental bioremediation systems of the three vectors: water, air and solids.

Learning outcomes

- CM34 (Design all the stages of obtaining biotechnological products or derivatives taking into account ethical and sustainable development aspects.) Design all the stages of obtaining biotechnological products or derivatives taking into account ethical and sustainable development aspects.
- KM36 (Describe the bases of the design of a biotechnological production process, as well as its environmental implications.) Describe the bases of the design of a biotechnological production process, as well as its environmental implications.
- SM32 (Apply safety standards both in the laboratory and in the design of biotechnological plants.) Apply safety standards both in the laboratory and in the design of biotechnological plants.

Contents

1.Microorganisms and natural environments. Historical perspective. General aspects. Microorganisms in the natural environment. Microbial processes of environmental impact.

2. Air environment I. Characteristics and stratification of the atmosphere. troposphere Dispersion through the air. Microorganisms: characteristics. Aerobiology methods. Man and the air environment.

3. Microbial interactions with inorganic pollutants. Microbial conversion of nitrates. acid mines Heavy metals: biological importance, interactions microbes, resistance mechanisms. Biorecovery

4. Adhesion to surfaces and biodeterioration. Colonization of surfaces. Bacterial biofilms: structure, physical-chemical and biological characteristics. Biofouling Biodeterioration. Biotechnological applications.

5. Microbial contamination of waters. Microorganisms and water pollution. Drinking water. Concept of indicator microorganism of pollution Analysis techniques and current regulations. Pathogenic microorganisms present in water i associated diseases.

6. Aerial environment II. Organic and inorganic pollutants in the air. Quantification of pollutants in gaseous streams pollutants Biological air purification processes: Biofilters, Percolator filters, Bioscrubbers.

7. Biological water purification processes I. Classification of processes. Environmental parameters and water quality standards. Aerobic processes.

8. Biological water purification processes II. Removal of nutrients. Anaerobic processes. Technology selection criteria.

9. Biological processes of purification and recovery of solid waste Waste characteristics: Types and biodegradability. Biological treatment processes: Composting and/or Methanization. Ecoparks.

10. Microorganisms and organic pollutants. Biodegradation Environmental parameters and biodegradation. Persistence and biomagnification. approach experimental Biodegradation of organic pollutants. Bioremediation

11. Biological control. Pest control strategies. Pest control for: bacteria, viruses, protozoa and fungi. The microorganisms as antagonists

Learning activities and methodology

Title	Hours	ECTS	Learning outcomes

Technical visits	8	0.32	KM36, SM32
Indivudual study	35	1.4	CM34, KM36, SM32
Individual reading	20	0.8	KM36, SM32
Lectures	32	1.28	CM34, KM36, SM32
Bibliographic search	16	0.64	KM36, SM32
Tutorials	4	0.16	CM34, KM36, SM32
Seminars	10	0.4	CM34, KM36, SM32
Preparation for oral presentations	15	0.6	CM34, KM36, SM32

The subject Environmental Biotechnology consists of three modules, which have been programmed in an integrated way, so the student will have to relate throughout the course the content and the activities programmed for that to achieve the skills indicated in this guide.

The three modules are as follows:

Master classes: Lectures or lectures represent the main activity to be carried out in the classroom and they allow basic concepts to be transmitted to students in a relatively short time. They will be complemented with Power Point type presentations and various didactic material that will be given to the students through the space Moodle.

Seminars: These are work sessions for groups with a small number of students, based on assignments proposed by the teaching staff, that students will work independently and that will be discussed or presented later in the classroom. This is a mandatory activity. In this activity, the use of AI is allowed but in a restricted manner. Therefore, for this subject, the use of Artificial Intelligence (AI) technologies is allowed exclusively in support tasks, such as bibliographic or information search, 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 lack 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.

Technical visits:Visits have been scheduled to waste treatment facilities of different types or to them to work on topics related to the subject in order to bring the student closer to real situations where the Environmental Biotechnologist can intervene. This is a mandatory activity.

Additional information

In order to support the training activities indicated above, students will be able to carry out tutorials individual sessions in the teaching staff's office, in which tutoring will have to be arranged beforehand. The student will have in the subject's Moodle space all the documentation provided by the teaching staff for to a good follow-up of the same. You can also consult the teaching space of the Degree Coordination for get updated information about the degree.

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
Therory assessement: Engineering	30	3	0.12	CM34, KM36, SM32
Technical visits assessment	15	2	0.08	CM34, KM36, SM32
Therory assessement : Microbiology	30	3	0.12	KM36, SM32
Seminars assessement	25	2	0.08	CM34, KM36, SM32

Assessment of the course will be individual and continuous through the following tests:

Theory assessment module (60% of the overall grade): Two written assessments for this module will be scheduled during the course. Each assessment must be passed independently. Each of the tests will account for 30% of the final course grade. The average of the two marks will only be calculated if a minimum grade of 4.5 out of 10 is obtained in each assessment. Otherwise, students must resit the failed component in the final examination.

Seminar assessment module (25% of the overall mark): The evaluation will include the following aspects: Oral presentation of the work done (15% of the overall mark). Taking written tests (10% of the overall mark). If the student has not participated in the preparation or defense of a seminar, the module is suspended.

Technical visits assessment module (15% of the final grade): At the end of visit, students will complete a short written quiz. The grade obtained on these quizzes will constitute the mark for this assessment component. Students who do not participate in the field trip will fail this module, and it cannot be retaken.

Final considerations

To pass the subject you must obtain a grade of 5 or higher in each module and have attended the field trips.

Students who do not pass any of the written tests will be able to recover them on the date scheduled for the final evaluation of the subject, as long as they have been evaluated in at least 2/3 of these It will be considered that a student will obtain the qualification of Not Assessable if he completes less than 67% of the assessment activities.

Students who wish to improve their grade will waive the previously obtained qualification, and will be examined of all the written tests corresponding to the different modules of the subject. Unique Assessment The single assessment consists of a single summary test in which the contents of the entire course will be assessed theory program of the subject. The grade obtained in this synthesis test will represent 60% of the final grade of the subject and must be equal to or greater than 5.

The single assessment will be done on the same day as the 2nd partial of the subject.

The seminar module assessment will follow the same process as the continuous assessment. The grade obtained it will account for 25% of the subject's final grade. The delivery of evidence from the seminars will follow the same procedure that to the continuous evaluation. The seminar module is compulsory, as is the field trip module. It is required to have approved the seminar module and having attended the field trips to be able to take the single assessment test. the note obtained in the seminar module, corresponds to 25% of the final grade and the field trip the remaining 15% and they must always be 5 or higher.

Use of Artificial Intelligence (AI):

For this course, the use of Artificial Intelligence (AI) technologies is permitted exclusively in support tasks, such as bibliographic or information searches, text correction or translations, and the resolution of complex mathematical systems in evaluable activities or in the resolution of class problems. 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 lack of transparency in the use of AI in this evaluable activity will be considered a lack of academic honesty and may lead to a partial or total penalty in the qualification of the activity, or greater sanctions in serious cases.

The commission of any irregularity in an assessment act (academic fraud, plagiarism or improper use of AI, unless this use is expressly authorized in this teaching guide), which may lead to a significant variation in the qualification, means that this act will be graded with a 0. In the event that the teaching guide provides that in order to pass the course it is an essential requirement to have obtained a minimum qualification in the evaluation or that several irregularities occur in the evaluation acts of the same course, the final grade for this subject is 0. Apart from this, a disciplinary process may be initiated against the student who incurs any of these irregularities.

Single Assessment

The single assessment consists of a single comprehensive examination covering the entire theoretical syllabus of the course. The grade obtained in this comprehensive examination will account for 60% of the final course grade and must be at least 5 out of 10. The single assessment will take place on the same day as the second midterm examination.

Assessment of the seminar module will follow the same procedure as in the continuous assessment system. The grade obtained will account for 25% of the final course grade. Submission of seminar assignments/evidence will follow the same procedure as in the continuous assessment system. Attendance at the seminar module, as well as at the field trips, is compulsory. Passing the seminar module and attending the field trips are prerequisites for taking the single assessment examination. The seminar module accounts for 25% of the final course grade, while the field trips account for the remaining 15%. In both cases, a minimum grade of 5 out of 10 is required.

Bibliography

- Atlas, R.M. & Bartha, R. 1997. Microbial Ecology. Fundamentals and Applications. 4th ed. Benjamin/Cummings Pub. Co., Menlo Park, California.

- Alexander, M. 1999. Biodegradation and Bioremediation. 2d ed. Academic Press

- Bilitewski, B. & col. 1994. Waste Management. Springer

- Bitton, G. 1999. Wastewater microbiology. 2d ed. Wiley Series in Ecological and applied microbiology.

- Bitton, G. 2003. Encyclopedia of environmental microbiology. Wiley, John & sons.

- Bueno, J. L. & col. 1997. Contaminación e Ingenieria ambiental. Ed. FICYT.

- Characklis, W.G. & K.C. Marshall. 1989. Biofilms. John Wiley & Sons.

- Cheremisinoff, N.P. 1996. Biotechnology for waste and wastewater treatment. Noyes Publications. US

- Devinny J.S., M.A. Deshusses & T.S. Webster.1999. Biofiltration for air pollution control. Lewis Publishers.

- Doyle, R.J. 2001. Methods in Enzymology. Microbial growth in biofilms. Volume 337. Academic Press.

- Eweis, J. B. Et al. 1999. Principios de Biorecuperación. McGraw Hill.

- Glazer, A.N. & H. Nikaido. 1994. Microbial biotechnology. Fundamentals of applied microbiology. Freeman and company.

- Hernandez, A. 1998 4ª Ed. Depuración de aguas. Paraninfo.

- Hernandez, A. 1996 . Manual de Depuración Uralita. Paraninfo.

- Hurst, Crawford, Garland, Lipson, Mills & Stetzenbach. 2007. Manual of environmental microbiology. 3th Edition. ASM Press.

- Jjemba, PK. 2004. Environmental Microbiology. Principles and applications.. Science Publishers.

- Jenkins, D. et a. 1993. Manual of the causes and control of activated sludge bulking and foaming. 2n edition. Lewis Publishers, Inc.

- Jorgensen, S.E. I col. 1989. Principles of environmental science and technology. Elsevier

- Levin, M. & M.A. Gealt. 1997. Biotratamiento de residuos tóxicos y peligrosos. McGrawHill.

- Madigan M, et al., (2015). Brock, biología de los microorganismos, 14ª ed., Pearson Educación SA.

- Madigan MT, Bender KS Buckley DH, Sattley WM, Stahl DA (2021). Brock. Biology of microorganisms, 16ª ed., Pearson SA.

- Madsen, EL. 2008. Environmental Microbiology: from genomes to biogeochemistry. Blackell Publishing.

- Maier, R. M. , Pepper, I. L. & Gerba, C. P. 2009. Environmental Microbiology. 2nd ed. Academic Press..

- Peavy H.S. & col. 1985. Environmental Engineering. McGraw-Hill.

- Ramalho, R.S. 1993. Tratamiento de aguas residuales. Reverté.

- Rittmann, B. E. & P.L. McMarty. 2001. Biotecnologia del medio ambiente. Principios i aplicaciones. McGraw Hill.

- Senior, E. 1995. Microbiology of landfill sites. 2nd ed. CRC.

- Sidwick, J.M. & col. 1987. Biotechnology of waste treatment and exploitation. John Wiley & Sons.

- Varnam, A.H.. & M.G. Evans. 2000. Environmental Microbiology. Manson Publishing.

- Haug, R.T. The practical handbook of compost engineering. 2003. Lewis Publishers.

- Joseph S. Devinny, Marc A. Deshusses, Todd S. Webster. 1999. Biofiltration for Air Pollution Control. CRC Press.

- Tchobanoglous, G. i Burton, F.L. (revisors). Ingeniería de aguas residuales: tratamiento, vertido y reutilización; Metcalf & Eddy, Inc. 1995. McGraw-Hill.

- American Public Health Association (APHA). 1995. Standard methods for the examination of water and wastewater.

- Randall, C.W., Barnard, J.L. i Stensel, H.D. 1992. Design and retrofit of wastewater treatment plants for biological nutrient removal. Technomic Publishing Co., Inc. (Water quality management library, Vol. 5).

- Tchobanoglous, G., Theisen, H., Vigil, S. 1994. Gestión integral de residuos sólidos. McGraw-Hill.

- McBean, E.A., Rovers, F.A., Farquhar, G.J. 1995. Solid waste landfill engineering and design. Prentice Hall.

In this link, you can find an infographic prepared by the Library Service to facilitate the location of electronic books: https://catalegclassic.uab.cat/search*cat/r?SEARCH=100955

Software

No specific software is needed in this subject.

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	44	Catalan	first semester	morning-mixed
(SEM) Seminars	441	Catalan	first semester	morning-mixed
(PCAM) Field practices	441	Catalan	first semester	morning-mixed