Introduction to Environmental Biotechnology (250654)

General Information

School	ETSECCPB
Departments	Departament d'Enginyeria Agroalimentària i Biotecnologia (DEAB)
Credits	5.0 ECTS
Programs	MÀSTER UNIVERSITARI EN ENGINYERIA AMBIENTAL (pla 2014)
Course	2024/25

Main teaching language at each group

- Group 10ES2 Spanish (Q2)

Faculty

Responsible Faculty: Margarita Lopez Martinez
Faculty: Oscar Huerta Pujol, Margarita Lopez Martinez

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.

Dynamic processes, reactions and reactors.
Bioenergetics and stoichiometry of biological reactions.

Kinetics of biological processes of interest in environmental engineering.
Kinetics of biofilm reactors and immobilized biomass.
Simultaneous expression of matrix kinetic biological processes.
Technical parameter identification of biological processes.
Techniques of qualitative and quantitative measurement of microbial populations.

The specific objective of the course is to build solid knowledge and to develop skills to further deal with the design and operation of biological processes interesting in the field of environmental engineering.

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

SUBJECT 1.0 Introduction to Environmental Biotechnology
UNIT 2. Basic concepts of environmental biotechnology
Problems and discussions

Process dynamics. microbiology

SUBJECT 3.0 Cellular metabolism and stoichiometry
SUBJECT 4.0. Microbial kinetics
Problems and discussions

Biotechnological processes

SUBJECT 5. Main substrates or matrices
SUBJECT 6.1 Main environmental biotechnology processes
SUBJECT 7. Minority environmental biotechnology processes
SUBJECT 8. Evaluation criteria
Problems and discussions
Technical visits

Subject evaluation

Activities

Coursework

Planning and follow-up of the course work

Dedication

10h

Teaching Methodology

The course consists of 3 hours per week of classroom activity, each day will consider a different topic of the syllabus.

Between half of the time and two thirds of the 3h class session, will be devoted to theoretical concepts and the rest of the period to individual or group exercises about calculations or discussions about the topic considered.
The discussion part aims to help the acquisition of the knowledge explained during the theoretical part.
The ATENEA virtual campus will held the oral presentation of the theoretical part, the essential support information for the theory and the practical part of the sessions.
All student must carry out a project in group about the management of a waste by biotechnological means.
At the end of the course, each group will expound the project to be discussed by the rest of the colleagues and teacher.

Grading Rules

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

The qualification of the subject is as follows:
- Exams 40%
- Project 40%
- Reports 10%
- Class exercises 10%

EXAMS: individual tests. No class notes are allowed. Only calculator is allowed.
PROJECT: in groups of 3-4 people. Final mark of each student includes teacher assessment, assessment of the rest of the groups (inter-group assessment) and assessment of the same group (assessment intra-group).
REPORTS OF TECHNICAL VISITS: during the course between 1 and 2 visits will be conducted to companies which work with biotechnological systems. A report or a questionnaire will be done about the visit.
CLASS EXERCICES: from discussion sessions or exercises, some individual or collective deliverables will be done.

Test Rules

EXAMS: individual tests. Notes cannot be taken. Only calculators are allowed.
COURSE WORK: done in groups of 3-4 people. The final mark of each student's work includes the teacher's assessment, the assessment made by the other groups (inter-group assessment) and the same group's assessment (intra-group assessment).
REPORTS ON VISITS: during the course there will be between 1 and 2 visits to facilities that make biotechnological systems. A report must be handed in or an individual questionnaire solved via Atenea.
CLASS EXERCISES: from the discussion sessions or exercise work, evaluable documents can be handed in to be done in groups.

Office Hours

To be arranged, preferably after class hours.
Also by virtual meetings

Bibliography

Basic

- Rittmann, B.E.; McCarty, P.L. Environmental biotechnology: principles and applications. Boston: McGraw-Hill, 2001. ISBN 0071181849.

Complementary

- Levenspiel, O. El omnilibro de los reactores químicos. Barcelona: Reverté, 1986. ISBN 8429173366.
- Weber, W.J. Control de la calidad del agua: procesos fisicoquímicos. Barcelona: Reverté, 1979. ISBN 8429175229.
- Henze, M.; Harremoes, P.; Cour Jansen, J.; Arvin, E. Wastewater treatment: biological and chemical processes. 3rd ed. Berlin: Springer, 2002. ISBN 3540422285.

- Henze, M.; van Loosdrecht, M.C.M.; Ekama, G.A.; Brdjanovic, D. Biological wastewater treatment: principles, modelling and design. London: IWA, 2008. ISBN 9781780401867.
- IWA task group on mathematical modelling for design and operation of biological wastewater treatment; Henze, M. [et al.]. Activated sludge models ASM1, ASM2, ASM2d and ASM3. London: IWA Publishing, 2000. ISBN 9781780402369.
- IWA Task Group for Mathematical Modelling of Anaerobic Digestion Processes; Batstone, D.J. [et al.]. Anaerobic digestion model no. 1 (ADM1). London: IWA Publishing, 2002. ISBN 1900222787.
- Dochain, D.; Vanrolleghem, P.A. Dynamical modelling and estimation in wastewater treatment processes. London: IWA Publishing, 2001. ISBN 1900222507.
- Kennes, C.; Veiga, M.C. (eds.). Bioreactors for waste gas treatment. Dordrecht: Springer Science+Business Media, 2001. ISBN 9789401709309.
- Metcalf & Eddy; Tchobanoglous, G. [et al.]. Wastewater engineering: treatment and resource recovery. 5th ed. New York: McGraw-Hill, 2014. ISBN 9780073401188.