COURSE DATA

DATA SUBJECT

Code: 43815
Name: Microbiological control of wastewater treatment processes
Cycle: Master's Degree
ECTS Credits: 3
Academic year: 2025-26

STUDY (S)

Degree	Center	Acad. year	Period
2250 - Master's Degree in Environmental Engineering	Escola Tècnica Superior d'Enginyeria	2	First quarter

SUBJECT-MATTER

Degree	Subject-matter	Character
2250 - Master's Degree in Environmental Engineering	Control microbiológico de procesos de depuración	ELECTIVES

COORDINATION

BORRAS FALOMIR LUIS

SUMMARY

Professor UPV: Salut Botella Grau

In the course, the student is expected to acquire the ability to make microscopic observations of sludge or wastewater to identify the main microbial morphologies as well as to recognize specific groups of microorganisms based on their response to different stains. The methods and techniques for isolating and identifying certain indicator or pathogenic microorganisms are explained using methodologies that involve the cultivation of said microorganisms as well as techniques not dependent on culture. The subject aims for the student to be able to interpret the results of the analysis carried out in order to diagnose possible problems in water treatment facilities, with special emphasis on the microbiological requirements for the reuse of treated water. The contents of this subject are closely related to the Sustainable Development Goals (SDG) 6 "Clean water and sanitation".

PREVIOUS KNOWLEDGE

RELATIONSHIP TO OTHER SUBJECTS OF THE SAME DEGREE

There are no specified enrollment restrictions with other subjects of the curriculum.

OTHER REQUIREMENTS

Relationship with other subjects of the same degree:
No enrollment restrictions have been specified with other subjects of the curriculum.

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No enrollment restrictions have been specified with other subjects of the curriculum.

COMPETENCES / LEARNING OUTCOMES

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Characterise emissions to land.

Characterise emissions to water.

Conduct appropriate experimentation, analyse and interpret data and use environmental engineering knowledge to draw conclusions.

Identify, formulate and solve complex environmental engineering problems by applying engineering, scientific and mathematical principles.

Interpret and apply national and international environmental legislation and adapt environmental solutions to these regulations.

Learn and apply new knowledge, using appropriate learning strategies.

Manage and operate treatment and/or purification systems in the field of environmental engineering

Students should apply acquired knowledge to solve problems in unfamiliar contexts within their field of study, including multidisciplinary scenarios.

Students should be able to integrate knowledge and address the complexity of making informed judgments based on incomplete or limited information, including reflections on the social and ethical responsibilities associated with the application of their knowledge and judgments.

Students should communicate conclusions and underlying knowledge clearly and unambiguously to both specialized and non-specialized audiences.

Students should demonstrate self-directed learning skills for continued academic growth.

Students should possess and understand foundational knowledge that enables original thinking and research in the field.

Work in a team effectively and with leadership, in a collaborative and inclusive environment, setting goals, planning tasks and meeting objectives.

DESCRIPTION OF CONTENTS

1. Microbiota of wastewater

1. Classification of microorganisms in wastewater.
2. The floccule: biological succession.
3. Microbiological problems in the wastewater treatment process.

2. Counting microorganisms through cultural methods

Counting techniques.

3. Isolation and identification of microorganisms through cultural methods

1. Culture media.
2. Identification methods.

4. Counting microorganisms by non-cultural methods

1. Sampling for microbiological counts.
2. Direct and indirect counts.
3. Filamentous count in biological systems for wastewater treatment.
4. Quantification of microorganisms by image analysis.
5. Limitations.

5. Detection and identification of microorganisms by techniques not dependent on cultivation

1. Fluorescent in situ hybridization (FISH). Principles and applications. Selection of probes.
2. Use of the fluorescence microscope. Selection of filters and fluorochromes. Limitations.
3. Polymerase chain reaction (PCR). Basic principles and selection of primers. Variations of the PCR.
4. Quantitative PCR (qPCR).

6. Identification of special characteristics of microorganisms through advanced techniques

1. Confocal Laser Microscopy.
2. Staining with DAPI. Cell viability.
3. Other techniques combined with FISH.
4. Scanning and transmission electron microscopy (SEM, TEM).
5. High throughput sequencing techniques.

7. Laboratory practices

1. Microscopic observations of water and sludge, identifying the main microbial groups by morphology.
2. Measurements by calculating the micrometric coefficient.
3. Microorganism count.
4. Physiological stains.
5. Detection and identification of microbial groups using the FISH technique.

WORKLOAD

PRESENCIAL ACTIVITIES

Activity	Hours
Theory	12,00
Theoretical and practical classes	2,00
Laboratory	14,00
Classroom practices	2,00
Total hours	**30,00**

NON PRESENCIAL ACTIVITIES

Activity	Hours
Attendance at other activities	0,00
Individual or group project	5,00
Independent study and work	15,00
Preparation of lessons	15,00
Preparation for assessment activities	10,00
Resolution of case studies	0,00
Total hours	**45,00**

TEACHING METHODOLOGY

The teaching sessions will be developed according to the following distribution:

- Theoretical activities.

In the theoretical classes, the topics will be developed providing a global and integrative vision, analysing in greater detail the key and more complex aspects, encouraging, at all times, the participation of the student.

- Practical activities.

These activities complement the theoretical activities in order to apply the basic concepts and expand them with the knowledge and experience that they acquire during the completion of the proposed work.

- Laboratory practices.

The laboratory practices complement the theoretical activities, allowing the student to apply the methods studied in the theoretical activities.

- Personal work of the student.

Carrying out (outside the classroom) of monographic works, directed bibliographic search, as well as the preparation of classes and exams (study). This task will be carried out individually and aims to promote autonomous work.

The e-learning platform (Virtual Classroom of the University of Valencia and / or PoliformaT of the Polytechnic University of Valencia) will be used as a communication support with the students. Through it, students will have access to the didactic material used in class, as well as the problems and exercises to be solved.

EVALUATION

The subject will be evaluated (both in the first and second call), through the presentation of a laboratory practice report (25% of the grade), two open-response written tests (each will account for 35% of the grade) and the delivery of activities during the course (continuous evaluation, 5% of the grade).

To pass the subject, the student must obtain a minimum grade of 4 points (out of 10) in each of the two written tests.

The final grade will be the weighted average of the grades from each written test, the laboratory report and the continuous evaluation, and must be greater than or equal to 5 to pass the subject.

For each failed written test, a single recovery may be made through a complementary evaluation (second call) on the date and time established by the Master's Academic Committee.

Written test: Written exam where the student must demonstrate mastery of the contents of the subject

based on the questions posed by the teaching staff (total weight 70%)

Laboratory practice report: Evaluation instrument that allows checking the concepts and/or skills acquired by the student in the development of their laboratory practices (total weight 25%).

Continuous evaluation: deliveries of activities carried out throughout the course (total weight 5%).

Regarding attendance requirements, the maximum absence allowed will be 20% in laboratory practices.

Copying or plagiarism of any activity that is part of the evaluation will result in the impossibility of passing the course, and the student will then be subject to the appropriate disciplinary procedures indicated in the ACTION PROTOCOL FOR FRAUDULENT PRACTICES AT THE UNIVERSITY OF VALENCIA (ACGUV 123/2020).

REFERENCES

- Seviour, R. And Nielsen, P.H. Microbial Ecology of Activated Sludge. IWA Publishing,London, 2010.
- Ferrer Polo, J., y Seco Torrecillas, A. Tratamientos biológicos de aguas residuales. Editorial UPV (358), 2009.
- Metcalf & Eddy. Wastewater Engineering: Treatment and reuse. 4th Ed. McGraw Hill, New York, 2003.
- David Jenkins, Michael G. Richard, Glen T. Daigger. Manual on the Causes and Control of Activated Sludge Bulking, Foaming, and Other Solids Separation Problems. IWA Publishing. 2004.
- Per Halkjaer Nielsen, Holger Daims and Hilde Lemmer. FISH Handbook for Biological Wastewater Treatment. IWA Publishing. 2009.
- Duncan Mara and Nigel Horan. Handbook of Water and Wastewater Microbiology. Elsevier. 2004