Water Potabilization and Urban Waste Water Treatment

Code: 102430
ECTS Credits: 5

2025/2026

Degree	Type	Year
Chemical Engineering	OT	4

Contact

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Teachers

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Teaching groups languages

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

Prerequisites

Completing the course "Environmental Engineering" is recommended before taking this course.

Objectives and Contextualisation

The main objective of the course is that the student is able to integrate the previous knowledge of chemical engineering and environmental engineering to design the most common operating units in the processes of wastewater treatment. In addition, the student must acquire a critical spirit to be able to assess the different alternatives that exist in these treatments and to know how to propose the best option under different scenarios.

Competences

- Analyse, evaluate, design and operate the systems or processes, equipment and installations used in chemical engineering in accordance with certain requirements, standards and specifications following the principles of sustainable development.
- Apply scientific method to systems in which chemical, physical or biological transformations are produced both on a microscopic and macroscopic scale.
- Assume the values of professional responsibility and ethics required in chemical engineering.

- Demonstrate knowledge of the different reaction, separation and processing operations for materials, and transport and circulation of fluids involved in the industrial processes of chemical engineering.
- Demonstrate understanding of the main concepts for controlling chemical engineering processes.
- Develop personal attitude.
- Develop personal work habits.
- Develop thinking habits.
- Objectively compare and select different technical options for chemical processes.
- Participate in the organisation and planning of companies.
- Show an understanding of the role of chemical engineering in the prevention and resolution of environmental and energy problems, in accordance with the principles of sustainable development.
- Understand and apply the basic principles on which chemical engineering is founded, and more precisely: balances of matter, energy and thermodynamic momentum, phase equilibrium and kinetic chemical equilibrium of the physical processes of matter, energy and momentum transfer, and kinetics of chemical reactions

Learning Outcomes

1. Apply matter and energy balance to typical continuous and discontinuous environmental engineering systems.
2. Apply numerical methods to resolve typical empirical cases in environmental engineering.
3. Apply PID controls of temperature and level to typical environmental engineering processes.
4. Apply the basics of chemical engineering to the treatment of urban and industrial solid waste and the obtainment of sources of renewable energy.
5. Apply unitary operations to environmental processes.
6. Calculate losses by friction in conduction in environmental technologies.
7. Critically analyse the results of experiments and the overall work done in processes related with the treatment of environmental problems.
8. Critically evaluate the work done.
9. Describe and explain in depth the technologies, tools and techniques applied to the treatment of industrial and urban solid waste and the production of sources of renewable energy
10. Design and calculate engineering solutions to environmental problems.
11. Develop a capacity for analysis, synthesis and prospection.
12. Generate innovative and competitive proposals in professional activity.
13. Manage information by critically incorporating the innovations of one's professional field and analyse future trends.
14. Monitor the progress of a chemical reaction in environmental processes.
15. Objectively distinguish different alternatives in solid and industrial waste treatment plants and in the processes of obtaining renewable energies
16. Organise and schedule the management of an environmental problem, an installation or an environmental service.
17. Work with common equipment used in the treatment of environmental problems.

Content

This course is divided in nine parts:

1. Introduction to the problem of wastewater
2. Water purification
3. Pipes and pumping
4. Pretreatment
5. Primary treatment
6. Secondary treatment
7. Sludge management
8. Treatment of odours
9. Tertiary treatment and potabilization

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Drinking water production systems	13	0.52	1, 5, 11, 10
WWTP design	15	0.6	1, 5, 11, 10, 15
WWTP visit	4	0.16	
Type: Supervised			
Problems subjects 1-5	8	0.32	1, 5, 9, 11, 10, 15
Problems subjects 6-9	6	0.24	1, 5, 11, 10
Type: Autonomous			
Group work. WWTP design	10	0.4	1, 5, 11, 10
Group work 2. Design and criteria and elements of an unitary process	10	0.4	1, 5, 11, 10
Problems resolution	25	1	
Theoretical fundamentals study	26	1.04	

Theory classes. The basic theoretical concepts for the subsequent practical development are introduced in an orderly and concise manner.
Classes of problems. A series of problems is selected from the collection of each theme. The resolution step by step of the most representative problems is shown and the resolution scheme of other problems is presented. Resolution of problems by the students.
Seminars 1) Sludge line of a WWTP. 2) Disinfection processes
Visit to WWTP, non mandatory

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
Group work	30	0	0	7, 1, 3, 4, 5, 2, 8, 6, 9, 11, 10, 15, 12, 13, 14, 16
Partial exam 1. Design of waste water purification processes	35	2	0.08	7, 1, 3, 4, 5, 2, 8, 6, 9, 11, 10, 15, 12, 13, 14, 17, 16

Partial exam 2. Design of drinking water production systems	35	2	0.08	7, 1, 3, 4, 5, 2, 8, 6, 9, 11, 10, 15, 12, 13, 14, 17, 16
Recuperation exam	70	4	0.16	7, 1, 3, 4, 5, 2, 8, 6, 9, 11, 10, 15, 12, 13, 14, 17, 16

This subject does not contemplate the single assessment system.

The evaluation will consist of two parts:
Two written partial examinations (70%: 35% each partial) that can include a part of theory and one of problems. A
minimum mark of 3.5 is needed in each one of the partial exams. Otherwise, it will be necessary to recover the partial suspended in the recovery exam.
Written assay that will have to be presented orally in which some of the main units of a sewage treatment plant (30%) will be designed. The use of AI is allowed for the completion of written assay.

To participate in the recovery exam the students must have been previously evaluated in a set of activities whose weight equals to a minimum of two thirds of the total grade of the subject.

Awarding an honors grade is the decision of the teaching staff responsible for the subject. The HG can only be awarded to students who have obtained a final grade equal to or greater than 9.00. Up to 5% of the total number of students enrolled can be awarded.

A student will be considered non-assessable (NA) if he/she has not presented a set of activities whose weight is equivalent to a minimum of two thirds of the total grade of the subject.

Without prejudice to other disciplinary measures that may be deemed appropriate, irregularities committed by the student that may lead to a variation in the grade of an evaluation act will be graded with a zero. Therefore, copying, plagiarism, cheating, allowing copying, unauthorized use of AI (e.g., Copilot, ChatGPT or equivalents), etc. in any of the evaluation activities will imply failing it with a zero. Assessment activities graded in this way and by this procedure will not be recoverable. If it is necessary to pass any of these assessment activities to pass the subject, this subject will be suspended directly, without the opportunity to recover it in the same year.

Repeating students may be exempt from carrying outthe written assay, maintaining their grade, provided that it is higher than 5.

The review of exams and assignments will be carried out in person, on a date agreed with the teaching staff.

Bibliography

- APHA/AWWA/WPCF. Standard methods for the examination of water and wastewater. 19th Ed. American Public Health Association, Washington, D. C. 1995.
- N.P. Cheremisinoff. Handbook of Water and Wastewater Treatment Technologies. Butterworth-Heinemann. Boston. 2002
- J.C. Crittenden, R.R. Trussell, D.W. Hand, K.J. Howe, G. Tchobanoglous. Water treatment: principles and design. John Wiley & Sons. Hoboken. 2005
- M.L. Davis, D.A. Cornwell. Introduction to Environmental Engineering, 5th Ed. McGraw Hill Inc. Editions. New York. 2008.
- C. Kennes, M.C. Veiga. Air Pollution Prevention and Control: Bioreactors and Bioenergy John Wiley & Sons Inc., Chichester. 2013.
- C. Menéndez-Gutiérrez, J.M. Pérez-Olmo. Procesos para el Tratamiento Biológico de Aguas Residuales Industriales. Ed. Universitaria. La Habana. 2007.

- Metcalf & Eddy, Inc. Wastewater Engineering: Treatment and Reuse.McGraw-Hill Inc. Editions. Boston. 2003.
- H.S. Peavy, D.R. Rowe, G. Tchobanoglous. Environmental Engineering. McGraw Hill Inc. Editions. N.Y. 1985.
- R.S. Ramalho. Tratamientos de Aguas Residuales. Editorial Reverté. Barcelona. 1993.
- M.C.M. van Loosdretch, P.H. Nielsen, C.M. López-Vázquez, D. Brdjanovic. Experimental Methods in Wastewater Treatment. IWA Publishing. London. 2016.

Software

No specific software will be required.

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
(PAUL) Classroom practices	211	Spanish	first semester	morning-mixed
(SEM) Seminars	211	Spanish	first semester	morning-mixed
(TE) Theory	21	Spanish	first semester	morning-mixed