COURSE DATA

Data Subject	
Code	43807
Name	Water treatment
Cycle	Master's degree
ECTS Credits	9.0
Academic year	2022 - 2023

Study (s)

Degree	Center	Acad. year	Period
2227 - M.U. en Ingeniería Ambiental	School of Engineering	1	First term
2250 - M.D. in Environmental Engineering	School of Engineering	1	First term

Subject-matter

Degree	Subject-matter	Character
2227 - M.U. en Ingeniería Ambiental	2 - Water treatment	Obligatory
2250 - M.D. in Environmental Engineering	12 - Tratamiento de aguas	Obligatory

Coordination

Name	Department
SECO TORRECILLAS, AURORA	245 - Chemical Engineering

SUMMARY

Professors UPV: Ramón Barat Baviera y Arcadio Agustín Pascual López

The subject Water treatments is a compulsory subject of four-monthly character that is taught in the first semester of the Master in Environmental Engineering. The subject, of 9 ECTS, has a theoretical-practical nature, so the theoretical knowledge is complemented both with the resolution of issues and problems and with the realization of lab work and practices. The subject aims to provide the student with the knowledge and skills necessary for the pre-design of water treatment facilities for human consumption or supply to facilities as well as the treatments applied in the treatment of urban and industrial wastewater. Therefore, the subject serves as the basis for the mandatory subject “Advanced modeling of water treatments”, as well as the optional “Management of sewage treatment plants” and “Simulation and advanced design of sewage treatment plants”.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

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

Other requirements

The subject of Water Treatment serves as the basis for the compulsory subject Advanced modeling of water treatments (taught in the second semester), as well as the optional Sewage treatment plant management and Simulation and advanced design of sewage treatment plants , taught within the specialty in EDAR Management.

Environmental quality assessment

OUTCOMES

2227 - M.U. en Ingeniería Ambiental

- 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.
- Identify and apply technologies, tools and techniques in the field of environmental engineering.
- Assume with responsibility and ethics the Environmental Engineer role in a professional context.
- Promote and apply the principles of sustainability.
- Adapt to changes, being able to apply the principles of Environmental Engineering to unknown cases and use new and advanced technologies and other relevant developments, with initiative and entrepreneurial spirit.
- Identify, declare and entirely analyze environmental problems.
- Carry out theoretical analyzes of environmental systems, both natural and artificial, and develop and apply mathematical models for their simulation, optimization or control.
- Design and calculate engineering solutions to environmental problems, comparing and selecting technical alternatives and identifying emerging technologies.

- Understand and apply environmental national and international legislation, adapting environmental solutions to these regulations.
- Evaluate the environmental quality of water from a global point of view, especially when there is a risk to public health.
- Be able to characterize the emissions to water, coming from the anthropogenic activity.
- Evaluate the treatment of wastewaters emissions to assess different alternatives and obtain the required information for the design of the selected treatment processes.
- Design and manage wastewater treatment systems.

2250 - M.D. in 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.
- Identify, formulate and solve complex environmental engineering problems by applying engineering, scientific and mathematical principles.
- Apply environmental engineering designs to produce solutions that meet specific needs addressing public health, safety and welfare taking account of global, cultural, social, environmental and economic factors.
- Recognise the ethical and professional responsibilities of environmental engineering and make informed judgements considering the impact of engineering solutions in global, economic, environmental and social contexts.
- Work in a team effectively and with leadership, in a collaborative and inclusive environment, setting goals, planning tasks and meeting objectives.
- Conduct appropriate experimentation, analyse and interpret data and use environmental engineering knowledge to draw conclusions.
- Learn and apply new knowledge, using appropriate learning strategies.
- Carry out a comprehensive assessment of environmental water quality.
- Characterise emissions to water.
- Implement measures for preventing pollution and recovering, protecting and improving environmental quality.

- Develop and apply mathematical models for the simulation, optimisation or control of processes in the field of environmental engineering.
- Design, calculate and select engineering solutions to environmental problems, comparing alternatives that include emerging technologies under criteria of technical, social, economic and environmental viability.
- Manage and operate treatment and/or purification systems in the field of environmental engineering
- Interpret and apply national and international environmental legislation and adapt environmental solutions to these regulations.
- Prepare and draft technical reports and/or environmental engineering projects considering technical, economic, social, energy and/or environmental aspects.
- Develop environmental solutions under the principles of circular economy and the sustainable development goals.

LEARNING OUTCOMES

1 Establish the criteria for the evaluation of water quality.

2 Apply the principles of sustainability to water treatment processes.

3 Know the possibilities of using wastewater as a source of resources.

4 Know and apply the different physical, chemical and biological processes for water treatment.

5 Evaluate different treatment alternatives from a technical, economic and social point of view.

6 Acquire the ability to plan, design and operate facilities for water treatment.

7 Know and apply advanced technologies for the treatment of persistent and emerging pollutants.

8 Know and apply advanced technologies for the minimization of sludge production and for its valorisation.

9 Know the importance of control in treatment plants.

10 Acquire a global vision of a treatment plant integrating the different processes and lines of treatment involved.

11 Acquire experience at the laboratory level on the operation of water treatment plants.

DESCRIPTION OF CONTENTS

1. Introduction to water treatment

Importance of water treatment. Legislation. Characterization of water. Methods for water treatment. Schemes of treatment. Sustainable management of water quality.

2. Physical treatments of water

Screening. Homogenization. Mixing. Flocculation. Sedimentation. Floatation. Aeration. Filtration. Membrane processes.

3. Chemical treatments of water

Precipitation. Coagulation. Adsorption. Oxidation. Ionic change. Disinfection.

4. Physical and chemical treatments of sludge

Introduction. Microbiology of processes. Kinetics and stoichiometry of the reactions.

5. Biological methods of wastewater treatment

5.1. Biological processes of suspension culture: Activated sludge. Removal of organic matter. Nitrification. Denitrification. Advanced treatments: Aerobic biomembrane reactors, SHARON Process, ANAMMOX, BABE. Biological removal of phosphorus. Wastewater treatment plants for the biological removal of nutrients. Aerobic digestion of sludge. Anaerobic treatment of suspension culture. Anaerobic membrane bioreactors. Anaerobic digestion of sludge.

5.2. Biological Processes of Solid Support: Trickling filters. Rotating biological contactors. Peat beds. Anaerobic processes of fixed biomass.

6. The new WWTP as resource recovery plant

7. Laboratory practices

Jar-test.
Study of the activated sludge process in a pilot plant.
Study of the zonal sedimentation process.
Calibration of the parameters of the biological model of the activated sludge process.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	34,00	100
Laboratory practices	28,00	100
Classroom practices	19,00	100
Theoretical and practical classes	5,00	100
Tutorials	4,00	100
Attendance at events and external activities	5,00	0
Development of group work	40,00	0
Development of individual work	5,00	0
Study and independent work	10,00	0
Preparation of evaluation activities	30,00	0
Preparing lectures	20,00	0
Preparation of practical classes and problem	15,00	0
Resolution of case studies	10,00	0
TOTAL	**225,00**	

TEACHING METHODOLOGY

The training activities will be developed according to the following distribution:

• Theoretical activities.

Description: In the theoretical classes the topics will be developed providing a global and integrating vision, analyzing in greater detail the key aspects and of greater complexity, promoting, at all times, the participation of the student.

• Practical activities.

Description: They complement the theoretical activities in order to apply the basic concepts and expand them with the knowledge and experience that they acquire during the realization of the proposed works. They include the following types of face-to-face activities:

- Classes of problems, questions in the classroom and resolution of practical cases including the use of specific software

- Discussion sessions and problem solving and exercises previously worked by the students

- Laboratory practices Visits to water treatment facilities

- Conferences and seminars

- Programmed tutoring (individualized or in groups)

- Realization of individual evaluation questionnaires in the classroom with the presence of the teacher.

• Student's personal work.

Description: Realization (outside the classroom) of monographic works, directed bibliographic search, issues and problems, as well as the preparation of classes and exams (study). This task will be carried out individually and tries to promote autonomous work.

• Work in small groups.

Description: Realization, by small groups of students (2-4) of work, issues, problems outside the classroom. This task complements the individual work and fosters the capacity for integration in work groups.

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

EVALUATION

Evaluation of laboratory practices: It will be carried out based on the evaluation of the corresponding reports. It will be valued with 30% of the final grade. It will be necessary to obtain at least 35 points out of 100 in each of the reports to average. In any case, it will be necessary to obtain at least 50 points out of 100 for it to count in the final grade. Attendance at laboratory practice sessions is mandatory.

Work: the student must carry out two works proposed by the teacher that will be valued with 40% of the final grade. It will be necessary to obtain 50 points out of 100 in each of them to be taken into account in the final grade.

Final exam: the student must take a written exam at the end of the semester that will be valued at 25% of the grade. To be counted in the final grade, a minimum of 35 points out of 100 must be obtained.

Continuous evaluation: based on the student's participation and degree of involvement in the teaching-learning process, taking into account regular attendance at the scheduled face-to-face activities and the resolution of proposed questions and problems. It will be valued with 5% of the final grade.

Failure to achieve any of the minimum qualifications exposed will mean failing the course. To pass the

subject it will be necessary to obtain at least 50 points out of 100 in the final grade.

REFERENCES

Basic

- Ferrer Polo, J., y Seco Torrecillas, A. Introducción a los tratamientos de aguas. Editorial UPV (309), 2011.
  Ferrer Polo, J., y Seco Torrecillas, A. Tratamientos físicos y químicos de aguas residuales. Editorial UPV (197), 2011.
  Ferrer Polo, J., Seco Torrecillas, A., Robles Martínez, A. Tratamientos biológicos de aguas residuales. Editorial UPV (358), 2018.
  Leslie Grady Jr. C.P.,. Daigger G.T., Lim, H.C.. Biological Wastewater Treatment. Marcel Dekker, Inc. New York, 2011.
  Metcalf & Eddy. Wastewater Engineering: Treatment and reuse. 4th Ed. McGraw Hill, New York, 2003.
  Water Environmental Federation. Wastewater Treatment Plant Design. WEF and IWA Publishing, Alexandria, 2003.
  Changes in the Biochemical Oxygen Demand Procedure in the 21st Edition of Standard Methods for the Examination of Water and Wastewater (Young, James | Clesceri, Lenore | Kamhawy, Sabry | Young, James)

Additional

- American Public Health Association, American Water Works Association and Water Environment Federation. Standard Methods for the Examination of Water and Wastewater 20th edn, Washington DC, USA, 2005.
  Cervantes, F., Pavlostathis, S., van Haandel, A. Advanced Biological Treatment Processes for Industrial Wastewaters. Principles & application. IWA Publishing, 2006.IWA. Process Science and Engineering for Water and Wastewater Treatment. IWAPublishing, London, 2002.
  Seviour, R. And Nielsen, P.H. Microbial Ecology of Activated Sludge. IWA Publishing,London, 2010.
  Gabriel Bitton. Wastewater microbiology. Wiley-Liss, cop. New York. 2005.