COURSE DATA

Data Subject	
Code	43808
Name	Advanced modeling of water treatment
Cycle	Master's degree
ECTS Credits	6.0
Academic year	2022 - 2023

Study (s)

Degree	Center	Acad. year	Period
2227 - M.U. en Ingeniería Ambiental	School of Engineering	1	Second term

Subject-matter

Degree	Subject-matter	Character
2227 - M.U. en Ingeniería Ambiental	2 - Water treatment	Obligatory

Coordination

Name	Department
SECO TORRECILLAS, AURORA	245 - Chemical Engineering

SUMMARY

Professors UPV: Joaquín Serralta Sevilla, Ramón Barat Baviera

Advanced Modeling of Water Treatments is a compulsory subject that is taught in the second semester of the first year of the Master in Environmental Engineering. This subject consists of a total of 6 credits divided into 1.2 credits of classroom theory and 4.8 credits of classroom practices.

This course is proposed as a clear continuation of the Water Treatment course taught during the first semester of the first year. Throughout the semester, different mathematical models will be studied to represent the different biological, physical and chemical processes in wastewater treatment. This subject is complemented by Simulation and Advanced Design of Wastewater Treatment Plants, a compulsory subject of the EDAR Management specialty, which is taught in the first semester of the second year, where the application of these models is shown through the use of a computer tool.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

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

Other requirements

This subject is presented as a clear continuation of the subject of water treatment that is taught during the first semester of the first year in which basic knowledge is imparted in terms of the physical, chemical and biological processes that take place in water treatment residuals Equally important are the concepts of material balance taught in the subject Transportation of pollutants in the natural environment during the first four months of the first year.

OUTCOMES

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- 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.
- 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.
- 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.
- 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.

LEARNING OUTCOMES

1 Knowledge of the basic tools of the models.
2 Knowledge of the mathematical models of activated sludge (ASM2d).
3 Knowledge of the mathematical models of anaerobic digestion (ADM1).
4 Knowledge of the mathematical models of the physical processes of sedimentation and gas exchange.
5 Knowledge of the mathematical models of chemical processes of acid-base balance and precipitation.
6 Generation of a global model by integrating existing models.
7 Ability to develop and apply new models.

DESCRIPTION OF CONTENTS

1. 1

Introduction

2. 2

Structure of the models

3. 3

Process modeling of heterotrophic bacteria

4. 4

Process modeling of autotrophic bacteria

5. 5

Joint modeling of the processes of heterotrophic and autotrophic bacteria

6. 6

Process modeling of polyphosphate (PAO) accumulative bacteria

7. 7

Model ASM2d (Activated Sludge Model No.2d)

8. 8

Modeling of anaerobic treatment processes

9. 9

Modeling of chemical processes

10. 10

Global Model (BNRM2, Biological Nutrient Removal Model No.2)

11. Evaluation

WORKLOAD

ACTIVITY	Hours	% To be attended
Classroom practices	44,00	100
Theory classes	9,00	100
Theoretical and practical classes	4,00	100
Seminars	3,00	100
Development of group work	30,00	0
Study and independent work	15,00	0
Preparation of evaluation activities	15,00	0
Preparation of practical classes and problem	15,00	0
Resolution of case studies	15,00	0
TOTAL	**150,00**	

TEACHING METHODOLOGY

The methodology used in this subject consists of Reverse Teaching. Before the face-to-face sessions, students are provided with learning materials (mainly videos) with which they must work autonomously. These learning materials explain the basic concepts that will be worked on in the classroom in the following sessions.

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

Taking into account the Reverse Teaching methodology applied in this subject, 12 test questionnaires are carried out throughout the course at the beginning of some classes with related questions about the learning objects made available to students. The evaluation of these questionnaires represents 5% of the grade for the course.

On the other hand, there will be two written exams in which the practical questions will predominate in which the students must demonstrate that they have understood and that they know how to apply the concepts explained and worked on throughout the semester. The first exam will take place in the middle of the semester and the second exam at the end of it. These exams represent 50% of the grade for the course (15% the first exam and 35% the second exam). A minimum grade of 4.5 is required in the average of the exam grades.

There will also be a final work in pairs that will be defended before the teachers of the subject. After the presentation of the final work, the students will respond orally to questions related to said work. The evaluation of the work presented and its defense represents 30% of the grade for the course. A minimum grade of 4.5 is required in this work.

Finally, active participation in the classroom along with the work done throughout the course accounts for 15% of the grade for the course.

Actividad	Ausencia máxima
Teoría Aula	20%
Práctica Aula	20%

REFERENCES

Basic

- Biological wastewater treatment (Grady, C.P. Leslie) Activated sludge models ASM1, ASM2, ASM2d and ASM3 (Henze, Mogens; IWA Task Group on Mathematical
  Modelling for Design and Operation of Biological Wastewater Treatment; Gujer, Willi; Mino, Takashi; Loosdrecht, Mark van
  Anaerobic digestion model nº 1 (IWA Task Group for Mathematical Modelling of Anearobic Digestion Processes; Batstone, D.J.
  Biological wastewater treatment : principles, modeling, and design. (Henze, Mogens; Loosdrecht, Mark van; Ekama, George A.; Brdjanovic, Damir)

Basic principles of wastewater treatment (Sperling, Marcos von)