VNIVERSITAT DE VALÈNCIA

Course Guide
45002 Modelación avanzada de tratamientos de aguas

COURSE DATA

Data Subject	
Code	45002
Name	Modelación avanzada de tratamientos de aguas
Cycle	Master's degree
ECTS Credits	7.5
Academic year	2023 - 2024

Study (s)

Degree	Center	Acad. year	Period
2250 - M.D. in Environmental Engineering	School of Engineering	1	Second term

Subject-matter

Degree	Subject-matter	Character
2250 - M.D. in Environmental Engineering	13 - Modelación avanzada de tratamiento de aguas	Obligatory

Coordination

Name	Department
SECO TORRECILLAS, AURORA	245 - Chemical Engineering

SUMMARY

Professor UPV: Ramón Barat Baviera and Joaquín Serralta Sevilla

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 7.5 credits divided into 1.5 credits of classroom theory, 5.4 credits of classroom practices and 0.6 credits of computer practices. This subject is proposed as a clear continuation of the subject of Water Treatment taught during the first four months 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 with Simulation and Advanced Design of Wastewater Treatment Plants, a compulsory subject in the specialty of WWTP Management, which is taught in the first four months of the second year, which shows the application of these models through the use of a computer tool.

This course provides students with the necessary training to use commercial programs for the simulation and design of wastewater treatment plants.

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

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 water treatments that is taught during the first semester of the first year in which the basic knowledge is taught regarding the physical, chemical and biological processes that take place in water treatment. residual. Also of great importance are the concepts of material balance taught in the subject of transport of pollutants in the natural environment during the first four months of the first year.

In this subject different mathematical

OUTCOMES

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.
- Learn and apply new knowledge, using appropriate learning strategies.
- 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
- 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

English version is not available

DESCRIPTION OF CONTENTS

1. Introduction

2. Structure of the models

3. Modeling of the processes of heterotrophic bacteria

4. Modeling the processes of autotrophic bacteria

5. Joint modeling of the processes of heterotrophic and autotrophic bacteria

6. Modeling of the processes of bacteria accumulating polyphosphates (PAO) and accumulating glycogen (GAO)

7. ASM2d Model (Activated Sludge Model No.2d)

8. Modeling of the processes of valorization of organic matter by anaerobic means

9. Modeling of advanced nitrogen removal processes

10. Modeling of chemical processes

11. Global Model (BNRM2s, Biological Nutrient Removal Model No.2s)

12. Implementation of mathematical models in Matlab

WORKLOAD

ACTIVITY	Hours	% To be attended
Classroom practices	51,00	100
Theory classes	15,00	100
Computer classroom practice	6,00	100
Theoretical and practical classes	3,00	100
Development of group work	30,00	0
Development of individual work	10,00	0
Study and independent work	30,00	0
Preparation of evaluation activities	35,00	0
Preparing lectures	7,50	0

TOTAL	**187,50**

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

Taking into account the Reverse Teaching methodology applied in this subject, throughout the course there are 15 test-type questionnaires at the beginning of some classes with related questions on the learning objects made available to students. The evaluation of these questionnaires supposes 5% of the note of the subject.

On the other hand, there will be two written exams in which the practical questions will predominate in which the students will have to show that they have understood and that they know how to apply the concepts explained and worked throughout the term. The first exam will be held in the middle of the semester and the second exam at the end of it. These exams account for 50% of the grade of the subject (15% the first exam and 35% the second exam). A minimum grade of 4.0 is required in the second exam.

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 answer orally to questions related to said work. The evaluation of the work presented and its defense supposes 30% of the note of the subject. A minimum grade of 4.0 is required in this work.

Finally, the active participation in the classroom together with the works carried out throughout the course supposes 15% of the note of the subject.

The recuperable acts of evaluation are: the exam and the academic work that between them account for 80% of the grade for the subject.

REFERENCES

Basic

- Biological wastewater treatment : principles, modeling, and design. (Henze, Mogens| Loosdrecht, Mark van | Ekama, George A | Brdjanovic, Damir)
  Biological wastewater treatment (Daigger, Glen T | Grady, C.P. Leslie | Love, Nancy G| Filipe, Carlos D.M)
  Activated sludge models ASM1, ASM2, ASM2d and ASM3 (Henze, Mogens | Gujer,Willi | Mino, Takashi | Loosdrecht, Mark van)
  Anaerobic digestion model nº 1 (Batstone, D.J.)
  Basic principles of wastewater treatment (Sperling, Marcos von)