

**1. General information****Course:** TECHNOLOGIES FOR WATER AND WASTEWATER TREATMENT**Type:** ELECTIVE**Degree:** 344 - CHEMICAL ENGINEERING**Center:** 1 - FACULTY OF SCIENCE AND CHEMICAL TECHNOLOGY**Year:** 4**Main language:** Spanish**Use of additional languages:****Web site:****Code:** 57736**ECTS credits:** 6**Academic year:** 2023-24**Group(s):** 21**Duration:** First semester**Second language:****English Friendly:** Y**Bilingual:** N**Lecturer:** JAVIER LLANOS LOPEZ - Group(s): 21

Building/Office	Department	Phone number	Email	Office hours
Enrique Costa/Despacho 7	INGENIERÍA QUÍMICA	3508	javier.llanos@uclm.es	Monday, Tuesday and Wednesday from 12 to 14 h.

Lecturer: CRISTINA SAEZ JIMENEZ - Group(s): 21

Building/Office	Department	Phone number	Email	Office hours
Enrique Costa Novella/ Despacho 4	INGENIERÍA QUÍMICA	6708	cristina.saez@uclm.es	monday, tuesday and wednesday from 12 to 14 h

2. Pre-Requisites

Those established in general for the Degree

3. Justification in the curriculum, relation to other subjects and to the profession

This subject is taught in the fourth year of the Degree and consists of a single subject that will be taught in the first semester. The student who has access to this subject has a great background in Chemical and Environmental Engineering and only needs to make their knowledge more practical. In this sense, the objective with which it is proposed is to provide the chemical engineer in training with the necessary knowledge to understand the operation of urban wastewater treatment plants, drinking water treatment stations, water regeneration stations and industrial water treatment and conditioning plants. It also aims to teach how to design these operations, showing water characterization techniques, and the simplified design algorithms that are most commonly used in practice.

4. Degree competences achieved in this course**Course competences**

Code	Description
CB02	Apply their knowledge to their job or vocation in a professional manner and show that they have the competences to construct and justify arguments and solve problems within their subject area.
E26	Knowledge about integration of processes and operations
E28	Ability to compare and select between technological alternatives
E33	Knowledge of the fundamentals and techniques of environmental analysis
E34	Capacity for calculation and design, and knowledge about the operation, of water treatment processes including human supply, industrial conditioning and the treatment of urban and industrial waste effluents.
G01	Ability to write, sign and develop projects in the field of chemical engineering that are intended, according to the knowledge acquired as established in section 5 of order CIN / 351/2009 of February 9, construction, reform, repair, conservation, demolition, manufacture, installation, assembly or operation of: structures, mechanical equipment, energy installations, electrical and electronic installations, industrial facilities and processes and manufacturing and automation processes.
G03	Knowledge in basic and technological subjects, which enables them to learn new methods and theories, and give them versatility to adapt to new situations.
G04	Ability to solve problems with initiative, decision making, creativity, critical reasoning and to communicate and transmit knowledge, skills and abilities in the field of Chemical Engineering.
G07	Ability to analyze and assess the social and environmental impact of technical solutions.
G11	Knowledge, understanding and ability to apply the necessary legislation in the exercise of the profession of Industrial Technical Engineer
G14	Proper oral and written communication
G15	ethical commitment and professional ethics
G19	Capacity for teamwork
G20	Ability to analyze and solve problems
G21	Ability to learn and work autonomously
G22	Ability to apply theoretical knowledge to practice
G26	Obtaining skills in interpersonal relationships.

5. Objectives or Learning Outcomes**Course learning outcomes**

Description

To have knowledge of the unitary operations in depuration and purification and reuse of water.

To have knowledge of water characterization techniques.

To have the ability to carry out the presizing of the unitary operations used in purification and reuse of water

To have the ability to analyze the operation of urban wastewater treatment plants

To have the ability to analyse the operation of industrial wastewater conditioning and treatment plants.

To have the ability to analyze the operation of drinking water treatment stations

6. Units / Contents

Unit 1: Treatment of water supply

- Unit 1.1 General treatments
- Unit 1.2 Disinfection
- Unit 1.3 Especific treatments
- Unit 1.4 Production of drinking water from seawater
- Unit 1.5 Pre-sizing of water purification plant

Unit 2: Treatment of urban wastewater

- Unit 2.1 Pretreatment
- Unit 2.2 Primary treatments
- Unit 2.3 Secondary treatments
- Unit 2.4 Biological processes of elimination of nutrients
- Unit 2.5 Physico-chemical tertiary treatments
- Unit 2.6 Sludge treatment
- Unit 2.7 Pre-sizing of wastewater plant

Unit 3: Regeneration of treated wastewater

- Unit 3.1 Fundamentals
- Unit 3.2 Pre-sizing of water regeneration plant

Unit 4: Treatment of industrial wastewater

- Unit 4.1 Water conditioning for use in industry
- Unit 4.2 Treatments

Unit 5: Laboratory practices

- Unit 5.1 Coagulation-floculation
- Unit 5.2 Active sludge
- Unit 5.3 Chlorination
- Unit 5.4 Efficiency of aerators

7. Activities, Units/Modules and Methodology

Training Activity	Methodology	Related Competences (only degrees before RD 822/2021)	ECTS	Hours	As	Com	Description
Class Attendance (theory) [ON-SITE]	Lectures	CB02 E26 E28 E34 G01 G03 G04 G07 G11 G14 G15 G19 G20 G21 G22 G26	1.5	37.5	N	-	
Laboratory practice or sessions [ON-SITE]	Practical or hands-on activities	CB02 E33 E34 G01 G03 G04 G07 G11 G14 G15 G19 G20 G21 G22 G26	0.4	10	Y	Y	
Workshops or seminars [ON-SITE]	Project/Problem Based Learning (PBL)	CB02 E26 E28 E34 G01 G03 G04 G07 G11 G14 G15 G19 G20 G21 G22 G26	0.4	10	Y	N	
Final test [ON-SITE]	Assessment tests	CB02 E26 E28 E33 E34 G01 G03 G04 G07 G11 G14 G15 G20 G21 G22	0.1	2.5	Y	Y	
Study and Exam Preparation [OFF-SITE]	Self-study	CB02 E26 E28 E34 G01 G03 G04 G07 G11 G14 G15 G19 G20 G21 G22 G26	3.6	90	N	-	
Total:			6	150			
Total credits of in-class work: 2.4			Total class time hours: 60				
Total credits of out of class work: 3.6			Total hours of out of class work: 90				

As: Assessable training activity

Com: Training activity of compulsory overcoming (It will be essential to overcome both continuous and non-continuous assessment).

8. Evaluation criteria and Grading System

Evaluation System	Continuous assessment	Non- continuous evaluation*	Description
Laboratory sessions	20.00%	20.00%	Memory of practical work and written exam. Assessment: practical work memory (40% practical note) and written exam (60% practical note)
Assessment of problem solving and/or case studies	30.00%	0.00%	Resolution in group of cases of pre-sizing of Water Treatment Stations and / or Evaluation of proposals for the treatment of specific effluents

Final test	50.00%	80.00%	Exam with theoretical-practical questions about the contents taught in the subject
Total:	100.00%	100.00%	

According to art. 4 of the UCLM Student Evaluation Regulations, it must be provided to students who cannot regularly attend face-to-face training activities the passing of the subject, having the right (art. 12.2) to be globally graded, in 2 annual calls per subject, an ordinary and an extraordinary one (evaluating 100% of the competences).

Evaluation criteria for the final exam:

Continuous assessment:

To pass the subject in each of the sections will require a minimum of 4.0 / 10 and the average must be equal to or greater than 5.0 / 10. Attendance at laboratory practices will be mandatory.

Non-continuous evaluation:

To pass the subject in each of the sections will require a minimum of 4.0/10 and the average must be equal to or greater than 5.0/10. Attendance at laboratory practices will be mandatory. Students who do not participate in the resolution of problems or cases will be evaluated on these skills with questions in the final exam of the subject.

9. Assignments, course calendar and important dates	
Not related to the syllabus/contents	
Hours	hours
Unit 1 (de 5): Treatment of water supply	
Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	10
Workshops or seminars [PRESENCIAL][Project/Problem Based Learning (PBL)]	2.5
Final test [PRESENCIAL][Assessment tests]	.75
Study and Exam Preparation [AUTÓNOMA][Self-study]	30
Unit 2 (de 5): Treatment of urban wastewater	
Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	17.5
Workshops or seminars [PRESENCIAL][Project/Problem Based Learning (PBL)]	5
Final test [PRESENCIAL][Assessment tests]	.75
Study and Exam Preparation [AUTÓNOMA][Self-study]	35
Unit 3 (de 5): Regeneration of treated wastewater	
Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	5
Workshops or seminars [PRESENCIAL][Project/Problem Based Learning (PBL)]	2.5
Final test [PRESENCIAL][Assessment tests]	.5
Study and Exam Preparation [AUTÓNOMA][Self-study]	10
Unit 4 (de 5): Treatment of industrial wastewater	
Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	5
Final test [PRESENCIAL][Assessment tests]	.25
Study and Exam Preparation [AUTÓNOMA][Self-study]	10
Unit 5 (de 5): Laboratory practices	
Activities	Hours
Laboratory practice or sessions [PRESENCIAL][Practical or hands-on activities]	10
Final test [PRESENCIAL][Assessment tests]	.25
Study and Exam Preparation [AUTÓNOMA][Self-study]	5
Global activity	
Activities	hours
Workshops or seminars [PRESENCIAL][Project/Problem Based Learning (PBL)]	10
Class Attendance (theory) [PRESENCIAL][Lectures]	37.5
Laboratory practice or sessions [PRESENCIAL][Practical or hands-on activities]	10
Final test [PRESENCIAL][Assessment tests]	2.5
Study and Exam Preparation [AUTÓNOMA][Self-study]	90
Total horas: 150	

10. Bibliography and Sources						
Author(s)	Title/Link	Publishing house	Citv	ISBN	Year	Description
HERNÁNDEZ MUÑOZ	Depuración de aguas residuales. 3ª ed	Paraninfo	Madrid		1994	
M. HENZE, P. HARREMOES, J.C. JANSSEN, E. ARVIN	Wastewater Treatment: Biological and Chemical Processes	Springer-Verlag	Berlin		1996	
WEF & ASCE	Design of Municipal Wastewater Treatment Plants. 2nd ed. (Volume I and II	Book Press INC	Vermont		1992	
WEF & ASCE	Operation of Municipal Wastewater Treatment Plants. 5th ed. (Volume I: Management and Support System. Volume II: Liquid processes.	Book Press INC	Vermont		1992	

