

**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:** 2021-22**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	

**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	

**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 and capacity of management and specification of the main industrial equipment in the area of knowledge of chemical engineering
E28	Ability to perform economic evaluations and establish the economic viability of a project
E33	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.
E34	Capacity for calculation and design, and knowledge about the operation, of gas treatment processes
G01	Capacity for the direction, of the activities object of the engineering projects described in the competence G1.
G03	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.
G04	Knowledge for the realization of measurements, calculations, valuations, appraisals, surveys, studies, reports, work plans and other analogous works.
G07	Ability to apply the principles and methods of quality.
G11	Proficiency in a second foreign language at level B1 of the Common European Framework of Reference for Languages
G14	ethical commitment and professional ethics
G15	Management capacity and information planning
G19	Ability to analyze and solve problems
G20	Ability to learn and work autonomously
G21	Ability to apply theoretical knowledge to practice
G22	Creativity and initiative
G26	Obtaining skills in interpersonal relationships.

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

Description

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

To have the ability to carry out the presizing of the unitary operations used in purification and reuse of water  
 To have knowledge of the unitary operations in depuration and purification and reuse of water.  
 To have knowledge of water characterization techniques.

## 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-flocculation

**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	-	
<b>Total:</b>			<b>6</b>	<b>150</b>			
<b>Total credits of in-class work: 2.4</b>			<b>Total class time hours: 60</b>				
<b>Total credits of out of class work: 3.6</b>			<b>Total hours of out of class work: 90</b>				

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%	30.00%	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%	50.00%	Exam with theoretical-practical questions about the contents taught in the subject
<b>Total:</b>	<b>100.00%</b>	<b>100.00%</b>	

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:

Evaluation criteria not defined

9. Assignments, course calendar and important dates	
Not related to the syllabus/contents	
Hours	hours
<b>Unit 1 (de 5): Treatment of water supply</b>	
<b>Activities</b>	<b>Hours</b>
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
<b>Unit 2 (de 5): Treatment of urban wastewater</b>	
<b>Activities</b>	<b>Hours</b>
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
<b>Unit 3 (de 5): Regeneration of treated wastewater</b>	
<b>Activities</b>	<b>Hours</b>
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
<b>Unit 4 (de 5): Treatment of industrial wastewater</b>	
<b>Activities</b>	<b>Hours</b>
Class Attendance (theory) [PRESENCIAL][Lectures]	5
Final test [PRESENCIAL][Assessment tests]	.25
Study and Exam Preparation [AUTÓNOMA][Self-study]	10
<b>Unit 5 (de 5): Laboratory practices</b>	
<b>Activities</b>	<b>Hours</b>
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
<b>Global activity</b>	
<b>Activities</b>	<b>hours</b>
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
<b>Total horas: 150</b>	

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. JANSEN, 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. Volume III: Solid processes)	Book Press INC	Vermont		1992	
DEGREMONT	Manual Técnico del Agua. 4ª edición española	GRAFO, S.A	Bilbao		1979	