

**1. General information****Course:** SANITARY ENGINEERING**Type:** CORE COURSE**Degree:** 2343 - MASTERS DEGREE PROGRAMME IN ENGINEERING OF ROADS, CANALS AND PORTS**Center:** 603 - E.T.S. CIVIL ENGINEERS OF CR**Year:** 2**Main language:** English**Use of additional languages:****Web site:****Code:** 310806**ECTS credits:** 4.5**Academic year:** 2019-20**Group(s):** 20**Duration:** First semester**Second language:** Spanish**English Friendly:** N**Bilingual:** Y**Lecturer:** LUIS RODRIGUEZ ROMERO - Group(s): 20

Building/Office	Department	Phone number	Email	Office hours
A50	INGENIERÍA QUÍMICA	926052491	luis.romero@uclm.es	Será fijado al comienzo del semestre/ It will be set at the beginning of the semester

**2. Pre-Requisites**

Not established

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

This subject is based on two of the competences included in the order CIN / 309/2009 relative to the degrees that qualify for the exercise of the profession of Ingeniero de Caminos, Canales y Puertos, namely:

- Ability to design and size water and wastewater treatment processes, as well as solid waste treatment ones.
- Ability to design and execute drinking water treatment processes, including desalination, and wastewater treatment. Collection and treatment of solid wastes (urban, industrial or even dangerous).

According to it, this subject focuses on the detailed study of the wastewater treatment processes most used in conventional WWTPs, as well as in the current management of municipal wastes and the drinking water treatment.

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

Code	Description
CB07	Apply the achieved knowledge and ability to solve problems in new or unfamiliar environments within broader (or multidisciplinary) contexts related to the area of study
CB09	Know how to communicate the conclusions and their supported knowledge and ultimate reasons to specialized and non-specialized audiences in a clear and unambiguous way
G16	Ability to design and execute water purification treatments, including desalination and sewage treatment. Collection and treatment of waste (urban, industrial or even hazardous).
G25	Ability to identify, measure, enunciate, analyse, diagnose and scientifically and technically describe a civil engineering problem
G27	Ability to communicate in a second language.
TE06	Ability to design and dimension water purification and wastewater treatment systems, as well as waste treatment systems.

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

Students are able to propose an optimal alternative for the integral management of MSW in a town or territory.

Students are able to propose an optimal solution for a wastewater treatment plant (WWTP) construction project.

Students can design the different elements and equipment of a WWTP.

Students know the regulations applicable to the treatment and management of wastewater and urban waste.

Students know the physical-chemical and biological fundamentals of the different wastewater and urban waste treatment processes.

**Additional outcomes**

Students know the technologies and projects of drinking water treatment

**6. Units / Contents****Unit 1: WASTEWATER TREATMENT****Unit 1.1** Introduction to Wastewater Treatment Plants design**Unit 1.2** Preliminary treatment**Unit 1.3** Primary treatment**Unit 1.4** Fundamentals of wastewater biological treatment**Unit 1.5** Suspended growth biological treatment processes**Unit 1.6** Attached growth and hybrid biological treatment processes

**Unit 1.7** Processes for nitrogen and phosphorus removal

**Unit 1.8** Wastewater plant residuals management

**Unit 2: WATER SUPPLY TREATMENT**

**Unit 2.1** Conventional drinking water treatment processes

**Unit 2.2** Advanced drinking water treatment processes

**Unit 3: MUNICIPAL SOLID WASTES MANAGEMENT**

**Unit 3.1** Current state of municipal solid waste management

**Unit 3.2** Biological treatment of MSW

**Unit 3.3** Thermal treatment of MSW

**Unit 3.4** Landfill design

7. Activities, Units/Modules and Methodology								
Training Activity	Methodology	Related Competences (only degrees before RD 822/2021)	ECTS	Hours	As	Com	R	Description
Class Attendance (theory) [ON-SITE]	Lectures	CB07 G25 G27 TE06	0.7	17.5	Y	N	Y	Master classes with the use of PowerPoint presentations previously provided to students
Problem solving and/or case studies [ON-SITE]	Workshops and Seminars	CB07 CB09 G27 TE06	0.24	6	Y	Y	Y	Seminars to solve problems or practical cases provided in advance to the students for their individual or group resolution. Before the start of the seminars, students must submit the exercises to the teacher. The problems and case studies are solved on the blackboard by the students
Computer room practice [ON-SITE]	Cooperative / Collaborative Learning	CB07 G27 TE06	0.12	3	Y	Y	Y	Computer practice with simulation software for the sizing of active sludge treatment plants
Project or Topic Presentations [ON-SITE]	Workshops and Seminars	CB09 G16 G25 G27 TE06	0.16	4	Y	Y	Y	Students, as a group, must prepare and present a previously agreed lesson with the teacher
Progress test [ON-SITE]	Assessment tests	CB07 G16 G25 G27 TE06	0.08	2	Y	N	Y	Partial progress tests, which may cover one or more lessons
Study and Exam Preparation [OFF-SITE]	Self-study	CB07 CB09 G16 G25 G27 TE06	2.4	60	Y	N	N	Study and/or preparation of tests, to be carried out by the student in an autonomous way.
Writing of reports or projects [OFF-SITE]	Group Work	CB07 CB09 G25 TE06	0.75	18.75	Y	Y	Y	Students, as a group, must complete the sizing of a WWTP from the characteristics indicated by the teacher
Final test [ON-SITE]		CB07 G16 G25 G27 TE06	0.05	1.25	Y	N	Y	Final exam of the formative activities not passed
<b>Total:</b>			<b>4.5</b>	<b>112.5</b>				
<b>Total credits of in-class work: 1.35</b>			<b>Total class time hours: 33.75</b>					
<b>Total credits of out of class work: 3.15</b>			<b>Total hours of out of class work: 78.75</b>					

As: Assessable training activity

Com: Training activity of compulsory overcoming

R: Rescheduling training activity

8. Evaluation criteria and Grading System			
Evaluation System	Grading System		Description
	Face-to-Face	Self-Study Student	
Assessment of active participation	5.00%	0.00%	Class attendance and participation in them will be valued, especially in the problem seminars.
Practicum and practical activities reports assessment	10.00%	0.00%	The practices will consist in the management of WWTP sizing software. Its realization will be obligatory.
Progress Tests	20.00%	0.00%	Several partial online tests will be made throughout the course that may include one or more topics. To pass this type of evaluation you will need to obtain an average score of 5 or more points in the set of all the tests.
Assessment of problem solving and/or case studies	45.00%	0.00%	It will consist of two different activities: (i) delivery of solved problems proposed by the professor and (ii) making of the preliminary sizing of a WWTP with assumptions proposed by the professor. The first activity will involve 25% of the final mark of the subject, being mandatory the delivery of at least 30% of the proposed problems. The WWTP preliminary design exercise will represent 20% of the final mark for the subject.
Oral presentations assessment	20.00%	0.00%	The students, as a group, must prepare and present a topic previously agreed with the teacher. It will be assessed the following issues: contents of the presentation (8% of the final

			grade), structure and quality (8% of the final grade) and the individual speech (4% of the final grade).
<b>Total:</b>	<b>100.00%</b>	<b>0.00%</b>	

#### Evaluation criteria for the final exam:

The evaluation criteria of each of the training activities and their relative weights in the final grade are those specified in the previous table. To pass without having to take a final evaluation test, it is necessary to obtain at least 5 points in the total of the evaluation and as long as the following requirements are met: (i) having completed all progress tests and obtained a 5 of average grade in total tests; (ii) have delivered at least 30% of the proposed problems; (iii) have carried out the practical activities with advantage; (iii) having made the presentation of the subject and (iv) having delivered the design work of the WWTP. In case of not fulfilling any of these requirements, the students will have to carry out the evaluation activities not carried out and / or do a theory and problems exam.

#### Specifications for the resit/retake exam:

The extraordinary evaluation will include the evaluation activities not passed in the ordinary call.

9. Assignments, course calendar and important dates	
Not related to the syllabus/contents	
Hours	hours
Computer room practice [PRESENCIAL][Cooperative / Collaborative Learning]	3
Progress test [PRESENCIAL][Assessment tests]	2
Writing of reports or projects [AUTÓNOMA][Group Work]	22.75
Final test [PRESENCIAL][]	1.25
Unit 1 (de 3): WASTEWATER TREATMENT	
Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	17.5
Problem solving and/or case studies [PRESENCIAL][Workshops and Seminars]	6
Study and Exam Preparation [AUTÓNOMA][Self-study]	49
Group 20:	
<b>Initial date:</b> 09-09-2019	<b>End date:</b> 15-11-2019
Unit 2 (de 3): WATER SUPPLY TREATMENT	
Activities	Hours
Project or Topic Presentations [PRESENCIAL][Workshops and Seminars]	1
Writing of reports or projects [AUTÓNOMA][Group Work]	7
Group 20:	
<b>Initial date:</b> 18-11-2019	<b>End date:</b> 20-11-2019
Unit 3 (de 3): MUNICIPAL SOLID WASTES MANAGEMENT	
Activities	Hours
Project or Topic Presentations [PRESENCIAL][Workshops and Seminars]	3
Group 20:	
<b>Initial date:</b> 21-11-2019	<b>End date:</b> 29-11-2019
Global activity	
Activities	hours
Final test [PRESENCIAL][]	1.25
Class Attendance (theory) [PRESENCIAL][Lectures]	17.5
Problem solving and/or case studies [PRESENCIAL][Workshops and Seminars]	6
Computer room practice [PRESENCIAL][Cooperative / Collaborative Learning]	3
Project or Topic Presentations [PRESENCIAL][Workshops and Seminars]	4
Progress test [PRESENCIAL][Assessment tests]	2
Study and Exam Preparation [AUTÓNOMA][Self-study]	49
Writing of reports or projects [AUTÓNOMA][Group Work]	29.75
<b>Total horas:</b> 112.5	

10. Bibliography and Sources						
Author(s)	Title/Link	Publishing house	Citv	ISBN	Year	Description
Colomer Mendoza, Francisco José	Tratamiento y gestión de residuos sólidos	Departamento de Ingeniería Rural y Agroalimentari		978-84-8363-071-6	2007	
Lin, Shun Dar	Water and wastewater calculations manual	McGraw-Hill		978-0-07-147624-9	2007	
	Gestión de los residuos sólidos urbanos: los residuos municipi	Asociación Mundial de las Grandes Metrópolis. Metr		84-609-5022-0	2005	
	Wastewater engineering: treatment and reuse	McGraw-Hill		007-124140-X	2004	
M.L. Davis	Water and wastewater engineering	McGraw-Hill			2010	
Qasim, Syed R.	Wastewater treatment plants: planning, design, and operation	CRC Press		1-56676-688-5	1999	
Tchobanoglous, George	Gestión integral de residuos sólidos	McGraw-Hill Interamericana de España		84-481-1830-8	1994	
Vaquero Díaz, Iván	Manual de diseño y construcción	U.D. Proyectos, E.T.S.I. Minas,		84-96140-05-9	2004	

Varios	de vertederos de residuos sólidos XXVI Curso sobre Tratamiento de Aguas Residuales y Explotación de Estaciones Depuradoras : Madrid, del 19 al 30 de noviembre de 2007	U.P.M.  CEDEX	2008
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