

**1. General information****Course:** TECHNOLOGIES FOR THE TREATMENT OF GASEOUS EFFLUENT**Code:** 57737**Type:** ELECTIVE**ECTS credits:** 6**Degree:** 344 - CHEMICAL ENGINEERING**Academic year:** 2023-24**Center:** 1 - FACULTY OF SCIENCE AND CHEMICAL TECHNOLOGY**Group(s):** 21**Year:** 4**Duration:** C2**Main language:** Spanish**Second language:** English**Use of additional languages:****English Friendly:** Y**Web site:****Bilingual:** N**Lecturer:** M<sup>a</sup> JESUS RAMOS MARCOS - Group(s): 21

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ITQUIMA	INGENIERÍA QUÍMICA	6348	mariajesus.ramos@uclm.es	Monday to Friday (9.00-10.00 h)

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**2. Pre-Requisites**

Not established

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

Subject included in the optional module Environmental Engineering. It addresses the study of the planning, design and operation of engineering techniques for the purification of polluted air currents. Given that any industrial chemical project must comply with environmental regulations and implement preventive or corrective measures of impact, it happens that this type of technology is of current use in any industrial chemical process that generates contaminated gaseous effluents into the atmosphere. Therefore, his knowledge is necessary when carrying out a complete design of a chemical plant. The techniques of elimination of solid particles, SO<sub>2</sub>, nitrogen oxides, etc. are studied and the design of industrial smokestacks is studied. Subsequently, practical cases are addressed in which the theoretical knowledge is applied to raise global systems of polluted air purification that emit different types of industries.

**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.
CB05	Have developed the necessary learning abilities to carry on studying autonomously
E35	Capacity for calculation and design, and knowledge about the operation, of gas treatment processes
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.
G02	Capacity for the direction, of the activities object of the engineering projects described in the competence G1.
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.
G11	Knowledge, understanding and ability to apply the necessary legislation in the exercise of the profession of Industrial Technical Engineer
G16	Management capacity and information planning
G17	Capacity for critical thinking and decision making
G18	Synthesis capacity
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

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

To have knowledge to design and operate contaminated air purification processes

To have the ability to assess the different options to minimize the emission of air pollutants

To be able to assess the environmental problems associated with the emissions of polluted gases in the industry.

## 6. Units / Contents

Unit 1: Air pollution abatement. Concepts.  
 Unit 2: Particulate removal. Principles.  
 Unit 3: Particulate removal. Mechanical devices.  
 Unit 4: Particulate removal. Electrostatic precipitators.  
 Unit 5: Particulate removal. Fabric filters.  
 Unit 6: Particulate removal. Scrubbers.  
 Unit 7: NOx abatement  
 Unit 8: SO2 abatement.  
 Unit 9: Volatile Organic Compounds abatement.  
 Unit 10: Greenhouse gases abatement  
 Unit 11: Design of industrial chimneys

## 7. Activities, Units/Modules and Methodology

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 CB05 E35 G01 G02 G03 G04 G11 G16 G17 G18 G19 G20 G21 G22	1.4	35	Y	N	Class attendance (theory and problems)
Computer room practice [ON-SITE]	Practical or hands-on activities	CB02 CB05 E35 G03 G04 G16 G17 G18 G19 G20 G22	0.2	5	Y	Y	Solve problems by PC simulation
Workshops or seminars [ON-SITE]	Project/Problem Based Learning (PBL)	CB02 CB05 E35 G01 G02 G03 G04 G16 G17 G18 G19 G20 G22	0.6	15	Y	Y	Solve problems and real cases in class
Group tutoring sessions [ON-SITE]	Guided or supervised work	CB02 CB05 E35 G01 G03 G04	0.1	2.5	N	-	Group tutorial to solve unclear concepts
Study and Exam Preparation [OFF-SITE]	Self-study	CB02 CB05 E35 G01 G02 G03 G04 G17 G18 G19 G20 G21 G22	3.6	90	N	-	Autonomous work
Final test [ON-SITE]	Assessment tests	CB02 CB05 E35 G01 G02 G03 G04 G11 G16 G17 G18 G19 G20 G21 G22	0.1	2.5	Y	Y	Definitive examination and partial evaluation tests
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
Theoretical exam	60.00%	60.00%	Continuous assessment option: Partial tests. Non-continuous assessment option: Single final test or exam. In both cases, the acquisition of competences and learning results of the training activity are evaluated (Theory and Problems)
Assessment of problem solving and/or case studies	25.00%	25.00%	Continuous evaluation option: The resolution of problems or practical cases is mandatory and attendance with use is required. The delivery of problems or cases solved in writing, worked on in class, is evaluated.  Single final assessment option: Those students who do not opt for continuous assessment have the option of being assessed in the single final option by means of an ordinary written final test. In this test the student is asked questions about the resolution of a practical case.
Assessment of activities done in the computer labs	15.00%	15.00%	Continuous assessment option: The activity in the computer room is mandatory and attendance is required with good use. The delivery of cases resolved in writing, worked on in class, is evaluated.  Single final assessment option: Those students who do not opt for continuous assessment have the option of being assessed in the single final option by means of an ordinary written final test.
<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:**

Each of the evaluable parts will be evaluated and the final grade will be calculated according to the evaluation percentages described above. A final grade equal to or greater than 5.00 is required to pass and a minimum of 4.00 in each of the three parts.

**Non-continuous evaluation:**

Each of the evaluable parts will be evaluated and the final grade will be calculated according to the evaluation percentages described above. A final grade equal to or greater than 5.00 is required to pass and a minimum of 4.00 in each of the three parts.

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

Criteria identical to ordinary evaluation

**Specifications for the second resit / retake exam:**

Criteria identical to ordinary evaluation

9. Assignments, course calendar and important dates	
Not related to the syllabus/contents	
Hours	hours
Class Attendance (theory) [PRESENCIAL][Lectures]	35
Computer room practice [PRESENCIAL][Practical or hands-on activities]	5
Workshops or seminars [PRESENCIAL][Project/Problem Based Learning (PBL)]	15
Group tutoring sessions [PRESENCIAL][Guided or supervised work]	2.5
Study and Exam Preparation [AUTÓNOMA][Self-study]	90
Final test [PRESENCIAL][Assessment tests]	2.5
Global activity	
Activities	hours
Class Attendance (theory) [PRESENCIAL][Lectures]	35
Final test [PRESENCIAL][Assessment tests]	2.5
Computer room practice [PRESENCIAL][Practical or hands-on activities]	5
Workshops or seminars [PRESENCIAL][Project/Problem Based Learning (PBL)]	15
Group tutoring sessions [PRESENCIAL][Guided or supervised work]	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
Nevers, Noel de	Ingeniería de control de la contaminación del aire	McGraw-Hill Interamericana		970-10-1682-3	1998	
Heinsohn, Robert Jennings	Sources and control of air pollution	Prentice Hall		0-13-624834-9+	1999	
Parker, Albert	Contaminación del aire por la industria	Reverté		978-84-291-7464-9	2001	
Theodore, Louis	Air pollution control equipment calculations	John Wiley & Sons		978-0-470-20967-7	2008	
Wark, Kenneth	Contaminación del aire : origen y control	Limusa		968-18-1954-3	2004	
	AIR pollution control and design for industry	Marcel Dekker		0-8247-9057-X	1993	
	Air pollution engineering manual	John Wiley		0-471-33333-6	2000	
	Contaminación e ingeniería ambiental	FICYT		84-923131-5-3 (o.c.)	1999	