UNIVERSIDAD DE CASTILLA - LA MANCHA

GUÍA DOCENTE

1. General information

Course: FOUNDATIONS OF ENVIRONMENTAL ENGINEERING
Code: 37318
Type: CORE COURSE
ECTS credits: 6
Degree: 340 - UNDERGRADUATE DEGREE PROGRAMME IN ENVIRONMENTAL SCIENCES
Academic year: 2023-24
Center: 501 - FACULTY OF ENVIRONMENTAL SCIENCES AND BIOCHEMISTRY
Group(s): 40
Year: 3
Duration: First semester
Main language: Spanish
Second language:
Use of additional languages:
English Friendly: Y
Web site:
Bilingual: N

Lecturer: **ISAAC ASENCIO CEGARRA** - Group(s): **40**

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Lecturer: **CARLOS JIMENEZ IZQUIERDO** - Group(s): **40**

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2. Pre-Requisites

Not established

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

Environmental Engineering is a discipline of importance for a Graduated in Environmental Sciences. For this reason, the syllabus of the Grade in Environmental Sciences in UCLM includes the subject Fundamentals of Environmental Engineering. The justification is base on providing the scientific-technical basis of engineering needed to tackle environmental pollution treatment and management technologies (water, air and soil).

The study of fundamentals of Environmental Engineering requires basic skills of Maths, Physics, Chemistry and Microbiology. For this, the students should have passed the 1st course subjects treating these skills: Maths, Physics, Chemistry, Environmental Chemical Analysis and Environmental Microbiology.

The subjects Management and Treatment of Industrial Effluents, Management and Treatment of Urban and Readily Assimilated Waste, Environmental Pollution, Processes and Technologies for Water Treatment, Energy and Environment (in 3rd and 4th courses), to a greater o lesser extend, should support on fundamentals of environmental engineering, because they show specific aspects of technologies for controlling environmental pollution (water, air and soil) that could not have been adequately addressed without the basic skills provided by the subject “Fundamentals of Environmental Engineering”.

4. Degree competences achieved in this course

Course competences

Code	Description
CB03	Be able to gather and process relevant information (usually within their subject area) to give opinions, including reflections on relevant social, scientific or ethical issues.
CB04	Transmit information, ideas, problems and solutions for both specialist and non-specialist audiences.
E01	Ability to understand and apply basic knowledge.
E02	Capacity for multidisciplinary consideration of an environmental problem
E03	Awareness of the temporal and spatial dimensions of environmental processes
E04	Ability to integrate experimental evidence found in field and/or laboratory studies with theoretical knowledge.
E05	Capacity for qualitative data interpretation
E06	Capacity for quantitative data interpretation
E24	Water resources management, supply and treatment capacity
E27	Know clean technologies and renewable energies.
T02	To know and apply the Information and Communication Technologies (ICT).
T03	To use a correct oral and written communication.

5. Objectives or Learning Outcomes

Course learning outcomes

Description

To know the legislation and quality criteria related to environmental technologies.

Train the student to work as a team.

To enable the student to work and learn autonomously, as well as for personal initiative.

To enable the student to listen and defend arguments orally and in writing.

To enable the student to search for information, its analysis, interpretation, synthesis and transmission.
To train the student to understand the unitary operations used in environmental engineering.
To enable the student to solve problems and interpret the results in a critical way.
To enable the student to relate theoretical concepts to experimental evidence.

Additional outcomes

The learning outcomes of the subject are:
1. To provide a general vision of problems that can be solved from environmental engineering.
2. To provide the basic knowledge on engineering for solving environmental problems.
3. To provide a general vision of processes employed in environmental engineering, such as sustainable exploitation of energy and wastes treatment (wastewaters, industrial and urban wastes) and contaminated soils.
SPECIFIC LEARNING OUTCOMES:
To know the basic strategies to control environmental problems.
To know the terms employed in the characterization of operations and processes.
To know the variables employed in the description of processes.
To have skills in changing units.
To establish and solve mass balances in different systems (stationary, dynamic, with chemical reaction).
To establish and solve energy balances in different systems (stationary, with chemical reaction).
To make the difference between molecular and turbulent transport and to know the variables affecting the transport velocities for both cases.
To know the main variables having influence on the fluid circulation inside tubes.
To know the variables having influence on heat transfer by conduction and convention.
To calculate the necessary insulation to minimize the loss by conduction in stationary systems.
To know the main principles and variables having influence on the design of basic operations of separation.
To know the quality indexes employed to characterize the environment: air, water and soils.
To be able to follow and take part in simple discussions on physical, chemical and biological depuration processes withing a working group (in Spanish and English).
To be able to work in group, assuming a collaborative role.

6. Units / Contents

Unit 1: Introduction
Unit 2: Fundamentals of operations and processes
Unit 3: Magnitudes and units
Unit 4: Macroscopic conservation equations: mass balances
Unit 5: Macroscopic conservation equations: energy balances
Unit 6: Generalities on transport phenomena
Unit 7: Fluid flow
Unit 8: Heat transfer
Unit 9: Mass transfer
Unit 10: Environmental quality indexes
Unit 11: Treatment processes
- **Unit 11.1** Physical treatment processes
- **Unit 11.2** Chemical treatment processes
- **Unit 11.3** Biological treatment processes

Unit 12: Laboratory practices
- **Unit 12.1** Practice 1: Mass balance
- **Unit 12.2** Practice 2: Energy balance
- **Unit 12.3** Practice 3: Fluid flow
- **Unit 12.4** Practice 4: Heat exchanger
- **Unit 12.5** Practice 5: Filtration

ADDITIONAL COMMENTS, REMARKS

The subject is divided into 4 blocks:

I. General concepts

1. Introduction

2. Fundamentals of operations and processes

3. Magnitudes and units

4. Macroscopic conservation equations: mass balances

5. Macroscopic conservation equations: energy balances

II. Transport phenomena

6. Generalities on transport phenomena

7. Fluid flow

8. Heat transfer

9. Mass transfer

III. Quality indexes

10. Envinronmental quality indexes

IV. Treatment processes

11.1. Physical treatment processes

11.2 Chemical treatment processes

11.3. Biologicas treatment processes

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	E01 E02 E24 E27	0.64	16	N	-	Participatory master classes
Laboratory practice or sessions [ON-SITE]	Practical or hands-on activities	CB03 CB04 E01 E02 E03 E04 E05 E06 E24 E27 T02 T03	0.8	20	Y	Y	Realization of laboratory practices and treatment of the experimental results using Excel spreadsheets. Attendance at practices is compulsory and non-reschedulable. Evaluation is recoverable in either extraordinary call or of special completion
Problem solving and/or case studies [ON-SITE]	Project/Problem Based Learning (PBL)	CB03 E02 E03 E24 E27 T02	0.48	12	N	-	Troubleshooting and case studies
Workshops or seminars [ON-SITE]	Cooperative / Collaborative Learning	CB03 CB04 E02 E03 E24 E27 T02 T03	0.08	2	Y	N	Group problem solving during class time
Project or Topic Presentations [ON-SITE]	Lectures	CB03 CB04 E02 E24 E27 T02 T03	0.2	5	Y	N	Presentation of works by students. During the presentations, ICT tools will be used to encourage the monitoring and participation of the students
Mid-term test [ON-SITE]	Assessment tests	CB03 CB04 E01 E02 E03 E05 E06 E24 E27 T02 T03	0.04	1	Y	N	A mid-course test during the semester that will consist of theory. Minimum mark is 4
Final test [ON-SITE]	Assessment tests	CB03 CB04 E01 E02 E03 E05 E06 E24 E27 T02 T03	0.06	1.5	Y	Y	Final test of the subject in the ordinary call that will consist of theory. Minimum mark is 4. It is recoverable in either extraordinary call or of special completion
Practicum and practical activities report writing or preparation [OFF-SITE]	Group Work	CB03 CB04 E01 E02 E03 E04 E05 E06 E24 E27 T02 T03	0.8	20	Y	Y	It will be compulsory to submit a practice report per group. The evaluation of the same is recoverable with an improved report, either in the extraordinary call or of special completion
Writing of reports or projects [OFF-SITE]	Group Work	CB03 E01 E02 E05 E06 E24 E27 T02	0.8	20	Y	N	Realization of works in group for later presentation in class
Study and Exam Preparation [OFF-SITE]	Self-study	CB03 E01 E02 E05 E06 E24 E27 T02	2	50	N	-	Preparation of tests, study of theoretical concepts and resolution of problems
Mid-term test [ON-SITE]	Assessment tests	CB03 CB04 E01 E02 E03 E05 E06 E24 E27 T02 T03	0.04	1	Y	N	A mid-course test during the semester that will consist of problems. Minimum mark is 4
Final test [ON-SITE]	Assessment tests	CB03 CB04 E01 E02 E03 E05 E06 E24 E27 T02 T03	0.06	1.5	Y	Y	Final test of the subject in the ordinary call that will consist of problems. Minimum mark is 4. It is recoverable in either extraordinary call or of special completion
		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**
Final test	25.00%	44.00%	A minimum mark of 4 in theory test is compulsory
Laboratory sessions	4.00%	4.00%	Attitude in lab will be evaluated. The minimum mark is 4. Attendance is compulsory
Practicum and practical activities reports assessment	8.00%	8.00%	A minimum mark of 4 in lab memory is compulsory. If this activity is failed, an improved report should be delivered
Mid-term tests	10.00%	0.00%	Progress tests on theory. A minimum mark of 4 is necessary to pass the test
Projects	15.00%	0.00%	There is not a minimum mark
Assessment of problem solving and/or case studies	3.00%	0.00%	There is not a minimum mark
			Progress tests on problems. A minimum mark of 4 is necessary

Mid-term tests	10.00%	0.00%	to pass the test
Final test	25.00%	44.00%	A minimum mark of 4 in problems test is compulsory
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:

In the evaluation of the different sections, the level of development of transversal and specific competences achieved will be taken into account.
The mark of each activity will be numerical (0-10) according to current legislation.
In all cases, the attendance to labwork and the delivery of a lab memory are compulsory. Both attitude (4 %) and memory (8 %) are evaluated.
The final mark is calculated taking into account the mark of final test on theory (25 %), final test on problems (25 %), practices (12 %), mid-course test on theory (10 %), progress test on problems (10 %), writing and presenting a work (15 %) and case studies (3 %). There is a minimum mark in some compulsory activities: final test (4 in both theory and problems) and practices (compulsory attendance and 4 in both attitude and memory).
The course will only be considered passed if the set of all assessable activities results in a grade of 5 or higher (out of 10).

Non-continuous evaluation:

The mode assigned by default to the student will be continuous assessment. Any student may request the change to the non-continuous assessment modality (before the end of the class period) by sending an email to the teacher, provided that the assessable activities that account for at least 50% of the grade for the exam have not been carried out. total evaluation of the subject.
In the evaluation of the different sections, the level of development of transversal and specific competences achieved will be taken into account.
The mark of each activity will be numerical (0-10) according to current legislation.
In all cases, the attendance to labwork and the delivery of a lab memory are compulsory. Both attitude (4 %) and memory (8 %) are evaluated.
The final mark is calculated taking into account the mark of final test on theory (44 %), final test on problems (44 %) and practices (12 %). There is a minimum mark in some compulsory activities: final test (4 in both theory and problems) and practices (compulsory attendance and 4 in both attitude and memory).
The course will only be considered passed if the set of all assessable activities results in a grade of 5 or higher (out of 10).

Specifications for the resit/retake exam:

In the retake evaluation, the final test will have a weight of 70 % in final mark. To pass the test, a minimum note of 4 in both theory test and problems test is compulsory.
The final mark is calculated taking into account the mark of practices (12 %), writing and presenting a work (15 %) and case studies (3 %), provided that practices and retake exam is passed.
The course will only be considered passed if the set of all assessable activities results in a grade of 5 or higher (out of 10).

Specifications for the second resit / retake exam:

In the second retake evaluation, the final test will have a weight of 70 % in final mark. To pass the test, a minimum note of 4 in both theory test and problems test is compulsory.
The final mark is calculated taking into account the mark of practices (12 %), writing and presenting a work (15 %) and case studies (3 %), provided that practices and retake exam is passed.
The course will only be considered passed if the set of all assessable activities results in a grade of 5 or higher (out of 10).

9. Assignments, course calendar and important dates

Not related to the syllabus/contents	
Hours	**hours**
Mid-term test [PRESENCIAL][Assessment tests]	2
Final test [PRESENCIAL][Assessment tests]	3
Study and Exam Preparation [AUTÓNOMA][Self-study]	50
Unit 1 (de 12): Introduction	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	1
Unit 2 (de 12): Fundamentals of operations and processes	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	1
Unit 3 (de 12): Magnitudes and units	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	1
Unit 4 (de 12): Macroscopic conservation equations: mass balances	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	2
Problem solving and/or case studies [PRESENCIAL][Project/Problem Based Learning (PBL)]	2
Workshops or seminars [PRESENCIAL][Cooperative / Collaborative Learning]	1
Unit 5 (de 12): Macroscopic conservation equations: energy balances	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	2
Problem solving and/or case studies [PRESENCIAL][Project/Problem Based Learning (PBL)]	2
Workshops or seminars [PRESENCIAL][Cooperative / Collaborative Learning]	1
Unit 6 (de 12): Generalities on transport phenomena	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	1
Unit 7 (de 12): Fluid flow	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	2
Problem solving and/or case studies [PRESENCIAL][Project/Problem Based Learning (PBL)]	2
Unit 8 (de 12): Heat transfer	

Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	2
Problem solving and/or case studies [PRESENCIAL][Project/Problem Based Learning (PBL)]	3
Unit 9 (de 12): Mass transfer	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	2
Problem solving and/or case studies [PRESENCIAL][Project/Problem Based Learning (PBL)]	1
Unit 10 (de 12): Environmental quality indexes	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	1
Problem solving and/or case studies [PRESENCIAL][Project/Problem Based Learning (PBL)]	2
Unit 11 (de 12): Treatment processes	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	1
Project or Topic Presentations [PRESENCIAL][Lectures]	5
Writing of reports or projects [AUTÓNOMA][Group Work]	20
Unit 12 (de 12): Laboratory practices	
Activities	**Hours**
Laboratory practice or sessions [PRESENCIAL][Practical or hands-on activities]	20
Practicum and practical activities report writing or preparation [AUTÓNOMA][Group Work]	20
Global activity	
Activities	**hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	16
Laboratory practice or sessions [PRESENCIAL][Practical or hands-on activities]	20
Problem solving and/or case studies [PRESENCIAL][Project/Problem Based Learning (PBL)]	12
Workshops or seminars [PRESENCIAL][Cooperative / Collaborative Learning]	2
Project or Topic Presentations [PRESENCIAL][Lectures]	5
Mid-term test [PRESENCIAL][Assessment tests]	2
Final test [PRESENCIAL][Assessment tests]	3
Practicum and practical activities report writing or preparation [AUTÓNOMA][Group Work]	20
Writing of reports or projects [AUTÓNOMA][Group Work]	20
Study and Exam Preparation [AUTÓNOMA][Self-study]	50
	Total horas: 150

10. Bibliography and Sources

Author(s)	Title/Link	Publishing house	Citv	ISBN	Year	Description
Costa López, J. y cols.	Curso de ingeniería química : introducción a los procesos, l	Reverté		84-291-7126-6	2002	La biblioteca posee además ediciones de los años: 1994, 1988 y 1983
Costa Novella, E.	Ingeniería química	Alhambra		84-205-0989-2	1983	Volumen 1. Conceptos generales
Costa Novella, E.	Ingeniería química	Alhambra		84-205-0989-2	1983	Volumen 3. Flujo de Fluidos
Coulson, J. M.	Ingeniería química.	Reverté				Volumenes 1 a 5 (1979-1984)
Davis, Mackenzie L.	Introduction to environmental engineering	McGraw-Hill		0-07-015918-1	1998	
Kiely, Gerard	Ingeniería ambiental : fundamentos, entornos, tecnologías y sistemas de gestión	McGraw-Hill		84-481-2039-6	2003	
Levenspiel, Octave	Flujo de fluidos e intercambio de calor	Reverte		84-291-7968-2	1998	
Martínez de la Cuesta, Pedro J.	Operaciones de separación en ingeniería química : métodos de	Pearson		84-205-4250-4	2004	
Calleja, G. y cols.	Introducción a la ingeniería química	Síntesis		84-7738-664-1	2008	La biblioteca posee además edición del año 1999
Masters, Gilbert M.	Introduction to environmental engineering and science	New Jersey Prentice Hall		0-13-155384-4	1998	
McCabe, Warren L.	Operaciones básicas de ingeniería química	Reverté		84-291-7360-9	2007	La biblioteca posee ediciones anteriores
Mihelcic, James R.	Fundamentals of environmental engineering	John Wiley & Sons		0-471-24313-2	1999	
Reible, Danny D.	Fundamentals of environmental engineering	Lewis Publishers		1-56670-047-7	1999	