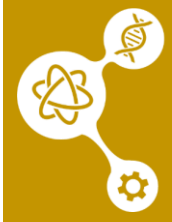
Academic year 2026/2027

Course guide:

ENVIRONMENTAL TECHNOLOGY



FACULTY OF CHEMICAL SCIENCES

1. IDENTIFICATION

Degree Programme	Bachelor's Degree in Chemical Engineering			Código	801547
Course Name	Environmental Technology			ECTS	6
Subject Area	Basic Engineering				
Module	Industrial Engineering				
Course Type	Compulsory	Course	Third year	Semester	Second
Department	Chemical Engineering and Materials				

Profesores responsables

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2. OBJECTIVES

General Objective

To introduce students to current environmental issues by characterizing the various sources of pollution and studying existing technologies for the treatment and control of polluting emissions. To familiarize them with the environmental legal framework and with the environmental management processes in industry.

Specific Objectives

- To understand environmental challenges of Spain, including the main resources, impacts, and the framework of responsibilities.
- To understand strategies for environmental protection, distinguishing between external and internal corrective measures.
- To understand how to integrate cutting-edge processes into traditional treatments.
- To know the sources and main characteristics of water pollution.
- To learn the measures for controlling and correcting water pollution.
- To understand the sources and main characteristics of air pollution.
- To learn the measures for controlling and correcting air pollution.
- To understand the main effects of air pollution.
- To understand the sources and main characteristics of solid waste pollution.
- To learn the measures for controlling and correcting pollution caused by solid waste.
- To introduce students to the problem of soil pollution and the main measures for its remediation.
- To familiarize students with the purpose of environmental audits and the need of minimization plans and environmental management systems.

- To learn about the different methodologies for conducting an environmental impact assessment.
- To know the main European and Spanish legislation on environmental pollution.

3. PRIOR KNOWLEDGE AND RECOMMENDATIONS

Prior knowledge

Students who access this subject, which is taught in the third year of the Degree, already have a sufficient basis to approach the study of this subject with guarantees of success.

Recommendations

Prior completion of the courses in Fundamentals of Chemical Engineering and Analytical Chemistry is recommended.

It is also recommended that students have a basic level of English that allows them to use bibliography in English, search for information, and communicate both in writing and orally in that language.

4. CONTENIDOS

Brief Description

Strategies for environmental protection. Legal aspects of environmental pollution. Sources and causes of water and air pollution. Corrective measures. Climate change. Greenhouse effect. Acid rain. Ozone layer depletion. Photochemical smog. Techniques for the storage, valorisation, and disposal of solid waste. Soil contamination and main technologies for its remediation. Environmental audits and minimization plans. Environmental impact assessment.

Course Syllabus

1. Introduction. The environment in Spain. Resources and impacts. Framework of competences and legal aspects. Relationship with economic activity. Strategies for environmental protection. Economic aspects. Environmental audits and minimization plans. Environmental management system. Environmental impact assessment.
2. Sources and causes of water pollution. Pollutants and effects. Urban pollution. Industrial pollution.
3. Wastewater treatments. Pretreatment. Primary treatment. Neutralization. Secondary treatment. Tertiary treatment. Advanced treatments. Reuse of treated water.
4. Treatment and management of sewage sludge. Origin and types of sludge. Conditioning. Digestion. Sludge valorisation and digester gas.
5. Air pollution. Atmospheric pollutants: sources, nature, and effects. Climate change. Thermal pollution. Greenhouse effect. Acid rain. Ozone layer depletion. Photochemical smog. Analysis of emissions and ambient air quality.
6. Methods for treating gas streams. Methods for capturing particulate matter. Methods for the removal of sulphur compounds. Methods for the removal of NOx. Methods for removing VOCs. Reduction of vehicle emissions. Dispersion of pollutants, use of chimneys.
7. Sources and classification of solid wastes. Legal aspects of waste management. European Waste Catalogue (EWC). Waste hierarchy. Integrated management systems.
8. Municipal solid waste. Application of the waste hierarchy to MSW. Collection, storage, transport, and conditioning procedures. Recovery techniques: selective separation, recycling, composting, and incineration. Disposal techniques: controlled landfill.

9. Industrial waste. Hazardousness assessment. Management techniques. Treatment and disposal methods. Secure landfill. Nuclear waste: generation, classification, treatment methods, management, and storage.
10. Soil pollution. Soil composition and properties. Sources of contamination and the behavior of contaminants in soil. Soil remediation and decontamination techniques.

5. COMPETENCES

General

CG7-MII1	Apply environmental technologies and sustainability criteria.

Specific

CE16-B1	Identify and characterise the different sources of pollution.
CE16-B2	Analyse and understand the technologies available for the treatment and control of pollutant emissions.
CE16-B3	Apply the methodology for predicting and assessing environmental impacts under the environmental legislative framework.
CE16-B4	Apply the knowledge acquired to understand and solve simple case studies related to environmental engineering.
CE16-B5	Search for and understand technical articles related to environmental engineering.

Cross-cutting

CT2-II1	Demonstrate capacity for analysis and synthesis in Industrial Engineering.
CT3-II1	Organise and plan documents and projects in the field of Engineering.
CT4-II1	Communicate in Spanish using standard audiovisual media.
CT5-II2	Use bibliography, specialised databases and resources accessible through the Internet.
CT6-II1	Use computer programs to calculate, design, simulate, approximate, and predict.
CT7-II1	Work in a team.
CT9-II1	Demonstrate professional ethical commitment.
CT10-II1	Integrate acquired knowledge and apply it to solving problems in Industrial Engineering.
CT11-II1	Learn autonomously.
CT13-II1	Demonstrate initiative and creativity in solving new situations.

6. WORKLOAD DISTRIBUTION BY ACTIVITIES

Activity	In-class (horas)	Self-study (horas)	Credits
Lectures	37,5	62,5	4
Seminars	7,5	17,5	1
Tutorials/guided work	4	6	0,4

Preparation of Coursework and Exams	3	12	0,6
Total	**52**	**98**	**6**

7. METHODOLOGY

The teaching practice will follow a complementary learning methodology based on cooperative learning, collaborative learning, and self-directed learning. This methodology will be implemented through lectures, seminars, and scheduled tutorials. Some of the recommended readings and support materials available on the virtual campus for this course will be in English:

- The **lectures** will be taught to the entire group. They will consist of lessons in which the complete course syllabus will be presented in an organized manner. Case studies related to safety of the treatments will be examined. At the beginning of each topic, the main content and objectives will be clearly stated. At the end of each topic, a summary of the most relevant content will be given, and new objectives will be proposed to connect previously studied material. To facilitate student participation in the lectures, diagrams, tables, figures, and any other necessary materials and/or information will be provided in advance in print or digital format, primarily through the **Virtual Campus**. Topic will be presented using PowerPoint presentations and the whiteboard.
- The **seminars** will be held in two groups. Their purpose is to delve deeper into specific aspects of the subject not covered in the lectures. Seminar materials will be provided in English and some activities will also be conducted in English.
- **Scheduled tutorials and guided projects** will be conducted in groups. Students will be assigned guided projects related to a pollution problem. Traditional treatments will be compared with cutting-edge environmental technologies. During the tutorials, students will have the opportunity to ask questions while independently working on the tasks required for their guided project and will receive appropriate guidance. Students will be encouraged to formulate questions and engage in open discussion on the topic presented. This activity will introduce students to specific literature searches and the evaluation and discussion of current technical articles related to environmental engineering.
- The **Virtual Campus** will be used to facilitate fluid communication between professors and students and as a tool to provide students with the materials used in both lectures and problem-solving sessions. It may also be used as a forum for presenting supplementary topics whose content, while important to the overall subject matter, is not deemed appropriate to cover in face-to-face classes. Some of the recommended readings and supporting materials available on the Virtual Campus for this course will be in English.

8. BIBLIOGRAPHY

Basic

- Metcalf & Eddy Inc. "*Wastewater Engineering: Treatment and Reuse*", 4ª ed. McGraw-Hill, Nueva York (Estados Unidos), 2004Kiely, G., "Ingeniería Ambiental", Ed. McGraw-Hill, 1999.
- Rodríguez Jiménez, J.J., "*La ingeniería ambiental*", Ed. Síntesis, 2002.
- Tchobanoglous, G., Theisen, H. y Vigil, S.A., "*Gestión integral de residuos sólidos*", Editorial McGraw-Hill, 1994.
- Wark, K. y Warn ASISTENCIA er, CF., "*Contaminación del aire*". Ed. Limusa, 1998..

Complementary

- M.L. Davis. "*Water and Wastewater Engineering: Design Principles and Practice*", 1ª ed. McGraw Hill. Michigan (Estados Unidos), 2010.
- Metcalf & Eddy, "*Ingeniería de Aguas Residuales*", 3ª Ed., Editorial McGraw-Hill, 1998.
- LaGrega, M.D., Buckingham, P.L. y Evans, J.C. "*Gestión de residuos tóxicos. Tratamiento, eliminación y recuperación de suelos*", Ed.McGraw Hill, 1996.
- Sillero Moreno, F. (2012). Tratamiento de residuos urbanos o municipales: gestión de residuos urbanos e industriales (UF0285). España: IC Editorial.
- Seoánez Calvo, M. (2002). *Tratado de la contaminación atmosférica: problemas, tratamiento y gestión*, Madrid: Mundi-Prensa, 2008
- Parker, A., "*Contaminación del aire por la Industria*", Ed. Reverté, 1994.
- Kutz, M. "*Handbook of Environmental Engineering*", John Wiley & Sons, 2018.
- N. Nevers. "*Air Pollution Control Engineering*", 3ª ed. Waveland Press Inc., 2016.
- Lund, H.F., "*Manual McGraw-Hill de reciclaje*", Editorial McGraw-Hill, 1996.

9. EVALUATIÓN

The final grade will result from the weighted average of the evaluable activities. However, to pass the subject it will be necessary to achieve the minimum grade established in each of them. If this requirement is not met, the final grade will be the weighted average obtained, with a maximum of 4.5 out of 10. This last criterion will be maintained for the extraordinary call.

The grades of the activities planned for the evaluation of the subject (midterm exams, tutorials, delivery of problems, etc.) will be communicated to the students sufficiently in advance before the final exam, so that they can adequately plan the study of this or other subjects. In any case, the minimum period of seven days will be respected between the publication of the grades and the date of the final exam of the subject.

- **EXÁMENES ESCRITOS: 70%**

  A final exam will be carried out in both the regular and in the extraordinary call. It will consist of a series of questions requiring the development or direct application of the theory. To pass the subject, students must obtain a minimum score of 5 out of 10.

  The written exams will assess the general competencies CG7-MII1 and the specific competencies CE16-B1, CE16-B2 and CE16-B3, and the cross-cutting competences CT2-II1 and CT10-II1.

❖ SELF-WORK AND GUIDED ACTIVITIES : 30%

The evaluation of the individual learning work carried out by the student will be carried out taking into account:

- The evaluation obtained in the questionnaires carried out at the end of each seminar
- The evaluation of the group projects developed and presented orally and in writing during tutorials.
- The student's ability to integrate cutting-edge knowledge from the field of Chemical Engineering within the context of Environmental Technology will be evaluated.
- The student's ability to appropriately integrate AI concepts will be assessed.
- Some activities may be evaluated in English.

The assessment of individual learning work completed by students during tutorials and seminars will take place during the extraordinary examination period, considering two possible scenarios:

- Students who passed these tutorial and seminar activities in June (grade higher than 5): their grade for these activities will be retained in the July (extraordinary) examination period.
- Students who did not pass these tutorial and seminar activities in June (grade lower than 5): questions related to the activities carried out in the tutorials and seminars will be included in the written exam so that they can be assessed for the entire course in the extraordinary July examination period.

The evaluation of these aspects will allow us to assess the degree of achievement of the general skills CG7-MII1, the specific skills CE16-B1, CE16-B2, CE16-B3, CE16-B4 and CE16-B5 and the transversal skills CT2-II1, CT3-II1, CT4-II1, CT5-II1, CT5-II2, CT6-II1, CT7-II1, CT9-II1, CT10-II1, CT11-II1, CT13-II1.

❖ ASISTENCIA Y PARTICIPACIÓN ACTIVA EN LAS CLASES:

To be able to access the global evaluation of the subject, the student must have participated in at least 70% of the face-to-face classroom activities (theory and seminars). Attendance at tutorials and work presentations is mandatory.

Active student participation in all teaching activities will be positively valued in the final grade.

ACTIVY SCHEDULE

UNIT	ACTIVITY	HOURS	GROUPS	START	END
Module 1: Unit 1	Lecture	5	1	1ª week	2ª Week
	Seminar	1	2		
Module 2: Units 2 to 4	Lecture	12	1	3ª Week	7ª Week
	Seminar	2,5	2		
Module 3: Units 5 and 6	Lecture	9,5	1	7ª Week	11ª Week
	Seminar	2	2		
Module 4: Units 7 to 10	Lecture	11	1	11ª Week	15ª Week
	Seminar	2	2		
	Tutorial 1*	1	3	3ª Week	3ª Week
	Tutorial 2*	1	3	7ª Week	7ª Week
	Tutorial 3*	1	3	11ª Week	11ª Week
	Tutorial 4*	1	3	14ª Week	14ª Week

* Scheduled tutorials are subject to possible modifications according to the global planning of the course.

SUMMARY OF ACTIVITIES

TEACHING ACTIVITY	ASSOCIATED COMPETENCES	TEACHING ACTIVITY	STUDENT ACTIVITY	EVALUATION	P	NP	TOTAL	C
Lectures	CG7-MII1, CE16B1, CE16B2, CE16B3, CT2-II1, CT3-II1, CT11-II1	Presentation of theoretical concepts, questions and new objectives.	Note taking. Formulation of questions and doubts.	Grading of the written exam.	37,5	62,5	100	
Seminars	CG7-MII1, CE16B1, CE16B2, CE16B5, CT2-II1, CT5-II2, CT6-II1, CT10-II1, CT11-II1	Extension of theoretical concepts.	Note taking. Active participation during the seminar.	Resolution of questions.	7,5	17,5	25	**10%**
Tutoríals	CG7-MII1, CE16B1, CE16B2, CE16B3, CE16B4, CT2-II1, CT3-II1, CT4-II1, CT5-II2, CT7-II1, CT9-II1, CT10-II1, CT13-II1	Proposed practical case studies. It helps students to prepare their work with explanations and bibliographic recommendations	Discussion and resolution of case studies. Presentation and defence of the teamwork.	Assessment of oral and written work.	4	6	10	**20%**
Exams	CG7-MII1, CE16B1, CE16B2, CE16B3, CT2-II1, CT4-II1, CT10-II1, CT13-II1	Preparation, monitoring, and grading of the exam. Student grading.	Study to prepare the exam. Exam execution.	Exam grading	3	12	15	**70%**

P: On-site activities

NP: Independent activities (self-study)

C: Grade