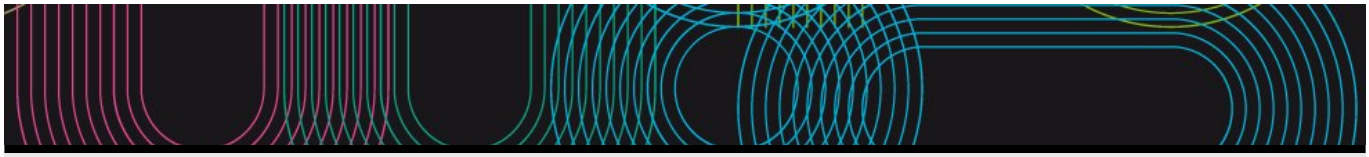

IDENTIFYING DATA				
Environmental technology				
Subject	Environmental technology			
Code	V12G380V01401			
Study programme	Grado en Ingeniería Mecánica			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	2nd	1st
Teaching language	Spanish Galician English			
Department				
Coordinator	Álvarez da Costa, Estrella			
Lecturers	Álvarez da Costa, Estrella Canosa Saa, José Manuel Moldes Menduíña, Ana Belén Moldes Moreira, Diego Moure Varela, Andrés			
E-mail	ealvarez@uvigo.es			
Web	http://moovi.uvigo.gal			
General description	Subject that belongs to the Block of Common Subjects of the Industrial Technologies. It is part of the curricula of all Degrees of Industrial Engineering. This subject provides an approach to Environmental Engineering, which is necessary to develop any engineering project. In it we work areas of Chemistry and Process Engineering, in order to study the pollutants behaviour and their effect on the environment and organisms, to design physical-chemical processes to mitigate pollution, as well as to evaluate the environmental impact of the industrial wastes. The subject's objective is to know, understand, and know how to apply the techniques used, on an industrial scale, in fields such as solid wastes treatment and management, wastewater treatment, soil remediation, treatment of polluting gas industrial emissions, and pollution prevention.			

Training and Learning Results	
Code	
B7	CG7 Ability to analyze and assess the social and environmental impact of the technical solutions.
C16	CE16 Basic knowledge and application of environmental technologies and sustainability.
D1	CT1 Analysis and synthesis
D2	CT2 Problems resolution.
D3	CT3 Oral and written proficiency.
D9	CT9 Apply knowledge.
D10	CT10 Self learning and work.
D12	CT12 Research skills.
D17	CT17 Working as a team.
D19	CT19 Sustainability and environmental commitment. Equitable, responsible and efficient use of resources.

Expected results from this subject	Training and Learning Results	
Basic knowledge and application of environmental technologies and sustainability	C16	D2 D3 D10 D19

Problem solving	C16	D2 D3 D10 D19
Oral and writing communication	C16	D2 D3 D10
Knowledge application to practical and real cases	C16	D2 D3 D10 D19
Analysis and synthesis	C16	D1 D2 D3 D9 D10 D12 D17 D19
Ability to analyze and determine the social and environmental impact of the technical solutions to environmental problems	B7	D1 D3 D9 D10 D17 D19

Contents	
Topic	
Lesson 1: Introduction to the environmental technology.	1. Material cycle economy. 2. Introduction to the best available techniques (BAT).
Lesson 2: Management of waste and effluents.	1. Generation of waste. Types and classification of wastes. 2. Codification of wastes. 3. Urban waste management. 4. Industrial waste management. Industrial waste treatment facilities. 5. Regulations
Lesson 3: Treatment of urban and industrial wastes.	1. Valorization. 2. Physico-chemical treatment. 3. Biological treatment. 4. Thermal treatment. 5. Landfilling. 6. Soil remediation technologies.
Lesson 4: Treatment of industrial and municipal wastewaters.	1. Characteristics of municipal and industrial wastewaters. 2. Wastewater treatment plant. 3. Sludge treatment. 4. Water treatment and reuse 5. Regulations
Lesson 5: Atmospheric pollution.	1. Types and origin of atmospheric pollutants. 2. Dispersion of pollutants in the atmosphere. 3. Effects of the atmospheric pollution. 4. Treatment of polluting gas emissions. 5. Regulations
Lesson 6: Sustainability and environmental impact assessment	1. Sustainable development 2. Life cycle analysis and economy. 3. Ecological footprint and carbon footprint. 4. Introduction to the environmental impact assessment
Practice 2: Preparation of immobilized activated charcoal for use as an adsorbent.	
Practice 1: Codification of wastes	
Practice 3: Contaminants removal by adsorption with immobilized activated charcoal.	
Practice 4: Coagulation-flocculation: Establishment of optimal working conditions.	
Practice 5: Simulation of certain stages of an EDAR.	
Practice 6: Life Cycle Analysis of a product.	

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	26	52	78
Problem solving	11	22	33
Laboratory practical	12	12	24
Objective questions exam	1	0	1
Problem and/or exercise solving	2	0	2
Report of practices, practicum and external practices	0	6	6
Case studies	0	6	6

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies

	Description
Lecturing	Teaching in the classroom of the key concepts and procedures for learning the syllabus contents
Problem solving	Solving exercises with the teacher's help and independently
Laboratory practical	Application of the knowledge acquired to the resolution of problems of environmental technology, using equipment and facilities available in the laboratory/computer room.

Personalized assistance

Methodologies	Description
Laboratory practical	In tutorials, students can consult with their teacher any questions about laboratory practices or the report of practices to be done. The tutoring schedule of the teaching staff will be public and accessible to the students.
Lecturing	In tutorials, students can consult with their teacher any questions arising in the lectures and related to the contents seen in them The schedule of tutorials of teachers will be public and accessible to students.
Problem solving	In tutorials, students can consult their teacher any questions about the resolution of problems raised in the classroom. The tutoring schedule of the teaching staff will be public and accessible to the students.

Assessment

	Description	Qualification	Training and Learning Results
Objective questions exam	Written test in which students must answer theoretical questions related to syllabus of the subject. CG7, CE16 and CT19 competences will be assessed in this test, based on student responses to the questions. CT1, CT3 and CT10 competences are also evaluated, since the test is written and requires students' analysis and synthesis skills.	30	B7 C16 D1 D3 D10 D19
Problem and/or exercise solving	Written proof in which students must solve several problems related to the syllabus of the subject. CT2, CT9 and CT19 competences will be assessed in this proof, based on the resolution of various exercises of environmental technology, which require the use of applied knowledge related to the contents of the subject. CT1, CT3 and CT10 competences are also evaluated, since the proof is written and requires students' analysis and synthesis skills.	30	D1 D2 D3 D9 D10 D19

Report of practices, practicum and external practices	Detailed report for each practices that includes an explanation of the experimental work, as well as the results obtained, their analysis and the conclusions drawn from them. The laboratory practices are in teams of 2 students, but the report will be given individually. A report submitted by a student who did not previously do the practical in the laboratory will not be evaluated under any circumstances. In the computer classroom practices, each student will work individually and, consequently, the reports will also be individual. Similarly, only the report handed by a student who has previously attended the corresponding practical session will be assessed. The competences: CG7, CE16, CT1, CT3, CT9 and CT10, are assessed based on the quality of the written report elaborated by each student on his/her own. The following points will be evaluated in the report: text style and correctness, structure and presentation, analysis and discussion of the results, and conclusions. Competences CT12 and CT17 will be assessed based on the laboratory work. Lab practices will be carried out in pairs, and it is expected the student develop research skills in the field of environmental technology.	10	B7 C16	D1 D3 D9 D10 D12 D17
Case studies	All exercises, seminars, practical cases and theoretical / practical tests that are made and delivered to the teacher throughout the course, related to the concepts and contents of the syllabus. Throughout a four-month time several tests are performed. Competences CG7 and CE16 will be assessed considering the students answers to the theoretical questions. Competences CT2, CT10 and CT12 will be assessed considering the students answers to the exercises. Competence CT3 will be assessed base on the two parts of the exam: theory and exercises; considering the precision and clarity of the answers.	30	B7 C16	D2 D3 D10 D12

Other comments on the Evaluation

Evaluation:

A student who choose continuous assessment, to pass the course, must achieve a **MINIMUN SCORE** of **4.0 points** (out of 10) ***in all the evaluation tests detailed in this guide***, ie, "Objective questions exam", "Problem and/or exercise solving", "Case studies" and "Report of practices". If a student reaches the minimum grade, to pass the subject must obtain a **FINAL GRADE** of **≥ 5.0**, that is, when the sum of grades of the "practice report", "Case study", "Objective questions exam" and the "Problem solving and/or exercises" is ≥ 5.0.

Students who "***officially renounces continuous assessment***", will make a "FINAL EXAM" (Objective questions exam + Problem and/or exercise solving) that will be worth 90% of the final grade, and a "EXAM OF PRACTICES" that will be worth 10% of the final grade. In any case, to pass the course, the student must achieve 50% of the maximum score in each of the constituent parts of the subject, ie, theory, problems and practices.

In addition, if a student misses more than 1 "laboratory practice", without a justified cause, in order to pass the course, he/she will have to do an exam of the practices that he/she did not do.

Second call:

In the second call the same criteria apply.

In relation to the July exam, the grade of "Case study" and "Practical report" will be kept, as soon as the student achieved the required minimum grade in the 1st call.

For the "Objective questions exam" and the "Resolution of problems and/or exercises" if, at the 1st call, a student suspended one of the test and approves the other with a grade ≥ 6, on the July exam, you only need to repeat the suspended part.

Ethical commitment:

The student is expected to present an adequate ethical behavior. If you detect "unethical behavior" (copying, plagiarism, unauthorized use of electronic devices, etc.) shall be deemed that the student does not meet the requirements for passing the subject. In this case the final grade, in the current academic year, will FAIL (0.0 points).

The use of electronic devices during the assessment tests will be allowed. The fact of introducing into the examination room an unauthorized electronic device, will be reason not pass the course in the current academic year, and the final grade will FAIL (0.0 points)

Sources of information

Basic Bibliography

Mihelcic, J.R. and Zimmerman, J. B., **Environmental Engineering: Fundamentals, sustainability, design**, Wiley, 2014

Davis, M.L. and Masten S.J., **Principles of Environmental Engineering and Science**, McGraw-Hill, 2014

Metcalf & Eddy, **Ingeniería de aguas residuales : tratamiento, vertido y reutilización**, McGraw-Hill, 1998

Acosta, J.A. et al., **Introducción a la contaminación de suelos**, Mundi-prensa, 2017

Complementary Bibliography

Tchobanoglous, G., **Gestión integral de residuos sólidos**, McGraw-Hill, 1996

Nemerow, N. L., **Tratamiento de vertidos industriales y peligrosos**, Diaz de Santos, 1998

Baird, C y Cann M., **Química Ambiental**, Reverté, 2014

Kiely, G., **Ingeniería Ambiental: fundamentos, entornos, tecnología y sistemas de gestión**, McGraw-Hill, 2001

Castells et al., **Reciclaje de residuos industriales: residuos sólidos urbanos y fangos de depuradora**, Díaz de Santos, 2009

Albergaria, J.M. and Nouws H.P.A., **Soil remediation**, Taylor and Francis, 2016

Sharma, H. D., and Reddy, K. R., **Geoenvironmental engineering: site remediation, waste containment, and emerging waste management technologies**, John Wiley & Sons, 2004

Wark and Warner, **Contaminación del aire: origen y control**, Limusa, 1996

Jonker, G. y Harmsen, J., **Ingeniería para la sostenibilidad**, Reverté, 2014

Azapagic, A. and Perdan S., **Sustainable development in practice: Case studies for engineers and scientists**, Wiley, 2011

Reddy, K.R., Cameselle, C. and Adams, J.A., **Sustainable Engineering: Drivers, Metrics, Tools, and Applications**, Wiley, 2019

Recommendations

Subjects that it is recommended to have taken before

Physics: Physics 1/V12G360V01102
Physics: Physics 2/V12G360V01202
Chemistry: Chemistry/V12G380V01205

Other comments

Recommendations:
To enroll in this subject is necessary to have passed or be enrolled in all subjects of previous courses to the course that is located this subject.