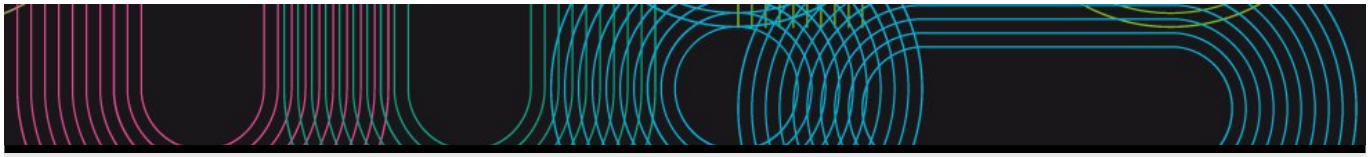

IDENTIFYING DATA				
Environmental technology				
Subject	Environmental technology			
Code	V12G380V01401			
Study programme	Degree in Mechanical Engineering			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	2nd	1st
Teaching language	Spanish Galician English			
Department				
Coordinator	Álvarez da Costa, Estrella			
Lecturers	Álvarez da Costa, Estrella Cameselle Fernández, Claudio Moldes Menduíña, Ana Belén Moldes Moreira, Diego Moure Varela, Andrés Rosales Villanueva, Emilio Yañez Diaz, Maria Remedios			
E-mail	ealvarez@uvigo.es			
Web	http://faitic.uvigo.es			
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. The main objective is to achieve a basic knowledge about the Treatment and management of solid wastes, wastewaters and pollutant emission to the atmosphere. It includes also the concepts of pollution prevention and sustainability. Subject of the "English Friendly" program. International students may request the teacher Claudio Cameselle Fernández (M1, M2 and M5 groups): a) Materials and bibliographic references for the follow-up of the subject in English. b) Attend tutorials in English. c) Tests and evaluations in English.			

Competencies	
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.

Learning outcomes	
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	"FINAL EXAM" consisting of theoretical questions related to the syllabus of the subject. CG7, CE16 and CT19 competences will be assessed in this exam, based on student responses to the questions. CT1, CT3 and CT10 competences are also evaluated, since the exam is written and requires students' analysis and synthesis skills.	30	B7 C16	D1 D3 D10 D19
Problem and/or exercise solving	"FINAL EXAM" consisting of problems related to the syllabus of the subject. CT2, CT9 and CT19 competences will be assessed in this exam, 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 exam 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 the results and their discussion. 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. The written report must be done in pairs.	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. Competenci 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 of10) ***in each of the parts of the "FINAL EXAM"*** , ie, theory (Objective questions exam) and problems (Problem and/orexercise solving). If a student reaches the minimum grade in both parts of the "FINAL EXAM", 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" and the "FINAL EXAM" (Exam of objective questions + Problem solving and/or exercises) is ≥ 5.0.

Students who "*officially renounces continuous assessment*", will make a "FINAL EXAM" (Objective questions exam + Problemand/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 constituentparts of the subject, ie, theory, problems and practices.

Second call:

In the second call the same criteria apply.

In relation to the July exam, grades of the "Case studies" and "Practices report" are maintained, and students only have to repeat the "FINAL EXAM", ie, "Objective questions exam" + "Problem and/or exercise solving".

If, at the 1st call, a student suspended one of the parts of the "FINAL EXAM" (theory or problems) and approves the other party 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.

Contingency plan

Description

=== EXCEPTIONAL PLANNING ===
Given the uncertain and unpredictable evolution of the health alert caused by COVID-19, the University of Vigo establishes an extraordinary planning that will be activated when the administrations and the institution itself determine it, considering safety, health and responsibility criteria both in distance and blended learning. These already planned measures guarantee, at the required time, the development of teaching in a more agile and effective way, as it is known in advance (or well in advance) by the students and teachers through the standardized tool.

=== ADAPTATION OF THE METHODOLOGIES ===

* Teaching methodologies maintained
All teaching methodologies planned will be maintained, although they would be adapted to remote teaching.

The " lectures" would be online, via the Remote Campus, Faitic or any other platform that the University of Vigo wouldprovide to the academic staff.

Of all " laboratory practices " initially planned, those non-experimental ones would be maintained, while the others would bereplaced by on-line practices.

* Non-attendance mechanisms for student attention (tutoring)
Tutoring would be online, in the teacher's "virtual office" or by e-mail. In any case, students should previously arrange withtheir teacher (by e-mail) the tutoring date.

* Modifications (if applicable) of the contents
In a virtual context, the three experimental practices would be replaced by online ones, maintaining the same contents.

=== ADAPTATION OF THE TESTS ===

In a virtual context, no changes would be required in the assessment criteria, or in the weighting of each test, in relation towhat is established for a presential assessment. Nor would it be necessary to make any changes in the type of tests .

Therefore, the assessment criteria are maintained, adapting the tests, if necessary and as indicated in the Rector's Resolution, to the telematic resources made available to the teaching staff