Teaching Guide				
Identifying Data				2021/22
Subject (*)	Residues		Code	610500011
Study programme	Mestrado Universitario en Ciencias, Tecnoloxías e Xestión Ambiental (plan 2012)			
Descriptors				
Cycle	Period	Year	Type	Credits
Official Master's Degree	2nd four-month period	First	Optional	3
Language	Galician			
Teaching method	Face-to-face			
Prerequisites				
Department	Física e Ciencias da TerraQuímica			
Coordinador	Soto Castiñeira, Manuel	E-mail	m.soto@udc.es	
Lecturers	Domínguez Pérez, Montserrat Soto Castiñeira, Manuel	E-mail	montserrat.dominguez.perez@udc.es m.soto@udc.es	
Web				
General description	This module is part of the Official Postgraduate Program in Environmental Science, Technology and Management (CTXA) as an optional subject and aims to introduce students to the problem of waste, its management and treatment technologies.			
Contingency plan	In case of a non-contact scenario (Scenario 3: confinement), the following adaptations will be carried out in teaching and activities. Teaching methodology that changes: ? Field trip / visit: would be canceled and replaced by an online practical seminar. ? Objective test: the same methodology will be followed, and it will be done using Moodle and Teams. ? Master session and seminars: the methodology would be the same using the Teams as a communication channel. ? Laboratory practices: they will be replaced by online work on waste management systems and materials (virtual visit to Nostián, virtual visit to the waste management and composting systems at the UDC, Exhibition ?O lixo na UDC - Nostián Model?) and its critical analysis, in online work sessions. For scenario 2 (distancing) the adaptation provided in the center will be adopted for cases in which the capacity of the classroom assigned for the subject is exceeded, by allocating additional spaces and teaching the class through TEAMS for students who are not in the classroom with the teacher. Mechanisms of personalized attention to students (both scenarios): ? Use of Moodle, Email and Teams Modifications in the evaluation (both scenarios): ? No changes are recorded.			

Study programme competences / results	
Code	Study programme competences / results
A1	Coñecemento das realidades interdisciplinares da Química e do Medio Ambiente, dos temas punteiros nestas disciplinas e das perspectivas de futuro.
A3	Capacitar ao alumno para o desenvolvemento dun traballo de investigación nun campo da Química ou do Medio Ambiente, incluíndo os procesos de caracterización de materiais, o estudo das súas propiedades fisicoquímicas e biolóxicas e dos procesos que poden sufrir no medio natural.
A6	Coñecemento do comportamento de diferentes especies químicas e dos procesos aos que poden estar sometidas unha vez liberadas no medio ambiente, incluíndo as súas relacións entre distintos compartimentos ambientais.
A10	Relacionar a presenza de especies químicas no medio natural cos conceptos de toxicidade e biodisponibilidade.
A16	Comprender a problemática asociada aos resíduos, os modos de xestionalos e as principais tecnoloxías de tratamento de resíduos.

A18	Coñecer as implicacións económicas dos problemas ambientais, os instrumentos de política económica e os principais indicadores ambientais.
A19	Coñecemento e interpretación da lexislación, normativa e procedementos administrativos básicos sobre medios acuosos, chans e atmosferas. Comprensión das bases científicas e económicas da sustentabilidade.
B2	Que os estudantes saiban aplicar os coñecementos adquiridos e a súa capacidade de resolución de problemas en contornas novas ou pouco coñecidos dentro de contextos máis amplos (ou multidisciplinares) relacionados coa súa área de estudo.
B3	Que os estudantes sexan capaces de integrar coñecementos e enfrontarse á complexidade de formular xuízos a partir dunha información que, sendo incompleta ou limitada, inclúa reflexións sobre as responsabilidades sociais e éticas vinculadas á aplicación dos seus coñecementos e suizos.
B4	Que os estudantes saiban comunicar as súas conclusións e os coñecementos e razóns últimas que as sustentan a públicos especializados e non especializados dun modo claro e sen ambigüedades.
B5	Que os estudantes posúan as habilidades de aprendizaxe que lles permitan continuar estudando dun modo que haberá de ser en gran medida autodirixido ou autónomo.
B6	Ser capaz de analizar datos e situacións, xestionar a información dispoñible e sintetizala, todo iso a un nivel especializado.
B8	Comprender, a un nivel especializado, as consecuencias do comportamento humano na contorna ambiental.
C1	Ser capaz de traballar en equipos, especialmente nos interdisciplinares e internacionais.
C2	Ser capaz de manter un pensamento crítico dentro dun compromiso ético e no marco da cultura da calidade.
C4	Expresarse correctamente, tanto de forma oral coma escrita, nas linguas oficiais da comunidade autónoma.
C7	Desenvolverse para o exercicio dunha cidadanía aberta, culta, crítica, comprometida, democrática e solidaria, capaz de analizar a realidade, diagnosticar problemas, formular e implantar solucións baseadas no coñecemento e orientadas ao ben común.
C9	Valorar criticamente o coñecemento, a tecnoloxía e a información dispoñible para resolver os problemas cos que deben enfrontarse.
C10	Asumir como profesional e cidadán a importancia da aprendizaxe ao longo da vida.

Learning outcomes			
Learning outcomes	Study programme competences / results		
Capacity to formulate and implement knowledge-based solutions and oriented to the common good.	AC3 AC18	BC4 BC5 BC6	CC2 CC7
Understand the problems associated with waste, modes of management and the main waste treatment technologies.	AC1 AC6 AC10 AC16 AC18 AC19	BC6 BC8	CC1 CC4
Personal development for the exercise of an open, critical and committed citizenry		BC2 BC3	CC9 CC10

Contents	
Topic	Sub-topic
SOLID WASTE	Waste definition Types of waste. Classification Quantities, composition and characteristics Environmental impact of waste Legislation and planning
WASTE MINIMIZATION	The need for prevention, prevention plan, environmental audit aimed at minimizing emissions, waste minimization plan, industrial best practices, examples.

SEPARATE COLLECTION AND RECYCLING	Selective collection of municipal solid waste (MSW). Collection of hazardous waste and special waste streams. Classification of MSW at plant. Quality and marketing of recovered products. Environmental balances of recycling and composting.
COMPOSTING OF ORGANIC WASTE	Definitions. The process of composting Parameters for composting process control Composting technologies
BIOMETHANIZATION OF ORGANIC WASTE	Anaerobic digestion The anaerobic technology for the treatment of the organic fraction of municipal solid waste
THERMAL TREATMENT OF SOLID WASTE	Energetic data of waste. Calorific value. Control of emissions from waste incinerators
PHYSICO-CHEMICAL TREATMENT OF HAZARDOUS WASTE	The CTRIG (Center for Industrial Waste Treatment of Galicia) Methods and operations of physical-chemical treatment
WASTE LANDFILLS	The current regulatory framework Design, operation and control of landfills

Planning				
Methodologies / tests	Competencies / Results	Teaching hours (in-person & virtual)	Student?s personal work hours	Total hours
Guest lecture / keynote speech	A3 A6 A10 A16 A19 B4 B5 B6 B8 C2 C1 C4 C7 C9 C10	9	27	36
Laboratory practice	A3 A16 B3 B6 C1 C4 C9	6	12	18
Seminar	A16 B6 C4 C7	4	12	16
Field trip	A16 B2 B8 C2 C7 C9	2	2	4
Objective test	A1 A3 A16 A18 A19 B6 B8	1	0	1
Personalized attention		0	0	0
(*)The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.				

Methodologies	
Methodologies	Description
Guest lecture / keynote speech	The teacher will expose orally using the audio-visual means of the basic contents of the subject. Will ask questions and other observations to direct the attention of the student on the key aspects. It will provide the student with the schemes, charts and tables that he deems appropriate.
Laboratory practice	Experimenting processes or some element of a process, based on the theoretical basis, the materials and methods available, obtaining experimental results, their analysis and assessment, and the writing of conclusions. They will have a previous script and will prepare a final report.
Seminar	Formulation of theoretical or practical problems and study and analysis of documentation, debate and reach conclusions in the group.
Field trip	A waste treatment facility will be visited, in which students must collect direct information, complete it with additional information (independent or from different sources), analyze it critically and draw conclusions. They will prepare a final report.
Objective test	It consists of a test type, with single or multiple answer, which will deal with the contents worked on in the lectures, seminars and analysis of documentary sources.

Personalized attention	
Methodologies	Description

Guest lecture / keynote speech Laboratory practice Seminar Field trip	There will be personalized attention, by email or in contact tutorials (individual or small group), on any aspect of the subject and the work of the student. Attendance to the student in relation to the laboratory practices and field trips will take place directly during their realization, as well as later.

Assessment			
Methodologies	Competencies / Results	Description	Qualification
Guest lecture / keynote speech	A3 A6 A10 A16 A19 B4 B5 B6 B8 C2 C1 C4 C7 C9 C10	Continuous assessment of the active participation of the student.	5
Laboratory practice	A3 A16 B3 B6 C1 C4 C9	Attendance to the lab practices and the preparation of a report according to the basic formal aspects will score 50% of the total of this methodology, and the quality of the report will score the remaining 50%.	30
Seminar	A16 B6 C4 C7	Continuous assessment of the active participation of the student.	15
Field trip	A16 B2 B8 C2 C7 C9	The realization of the field trips (visits to treatment plants) and the elaboration of a memory according to the basic formal aspects will score 50% of the section, and the quality of the memory will score the remaining 50%.	10
Objective test	A1 A3 A16 A18 A19 B6 B8	Quantification based on the percentage of correct answers.	40

Assessment comments
The works that are agreed upon and the laboratory and field reports must be delivered within a maximum of 2 weeks. The qualification of Not Presented is reserved for those students who have participated in less than 40% of the programmed activities and / or did not participate in the objective test. The fraudulent carrying out of the tests or evaluation activities will directly imply the qualification of suspended '0' in the subject in the corresponding call, thus invalidating any qualification obtained in all the evaluation activities towards the extraordinary call.

Sources of information	
Basic	G. Tchobanoglous, H. Theisen and S.Vigil (1994). GESTIÓN INTEGRAL DE RESIDUOS SÓLIDOS. Madrid. McGraw-HillInstitut Cerdá (1994). MANUAL DE MINIMIZACIÓN DE RESIDUOS Y EMISIONES INDUSTRIALES. BarcelonaM. Soto e A. Vega (Ed.) (2001). Tratamento de resíduos sólidos urbanos . Universidade da Coruña.Moreno Casco, J. / Moral Herrero, R. (2008). COMPOSTAJE. Madrid. Mundi Pres. Lasaridi, K.E. e Stentiford, E.I. (1998). A simple respirometric technique for assessing compost stability. . Water Research, 32, 3717?3723.W.F. Brinton Jr, E. Evans, M.L. Droffner e R.B. Brinton. (1995). Standardized test for evaluation of compost self-heating . BioCycle, pp 64-69Sánchez e cols. (2014). DE RESIDUO A RECURSO. EL CAMINO HACIA LA SOSTENIBILIDAD. Residuos Urbanos. Mundi-Prensa: Madrid.Sánchez e cols. (2016). DE RESIDUO A RECURSO. EL CAMINO HACIA LA SOSTENIBILIDAD. Residuos Ganaderos. Mundi-Prensa: Madrid.Vanessa Prieto-Sandoval*, Carmen Jaca, Marta Ormazabal. Towards a consensus on the circular economy. Journal of Cleaner Production 179 (2018) 605-615.Exposición: O lixo na UDC - Modelo Nostián: https://udc.es/sociedade/medio_ambiente/compostaxe/expo-residuos/

Complementary	(). http://www.envirowise.gov.uk/; www.sogama.es. (). http://www.xunta.es/conselle/cma/; http://www.xunta.es/conselle/cma/; http://www.adega.info; http://reports.eea.europa.eu; http://www.epa.gov/epaoswer/non-hw/reduce/;. Revista CERNA (Revista Galega de Ecoloxía e Medio Ambiente). Santiago de Compostela. Ed. ADEGA. http://www.adega.gal/revistacerna/portada.php ?Cerrar o círculo: Un plan de acción da UE para a economía circular? [COM (2015) 614 final]: http://eur-lex.europa.eu/resource.html?uri=cellar:8a8ef5e8-99a0-11e5-b3b7-01aa75ed71a1.0011.02/DOC_1&format=PDF

Recommendations
Subjects that it is recommended to have taken before
Subjects that are recommended to be taken simultaneously
Subjects that continue the syllabus
Other comments
Green Campus Program of the Faculty of Science To help achieve a sustainable environment and comply with point 6 of the "Environmental Declaration of the Faculty of Sciences (2020)", the documents elaborated in this suject:a. They will be requested mostly in virtual format and computer support.b. To be made on paper:- Plastics will not be used.- Double-sided prints will be made.- Recycled paper will be used.- Drafts will be avoided.

(*)The teaching guide is the document in which the URV publishes the information about all its courses. It is a public document and cannot be modified. Only in exceptional cases can it be revised by the competent agent or duly revised so that it is in line with current legislation.