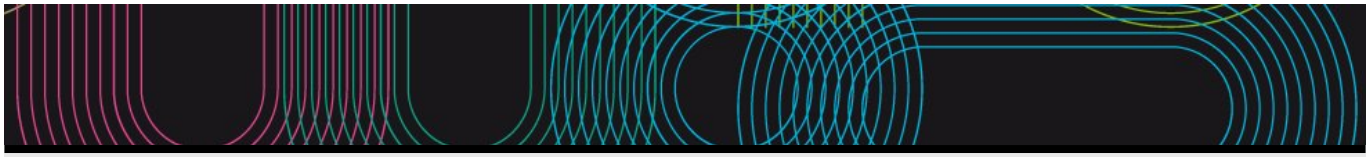

IDENTIFYING DATA				
Sewage treatment techniques				
Subject	Sewage treatment techniques			
Code	O01G261V01928			
Study programme	Grado en Ciencias Ambientales			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Optional	4th	2nd
Teaching language	#EnglishFriendly Spanish			
Department				
Coordinator	Torres Pérez, María Dolores			
Lecturers	Domínguez González, Herminia Ferreira Santos, Pedro Flórez Fernández, Noelia Torres Pérez, María Dolores			
E-mail	matorres@uvigo.es			
Web				
General description	This subject provides scientific-technical knowledge on the unit operations useful for wastewater treatment addressing fundamentals, design and operation principles, as well as equipments and examples of application of these technologies. The course will provide: 1) review of general concepts (characterization, regulation, selection criteria, □) 2) presentation of the different physical, chemical and biological unit operations 3) criteria for the selection of commercial and developing technologies for the treatment of domestic and industrial wastewaters, sludge management and reuse of by-products and water. English Friendly subject: International students may request from the teachers: a) resources and bibliographic references in English, b) tutoring sessions in English, c) exams and assessments in English.			

Training and Learning Results	
Code	
A3	Students will be able to gather and interpret relevant data (normally within their field of study) that will allow them to have a reflection-based considered opinion on important issues of social, scientific and ethical nature.
A4	Students will be able to present information, ideas, problems and solutions both to specialist and non-specialist audiences.
B1	Students will acquire analysis, synthesis and information-management skills to be applied in the food and agriculture and environmental sectors
C1	To know the physical, chemical and biological foundations linked with the environment and its technological processes
C3	To be familiar with the temporal and spatial dimensions of environmental processes.
C4	Ability to integrate the experimental data found in field and/or lab work with theoretical knowledge.
C5	Ability to interpret data from quantitative and qualitative perspectives.
C15	To be familiar with hydrological processes.
C18	To be familiar with all the concepts linked to clean technologies and renewable energy.
C19	To be familiar with the fundamentals of renewable and non-renewable energies.
C20	To be familiar with the fundamentals required to identify and assess environmental costs.
D1	Capacity of analysis, organization and planning.
D3	COral and written communication in the native language and foreign
D4	Ability of autonomous learning and information management.
D5	Ability of problem solving and decision making
D9	Team of interdisciplinary nature

Expected results from this subject

Expected results from this subject	Training and Learning Results			
FROG1. Identification and knowledge of the main strategies of minimization and valorization of compounds found in liquid waste streams and reuse of valuable byproducts and water	A3 A4	B1	C1 C3 C4 C5 C15 C18	D4 D9
FROG2. Understanding of the bases of the physical, chemical and biological unit operations for wastewater treatment and ability to understand the major variables affecting their design and operation		B1	C1 C4 C5 C19	D1 D4
FROG3. Knowledge of conventional commercially available technologies as well as other emerging ones	A4		C4 C5 C18	D1 D4 D9
FROG4. Application of the knowledge acquired to the comparison and selection of the alternatives more suitable for the treatment of urban and industrial waste streams		B1	C4 C5 C20	D3 D4 D5 D9

Contents	
Topic	
Section I. Introduction	Unit 1. The water cycle Unit 2. Estimation of flowrates and physicochemical and biological characterization of wastewaters (S1) Unit 3. Regulation. Minimization, treatment and reuse. Objetives and selection criteria
Section II. Pretreatment and physical treatments	Unit 4. Grit removal Unit 5. Pumping and mixing Unit 6. Sedimentation Unit 7. Flotation Unit 8. Other technologies: membranes, adsorption
Section III. Chemical treatments	Unit 9. Neutralization and precipitation Unit 10. Coagulation-flocculation Unit 11. Disinfection
Section IV. Biological treatments	Unit 12. Fundamentals of biological treatments Unit 13. Aerobic processes Unit 14. Anaerobic processes Unit 15. Sludge treatment and disposal Unit 16. Eliminación biológica de nitrógeno y fósforo
Section V. Examples of wastewater treatment (Case studies)	Unit 17. Valorization of components in the effluents or generated during treatment Unit 18. Reuse of treated effluents Unit 19. Domestic wastewater treatment Unit 20. Industrial wastewater treatment

Planning			
	Class hours	Hours outside the classroom	Total hours
Lecturing	28	42	70
Problem solving	4	12	16
Case studies	10	30	40
Laboratory practical	14	10	24
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Methodologies	
	Description
Lecturing	The theoretical bases will be exposed and some examples of each will be presented and discussed, with support of audiovisual materials. The information wil be available in electronic format in the teaching platform In the virtual mode, the discussion the doubts and comments will be explained in the virtual office and by e-mail

Problem solving	Different exercises will be proposed and solved in the Seminars, with support of audiovisual materials. Part of these exercises will be solved by the teacher in the classroom and another part by the students in group. In the virtual mode discussion and doubts will be solved either on line or with telematic tools
Case studies	A number of practical and real examples will be discussed in order to apply the knowledge of the available technologies. The students will use information from a variety of sources, inlcuding scientific literature and commercial leaflets In the virtual mode the students can have support in the virtual office and by e-mail
Laboratory practical	The experimental tasks will be performed in the laboratory with the aim of obtaining results; the analysis of the experimental data will be performed in a computer classroom. In the virtual mode, simulation engineering software will be used to model wastewater treatment processes

Personalized assistance

Methodologies	Description
Lecturing	In the presential mode the contents will be presented in the classroom and the questions wil be solved directly. Additional questions can be solved in presential or virtual sessions In the virtual mode, the contents will be exposed by telematic means and the queries can be solved in real time, in the virtual dispatch and by e-mail.
Problem solving	In the presential mode the exercises will be solved in the seminar sessions and the questions wil be solved directly. Additional questions can be solved in presential or virtual sessions In the virtual mode, the seminars will be telematic and the queries can be solved in real time, in the virtual dispatch and by e-mail.
Case studies	The students can get their doubts solved in the electronic office and by e-mail
Laboratory practical	The supervisor in the lab will aid in the experimental sessions and in the interpretation of data by the electronic office and e-mail both in the presential and virtual modes

Assessment

	Description	Qualification	Training and Learning Results			
Lecturing	Short questions in the official examination (up to 2,5 points) Evaluate the RA1, RA2 and RA3	25		B1	C1 C3 C4 C5 C15 C18 C20	D3 D4
Problem solving	Exercises similar tho those solved in the seminar sessions (up to 1,5 points) Evaluate the RA1 and RA4	15		B1	C5	D1 D4 D5 D9
Case studies	Short proofs, resolution of exercises and webquests performed either in individual or in group (up to 2 points). Case study on the selection of the wastewater treatment sequence proposed for a selected industrial or urban wstewater (up to 2 points). They evaluate RA1, RA2 and RA3	40	A3 A4	B1	C3 C5 C18 C19 C20	D1 D3 D4 D5 D9
Laboratory practical	the following aspects wil be evaluated: 1) attendance and attitude (0,5 points) 2) treatment of data (0,5 points) 3 the answers to short questions or type test in the examination (1 point) Evaluates RA2	20		B1	C3 C4 C5 C18 C20	D3 D4

Other comments on the Evaluation

The preferred evaluation modality is Continuous Evaluation. Those students who want the Global Assessment (100% of the grade in the official exam) must notify the coordinator of the subject, by email or through the Moovi platform, within a period not exceeding one month from the beginning of the teaching of the matter.

The following activities will be considered:

- Presentation of short proofs, exercises and webquest: 2,0 points

- Real case: 2,0 points

- Laboratory: 2,0 points

- Exam, theory: 2,5 points

- Exame, exercises: 1,5 points

The assessment of the activities will be maintained for the second call of the subject. In all the modalities, to pass the subject a minimum grade of 3 out of 10 is required in the exam. End of degree call: the student who chooses to take the final exam will be evaluated only with the exam (which will be worth 100% of the grade). In case of not attending said exam, or not passing it, he will be evaluated in the same way as the rest of the students.

The subject exams will be held on the date and time indicated: April 1, 2024 at 10 a.m. (1st edition); July 9, 2024 at 10 a.m. (2nd edition); September 25, 2023 at 4:00 p.m. (End of career).

Sources of information

Basic Bibliography

Metcalf & Eddy Inc, **Wastewater engineering**, 3, Mcgraw-Hill Education, 2003
Ramalho, R. S., **Introduction to Wastewater Treatment Processes**, 2, Academic Press, 2013
Davis, M. L., **Water and wastewater Engineering**, Professional edition, Mc-Graw Hill, 2010

Complementary Bibliography

Recommendations

Subjects that are recommended to be taken simultaneously

Environmental impact assessment/O01G261V01503
Environmental auditing and management/O01G261V01701

Subjects that it is recommended to have taken before

Biology: Biology/O01G261V01102
Environmental legislation/O01G261V01205
Chemistry: Chemistry II/O01G261V01203
Instrumental analysis/O01G261V01403
Environmental physics/O01G261V01911
Hydrology/O01G261V01501
Environmental engineering/O01G261V01502