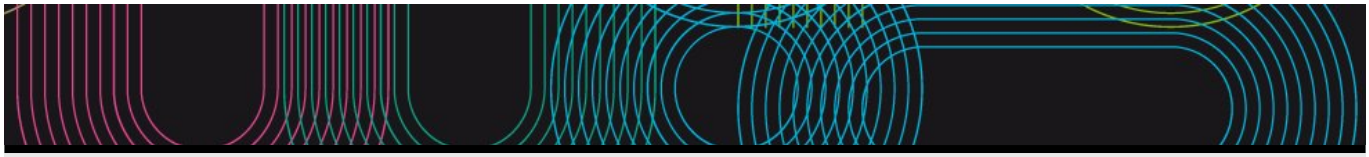

IDENTIFYING DATA				
Environmental physics				
Subject	Environmental physics			
Code	O01G261V01911			
Study programme	Grado en Ciencias Ambientales			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Optional	3rd	2nd
Teaching language	Spanish			
Department				
Coordinator	Gómez Gesteira, Ramón			
Lecturers	Castro Rodríguez, María Teresa de Gómez Gesteira, Ramón			
E-mail	mggesteira@uvigo.es			
Web				
General description	The environmental physics describes the basic physical principles of the environment from the atmosphere to the ocean.			

Competencies	
Code	
CB3	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.
CB4	Students will be able to present information, ideas, problems and solutions both to specialist and non-specialist audiences.
CG1	Students will acquire analysis, synthesis and information-management skills to be applied in the food and agriculture and environmental sectors
CG2	Students will acquire and apply teamwork abilities and skills.
CE1	To know the physical, chemical and biological foundations linked with the environment and its technological processes
CE3	To be familiar with the temporal and spatial dimensions of environmental processes.
CE4	Ability to integrate the experimental data found in field and/or lab work with theoretical knowledge.
CE5	Ability to interpret data from quantitative and qualitative perspectives.
CT1	Capacity of analysis, organization and planning.
CT3	COral and written communication in the native language and foreign
CT4	Ability of autonomous learning and information management.
CT5	Ability of problem solving and decision making
CT9	Team of interdisciplinary nature

Learning outcomes				
Learning outcomes		Competences		
RA1. Understanding of the concepts and basic processes of the environmental physics		CG1	CE1 CE3 CE5	CT3 CT4
RA2. Develop skills to handle databases and resolve practical problems.	CB3 CB4	CG2	CE4	CT1 CT3 CT5 CT9

Contents
Topic

Subject 1. Preliminaries	1.1. The system Earth. 1.2. The atmosphere 1.2.1. Atmospheric layers 1.2.2. Composition of the atmosphere. 1.2.3. Global wind circulation 1.3 Comparison between ocean and atmosphere 1.3.1. Density 1.3.2. Specific heat 1.3.3. Optical properties. 1.4. The ocean 1.4.1. Ocean layers 1.4.2. Buoyancy, stability and Brunt-Väisälä frequency
Subject 2. Thermodynamics	2.1. Introduction 2.2. Laws of the Termodinámica 2.2.1. First Law of the Termodinámica. 2.2.2. Second Law of the Termodinámica. 2.2.3. Third Law of the Termodinámica. 2.3. Latent heat 2.4. Transfer of thermal energy 2.4.1. Conduction 2.4.2. Radiation 2.4.3. Convection 2.4.4. Change of state
Subject 3. Earth□s energy budget	3.1. Introduction 3.2. Sun radiation 3.3. Incoming and outgoing radiation 3.4 Greenhouse effects 3.5. Earth□s energy budget 3.6. Variations in the Solar constant 3.7. Ocean energy budget
Subject 4. The equations of movement	4.1 Introduction 4.2 Fundamentals 4.3 Conservation of momentum 4.3.1 The gradient of pressure 4.3.2 The fictitious forces on Earth 4.3.3 Gravity 4.3.4 Friction forces 4.3.5 Conservation of momentum equations in components 4.4 Conservation of mass 4.5 Turbulence
Subject 5. Atmospheric stability	5.1. Introduction 5.2. The hypsometric equation 5.3. Adiabatic gradients of temperature 5.4. The humidity 5.5. The potential temperature 5.6. Virtual temperature 5.7. Saturate adiabatic lapse
Subject 6. Geostrophic currents	6.1 Introduction 6.2 Hydrostatic balance 6.3 Geostrophic currents 6.3.1 Baroclinic and barotropic conditions 6.3.2 Sea level inclination 6.3.3 Equations of movement 6.3.4 Practical calculation of geostrophic currents 6.3.5 Limitations
Subject 7. Oceanic currents generated by the wind	7.1 Introduction. 7.2 Equations of movement. 7.3 Wind induced transport. 7.4 Coastal upwelling. 7.5 Upwelling index. 7.6 Upwelling areas.

Planning			
	Class hours	Hours outside the classroom	Total hours

Lecturing	28	70	98
Seminars	14	38	52

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

Methodologies

	Description
Lecturing	Theoretical explanation of the environmental physical processes.
Seminars	Analysis of practical exercises to know them, interpret them, diagnose them, generate hypothesis and propose procedures for their resolution. This will serve to see the application of theoretical concepts to the reality.

Personalized assistance

Methodologies	Description
Seminars	Seminars (maximum group of 20 people) will be programmed at the end of each subject to do practical exercises. Additionally, a battery of questions to analyze the most important concepts of each subject will be provided to the students. Students must do these bulletins in an individual way. The practical activities will be able to be individual or in couples. Some practical activities will begin in the seminars and then the student must finalized them byself. Tutorial classes will be on Mondays between 16:00 and 18:00 h.

Assessment

	Description	Qualification	Evaluated Competencess			
Lecturing	All environmental processes will be explained theoretically both in an expository and reasoned way. To do this, powerpoint will be used and the information will be previously uploaded in FAITIC.	60		CG1	CE1 CE3 CE5	CT3 CT4
Seminars	Seminars (maximum group of 20 people) will be programed at the end of each subject to do practical exercises . Additionally, a battery of questions to analyse the most important concepts of each subject will be provided to the students. The student´s skill to solve practical activities will be evaluated by means of these questions and the practical exercises.	40	CB3 CB4	CG2	CE1 CE3 CE4 CE5	CT1 CT3 CT5 CT9

Other comments on the Evaluation

In case of face- to- face teaching, it is mandatory the attendance to lessons and especially to seminars.
In case of online/face-to-face teaching, it is mandatory the attendance to lessons and especially to seminars for those students who can attend in person.
The students that cannot attend the course must justify it properly at the beginning. The evaluation will be carried out by means of alternative activities proposed by the teacher.
Examinations: End of degree: 09/29/2021 16:00 h **End of course:** 03/29/2022 16:00 h **July:** 07/06/2022 16:00 h
In case of error in the transcription of examination dates , the valid dates will be the ones officially approved and published in the board of announcements and in the web of the Centre.
Announcement July: The student will be evaluated with an exam (60% of the final mark) and the practical cases solved in seminars (40% of the final mark).**Announcement end of degree:** The student will only be evaluated with this examn that will be the 100% of the final mark.

Sources of information

Basic Bibliography

P. Hughes & N.J. Manson, **Introduction to environmental physics. Planet Earth, life and climate**, CRC Press Taylor & Francis group, 2014

G.S. Campbell & J.M. Norman, **An introduction to environmental biophysics**, 2, Springer- Verlag, 1998

J.L. Monteith & M.H. Unsworth, **Principles of environmental physics. Plants, animal and the atmosphere**, 4, Academic Press (Elsevier), 2013

E. Boeker & R. vanGrondelle, **Environmental Physics: Sustainable energy and climate change**, 3, John Willey and Sons, 2011

Complementary Bibliography

Recommendations

Subjects that continue the syllabus

Energy and energy sustainability/O01G261V01505
Environmental engineering/O01G261V01502
Meteorology/O01G261V01912
Environmental modelling and simulation/O01G261V01504

Subjects that it is recommended to have taken before

Physics: Physics II/O01G261V01201
Physics: Physics I/O01G261V01101
Mathematics: Mathematics II/O01G261V01202
Mathematics: Mathematics I/O01G261V01104

Contingency plan

Description

=== EXCEPTIONAL MEASURES SCHEDULED ===
In front of the uncertain and unpredictable evolution of the sanitary alert caused by the *COVID-19, the University of Vigo establishes extraordinary planning that will activate at the moment in that the administrations and the own institution determine it attending to criteria of security, health, and responsibility, and guaranteeing the teaching in a no face-to-face stage or partially face-to-face. These already scheduled measures guarantee, at the moment that was prescriptive, the development of the teaching of a more agile and effective way when being known in advance (or with a wide *antelación) by the students and the professorate through the tool normalized and institutionalized of the educational guides.

=== ADAPTATION OF THE METHODOLOGIES ===
* Educational Methodologies that keep
Both in the case of online and partially face-to-face teaching:
We will keep the use of MOOVI platform to upload all information necessary to reach the main objectives of the subject
Solving practical cases in seminars

* Educational Methodologies that modify
In the case of partially face-to-face teaching:
Some of the face-to-face methodologies, lecturing classes, and solving practical cases, will be on-line through platforms like remote Campus, Zoom, Teams...

In the case of online teaching:
All face-to-face methodologies, lecturing classes, and solving practical cases, will be on-line through platforms like remote Campus, Zoom, Teams...

* Mechanism no face-to-face of attention to the students (tutorials)
Tutoríal classes will be on-line through the Remote Campus requesting an appointment to the teacher´s email.

* Modifications (if they proceed) of the contents to give
Both in the case of online and partially face-to-face teaching, there will not be modifications to the contents.
* Additional bibliography to facilitate the car-learning
Both in the case of online and partially face-to-face teaching, additional bibliography will not be necessary
* Other modifications

=== ADAPTATION OF THE EVALUATION ===
Both in the case of online and partially face-to-face teaching:
Tests already done will keep their weight
Pending tests also keep their weight

* Test that they modify
In the case of partially face-to-face teaching:
There will not be changes in the evaluation proofs.

In the case of online teaching:
[Face-to-Face tests] => [Online tests through Moovi, Campus Remoto, Teams, Zoom.]

* New proofs
New tests will not be necessary
* Additional Information
Both in the case of online and partially face-to-face teaching, the assessments will be the same described in step 7 of the present teaching guide.