



(*)Facultade de Ciencias do Mar

Grado en Ciencias del Mar

Subjects

Year 1st

Code	Name	Quadmester	Total Cr.
V10G061V01101	Biology: Biology I	1st	6
V10G061V01102	Physics: Physics I	1st	6
V10G061V01103	Geology: Geology 1	1st	6
V10G061V01104	Mathematics: Mathematics I	1st	6
V10G061V01105	Chemistry: Chemistry I	1st	6
V10G061V01106	Biology: Biology 2	2nd	6
V10G061V01107	Statistics	2nd	6
V10G061V01108	Geology: Geology 2	2nd	6
V10G061V01109	Mathematics: Mathematics II	2nd	6
V10G061V01110	Chemistry: Chemistry 2	2nd	6

Year 2nd

Code	Name	Quadmester	Total Cr.
V10G061V01201	Biochemistry	1st	6
V10G061V01202	Marine botany	1st	6
V10G061V01203	Physics: Physics II	1st	6
V10G061V01204	Chemical oceanography I	1st	6
V10G061V01205	Sedimentology	1st	6
V10G061V01206	Marine Ecology	2nd	6
V10G061V01207	Coastal and marine sedimentary habitats	2nd	6
V10G061V01208	Principles of marine microbiology	2nd	6
V10G061V01209	Chemical oceanography II	2nd	6
V10G061V01210	Marine zoology	2nd	6

Year 3rd

Code	Name	Quadmester	Total Cr.
V10G061V01301	Biological oceanography I	1st	6
V10G061V01302	Physical oceanography I	1st	6
V10G061V01303	Geological oceanography I	1st	6

V10G061V01304	Chemistry applied to the marine environment I	1st	6
V10G061V01305	Physiology of marine organisms	1st	6
V10G061V01306	Biological oceanography II	2nd	6
V10G061V01307	Physical oceanography II	2nd	6
V10G061V01308	Geological oceanography II	2nd	6
V10G061V01309	Chemistry applied to the marine environment II	2nd	6
V10G061V01310	Aquaculture	2nd	6

Year 4th

Code	Name	Quadmester	Total Cr.
V10G061V01401	Marine Pollution	1st	6
V10G061V01402	Ocean Dynamics	1st	6
V10G061V01403	Applied marine geology	1st	6
V10G061V01404	Marine and coastal management	1st	6
V10G061V01405	Fishing	1st	6
V10G061V01406	Basin Analysis	2nd	6
V10G061V01407	Fish and shellfish biology	2nd	6
V10G061V01408	Economics and legislation	2nd	6
V10G061V01409	Geographic analysis methods	2nd	6
V10G061V01410	Modelling	2nd	6
V10G061V01411	Marine microbiology and parasitology	2nd	6
V10G061V01412	Marine genetic resources	2nd	6
V10G061V01413	Remote sensing	2nd	6
V10G061V01981	Internships	2nd	6
V10G061V01991	Final Year Dissertation	2nd	12

IDENTIFYING DATA				
Biology: Biology I				
Subject	Biology: Biology I			
Code	V10G061V01101			
Study programme	Grado en Ciencias del Mar			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Basic education	1st	1st
Teaching language	#EnglishFriendly Spanish			
Department				
Coordinator	Pasantes Ludeña, Juan José			
Lecturers	Caballero Rúa, Armando Miguel Villegas, Encarnación de Pasantes Ludeña, Juan José			
E-mail	pasantes@uvigo.es			
Web				
General description	Biology I is one of the mandatory subjects in the first semester of the first year of the Degree in Marine Sciences. The basic biological principles of cell biology and genetics are studied, mainly: 1) cell and tissue organisation. 2) development and cell differentiation. 3) transmission and characterization of hereditary material. 4) basic aspects of evolution and the origin of species. Theoretical and practical lessons are employed in the teaching program in order the students be familiar with 1) microscopic identification 2) the solving of practical problems in genetics and cell biology. English Friendly subject: International students may request from the teachers: a) materials and bibliographic references in English, b) tutoring sessions in English, c) exams and assessments in English.			

Training and Learning Results	
Code	
B1	Know and use vocabulary, concepts, principles and theories related to oceanography and apply everything learned in a professional and/or research environment.
B2	Plan and execute surveys in the field and laboratory work, applying basic tools and techniques for sampling, data acquisition and analysis in the water column, sea bottom and marine substratum.
B3	Recognize and implement good practices in measurement and experimentation, and work responsibly and safely both in field surveys and in the laboratory.
B4	Manage, process and interpret the data and information obtained both in the field and in the laboratory.
B5	Develop, implement and write basic or applied projects in oceanography from a multidisciplinary perspective.
C9	Acquire basic knowledge about the structural and functional organization and the evolution of marine organisms.
C11	Apply the knowledge and techniques acquired to the characterization and sustainable use of living resources and marine ecosystems.
D1	Develop the search, analysis and synthesis of information skills oriented to the identification and resolution of problems.
D2	Acquire the ability to learn autonomously, continuously and collaboratively, organizing and planning tasks over time.

Expected results from this subject	
Expected results from this subject	Training and Learning Results

1. Define, look for, organize and elaborate works with information of the subject	B1	C9	D1
2. Cooperatively workout exercise resolution	B2	C11	D2
3. Use of telematic tools and other sources for autonomous learning	B3		
	B4		
	B5		

CELL BIOLOGY

4. Know the origin, evolution and internal organization of eukaryotic cell
5. Recognize the relationships between eukaryotic cell components in the different cell cycle phases
6. Know the general characteristics of embryonic development.
7. Recognize the diversity and organization of animal tissues.
8. Microscopically identifying eukaryotic cell and animal tissue components.
9. Establish relationships between cell organization and cell and tissue function.

GENETICS

10. Importance of DNA in biology
11. Apply the scientific method and basic research technologies in Genetics
12. Learn how to establish genetic hypotheses and strategies to refute them
13. Manage the basic mechanisms for the transmission of the hereditary material
14. Know the molecular structure, the regulation and the expression of the hereditary material
15. Know the basic genomic principles and their biotechnological applications.
16. Know the origin of the biological diversity and the evolutionary history of the species

Contents

Topic	
Cell biology, 1st part. Eukaryotic cells.	Evolution. Similarities and differences of animal and plant cells. Cell membranes and cell organelles: composition, morphology and function. Vesicular traffic. Cytosol, cytoskeleton and cell movement. Nucleus: components and functions.
Cell biology, 2nd part. Cell division and bases of animal embryonic development	Cell cycle. Apoptosis. Gametogenesis. Fertilization and development of the zygote.
Cell biology, 3rd part. Animal tissues	General organisation and function.
Genetics	DNA structure, organisation, replication, alterations and expression. Mendelian heredity and its variations. Linkage and recombination. DNA technologies and their applications

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	39	39	78
Problem solving	6.5	6.5	13
Practices through ICT	6	6	12
Objective questions exam	2	14.5	16.5
Problem and/or exercise solving	0.5	30	30.5

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

Methodologies

	Description
Lecturing	Description, by the teaching staff, of the contents of the study subject, of the theoretical bases and/or the guidelines of the work, the exercise or the project to be developed by the students.
Problem solving	Resolution of genetic exercises.
Practices through ICT	Application of the learned contents to specific situations and acquisition of basic skills and procedures related with the object of study in spaces with specialized equipment (laboratories, computing rooms, etc.).

Personalized assistance

Methodologies	Description
Practices through ICT	The teaching staff will continuously assess the participation of the students along the course. Students who wish it may attend personal tutorials to resolve doubts and/or uncertainties, mainly at the times indicated on the faculty website and/or on the MOOVI platform. To better optimize the procedure, the student is requested to contact the teacher in advance by email, with reasonable anticipation.

Lecturing	The teaching staff will continuously assess the participation of the students along the master sessions and their on-line activities. Students who wish it may attend personal tutorials to resolve doubts and/or uncertainties, mainly at the times indicated on the faculty website and/or on the MOOVI platform. To better optimize the procedure, the student is requested to contact the teacher in advance by email, with reasonable anticipation.
Problem solving	The teaching staff will continuous assess the participation of the students in exercise solving and in the quality of solved exercises. Students who wish it may attend personal tutorials to resolve doubts and/or uncertainties, mainly at the times indicated on the faculty website and/or on the MOOVI platform. To better optimize the procedure, the student is requested to contact the teacher in advance by email, with reasonable anticipation.
Tests	Description
Problem and/or exercise solving	The teaching staff will continuous assess the quality of the solved problems, questions and exercises for each student along the semester. Students who wish it may attend personal tutorials to resolve doubts and/or uncertainties, mainly at the times indicated on the faculty website and/or on the MOOVI platform. To better optimize the procedure, the student is requested to contact the teacher in advance by email, with reasonable anticipation.

Assessment					
	Description	Qualification	Training and Learning Results		
Lecturing	Final exam: the assesment of the subject Biology I will be performed by means of a written exam. In this exam the theoretical and practical contents will be evaluated by means of test of multiple answers, questions with specific short or long answers, identification and interpretation of figures / images as well as the resolution of genetic problems Final exam. Cellr biology 19 % Genetics 19 %	38	B1 B2 B3 B4 B5	C9 C11	D1 D2
Objective questions exam	Final exam	2	B1 B2 B3 B4 B5	C9 C11	D1 D2
Problem and/or exercise solving	Evaluation will be the result of the assesment of the quality of the resolution of the Genetic problems and exercises (15 %) and the marks obtained in Cell biology (30 %) and Genetics (15 %) questionnaires.	60	B1 B2 B3 B4 B5	C9 C11	D1 D2

Other comments on the Evaluation

The final qualification includes:

a) The mark obtained in solving problems, exercise and questionnaires along the course (60 %: Cell Biology 30 %, Genetics 30 %). This mark will be kept for the second opportunity

b) The mark obtained in the first or second opportunity exam (40 %: Cell Biology 20 %, Genetics 20 %).

To pass the subject, a minimum of 2 points in each of the two blocks that compose the subject (Genetics and Cell Biology), and a minimum of 5 points in total, are required. It is also necessary to reach a minimum of 4 points from a total of 10 in the Genetics exam. If those minimums are not reached, the maximum numerical qualification to be reflected in the "acta" will be 4.5.

In case that the final calification do not reach the pass minimum (5 points), but are equal or higher than 2.5 in one of the two blocks (Genetics or Cell Biology), the mark will be kept for the "second edition" (July) if the student is explicitly in accordance with it.

Global assessment option: The application for this evaluation option must be submitted in the time and manner determined by the Center, which will be published prior to the academic start.

For students that chose global evaluation, marks will be the result of a single exam (100%)

Date, time and place of exams will be published in the official web of Marien Sciencies Faculty:

<http://mar.uvigo.es/alumnado/examenes/>

The students from previous courses will have to take part in all the programmed activities again.

Students are strongly requested to fulfil a honest and responsible behaviour. It is considered completely unacceptable any alteration or fraud (i.e., copy or plagiarism) contributing to modify the level of knowledge and abilities acquired in exams, evaluations, reports or any kind of teacher's proposed work. Fraudulent behaviour may cause failing the course for a whole academic year. An internal dossier of these activities will be built and, when reoffending, the university rectorate will be asked to open a disciplinary record

Sources of information

Basic Bibliography

Campbell N. A. & Reece J. B., **1. BIOLOGÍA**, 7ª ed, Panamericana, 2007

Pierce BA, **Genética. Un enfoque conceptual**, 5ª ed, Panamericana, 2015

Complementary Bibliography

Sadava / Heller / Orians / Purves / Hillis, **VIDA La Ciencia de la Biología**, 8ª ed, Panamericana, 2009

Griffiths / Doebley / Peichel / Wassarman, **Introduction to Genetic Analysis**, 12 ed, Macmillan education, 2020

Schnek, A. Massarini, A. Curtis, **Biología**, 7ª ed, Panamericana, 2008

Recommendations

Other comments

The study of the subject in a continuous way will allow the students to take part in active form in the course syllabus. It is recommended to show a real interest in the course, showing a good attitude and demonstrating aptitude in the acquisition of knowledges. The knowing, comprehending, thinking and reasoning the basic notions of the subject will be indispensable to take part in the distinct activities proposed by the teaching staff and be evaluated positively.

IDENTIFYING DATA				
Physics: Physics I				
Subject	Physics: Physics I			
Code	V10G061V01102			
Study programme	Grado en Ciencias del Mar			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Basic education	1st	1st
Teaching language	#EnglishFriendly Spanish Galician English			
Department				
Coordinator	Mato Corzón, Marta María			
Lecturers	Cabaleiro Álvarez, David Mato Corzón, Marta María Sánchez Carnero, Noela Belén Souto Torres, Carlos Alberto Varela Benvenuto, Ramiro Alberto Vijande López, Javier			
E-mail	fammmc@uvigo.es			
Web	http://https://mar.uvigo.es/			
General description	Physics, as a science, deals with the description of matter and its interactions, developing theories in accordance with empirical knowledge. From this definition one can study from the smallest scales (subatomic) to the macroscopic scale, hence the different branches of Physics. Physics is the base of an uncountable number of scientific and technological applications, and in particular for the Sea Sciences student it's a basic tool to understand other theories and subjects in the following years of the grade. The knowledge and application of laws and principles studied in Physics allows the interpretation of the marine environment and the development of models related with it. Furthermore, it is important to understand the fundamental physics concepts to understand how the instruments work and to know how to use and control them. 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	
A4	Students can communicate information, ideas, problems and solutions to both specialist and non-specialist audiences
A5	Students have developed those learning skills that are necessary for them to continue to undertake further study with a high degree of autonomy
B3	Recognize and implement good practices in measurement and experimentation, and work responsibly and safely both in field surveys and in the laboratory.
C4	Know, analyze and interpret the physical properties of the ocean according to current theories, as well as to know the most relevant sampling tools and techniques.
D1	Develop the search, analysis and synthesis of information skills oriented to the identification and resolution of problems.
D2	Acquire the ability to learn autonomously, continuously and collaboratively, organizing and planning tasks over time.

Expected results from this subject

Expected results from this subject	Training and Learning Results			
1. Understand the need of a reference system to describe a movement. Understand the movement and his causes. Identify the different types of movements. Know how graph any observation to.	A4 A5	B3	C4	D1 D2
2. Identify the field of application of classical mechanics. Understand systems of particles and the rigid bodies. Solve mechanical problems using Newton's laws and conservation laws.	A4 A5	B3	C4	D1 D2
3. Understand and use in a quantitative way the concept of energy (non thermal). Recognize the transformations of energy to explain any daily phenomenon. Identify kinetic and potential energy in different situations. Explain and use the conservation of mechanical energy in simple situations. Understand work as a form of energy exchange. Solve problems related with work, power and conservation of mechanical energy. Evaluate the importance of energy saving.	A4 A5	B3	C4	D1 D2
4. Know and understand the basic equations of the kinematics and dynamics of a simple harmonic oscillator, damped harmonic oscillator and driven harmonic oscillator, and the phenomenon of resonance.	A4 A5	B3	C4	D1 D2
5. Know the evolution of the Universe along the history. Know Newton's law of Gravitation, and understand his application to celestial and terrestrial bodies' movements. Understand the relation between the properties of a planet and the weight of a body in his surface.	A4 A5	B3	C4	D1 D2

6. Understand the Earth as a reference system, his movement around the Sun, as well as those of the Moon. Apply that knowledge to explain phenomena like the tides, the different Moon phases, the calendar's stations, etc.	A4 A5	B3	C4	D1 D2
7. To know the basic characteristics of continuous bodies.	A4 A5	B3	C4	D1 D2

Contents

Topic	
1. Kinematics of particles.	1.1. The position vector and the path. Celerity, velocity and acceleration (medium and instantaneous). 1.2. Intrinsic components of acceleration (normal and tangential) and his interpretation. 1.3. Movement of the particle in space. Analysis of different types of movements. 1.4. Change of the reference system. Relative movement. Translation and rotation of the reference axes. Drag velocity and relative velocity. Drag acceleration and relative acceleration
2. Newtonian dynamics.	2.1. Introduction: Dynamics as a part of physics. 2.2. Dynamics of the particle: Dynamic's principles or Newton's laws of motion. Linear momentum. Mechanical impulse. Linear momentum conservation theorem. Angular momentum and his conservation. Central forces. Dynamics of the circular movement. 2.3. Dynamics of systems of particles: Types of systems; internal and external forces. Centre of mass of a system of particles. Movement of a system of particles. Newton's second law for a system of particles. Linear momentum of a system of particles. Principle of conservation of linear momentum of a system of particles and applications. Angular momentum of a system of particles. Conservation of angular momentum in a system of particles. 2.4. Dynamics of the rigid solid: Dynamics of rotation. Momentum of inertia of rigid body. Calculation of momentums of inertia. Steiner's theorem. Kinetic momentum of rotation. Angular impulse. Conservation principle.
3. Work and energy	3.1. The different forms of energy. Definitions of work, power and energy. 3.2. Mechanical, kinetic and potential energy. Theorem of live forces. Conservation mechanical energy. 3.3. Mechanical, kinetic and potential energy of a system of particles. 3.4. Theorem of live forces and conservation of energy for a system of particles. 3.5. Kinetic rotational energy.
4. Simple harmonic motion.	4.1. The simple harmonic motion. Kinematics of the harmonic oscillator. Representation as rotating vectors. 4.2 Dynamics of the harmonic oscillator and his physical interpretation. Energy of a harmonic oscillator. 4.2. The simple pendulum. 4.3. Notion of forced oscillator. Resonance. 4.4. Fourier analysis of the periodic movement.
5. Gravitation. Applications to the Earth.	5.1. Historical evolution. 5.2. Newton's law of Gravitation. 5.3. Gravitational field and potential on Earth. The local gravitational field. 5.4. Movement of the planets and satellites
6. The Earth as a reference system.	6.1. The movements of the Earth in space. The stations. The phases of the Moon. 6.2. Dimensions and terrestrial coordinates. 6.3. The local reference system. Accelerations of inertia. 6.4. The Coriolis acceleration. 6.5. The centrifugal and terrestrial acceleration. The geopotential. 6.6. Newtonian theory of tides. The tidal ellipsoid.
7. Continuous media	7.1. Introduction, qualitative ranking of the material. 7.2. Elasticity and shear deformation.
LABORATORY	1. TREATMENT OF EXPERIMENTAL DATA. 2. MEASURING INSTRUMENTS. 3. MEASURING THE REACTION TIME. 4. STATIC STUDY OF A SPRING. HOOKE'S LAW. 5. OSCILLATORY MOVEMENTS IN A SPRING. SIMPLE HARMONIC MOTION. 6. STUDY OF THE SIMPLE PENDULUM.

Planning

	Class hours	Hours outside the classroom	Total hours
Laboratory practical	15	3	18
Lecturing	30	20	50
Seminars	7	30	37
Problem and/or exercise solving	0	30	30
Report of practices, practicum and external practices	0	15	15

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

Methodologies

	Description
Laboratory practical	Realization of different laboratory experiments with which the students will get basic knowledge in the experimental procedure in physics, as well as in the calculation of the error of a measurement. The attendance to the laboratory and the delivery in time and form of the corresponding report is a must for this subject in the year in course, both in the global assessment option and in the continuous assessment option.
Lecturing	Exhibition and explanation of the diverse physical concepts and his motivation, of the distinct laws with which relate, as well as the demonstration of the required theorems. Resolution of some practical examples to support the theoretical explanations.
Seminars	Resolution of different problems related with the theory, doubts and concepts of difficult understanding. Exercises that the student must solve autonomously will be proposed. The attendance at the seminars and the delivery of the proposed exercises is mandatory to pass the subject in the continuous assessment option.

Personalized assistance

Methodologies	Description
Seminars	The teacher will solve any doubts that are presented to the students in solving the problems. Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated (Mondays and Tuesdays from 11:00 a.m. to 2:00 p.m.). To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation.
Lecturing	The teacher will solve any doubts that are presented to the students in the lecturing. Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated (Mondays and Tuesdays from 11:00 a.m. to 2:00 p.m.). To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation.
Laboratory practical	The teacher will solve any doubts that are presented to the students in the laboratory about the material used, what is used and how is used correctly, the experimental procedure used, the analysis of results, the necessary computer tools, ... Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated (Mondays and Tuesdays from 11:00 a.m. to 2:00 p.m.). To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation.

Assessment

	Description	Qualification	Training and Learning Results		
Seminars	There will be a test with problems similar to the ones solved during the seminars' sessions and/or the deliveries of the proposed problems.	30	A4 A5	C4	D1 D2
Problem and/or exercise solving	It will qualify the assimilation of knowledge of the students with a written test with a diversity of problems related to the theory and seminars. A minimum score of 3.5 points over 10.0 will be demanded in this exam to pass the subject.	40	A4 A5	C4	D1 D2
Report of practices, practicum and external practices	It will evaluate the students ability to implement the laboratory procedure, successfully finish the experiments, and elaborate a proper report with all the information required.	30	A4 A5	B3 C4	D1 D2

Other comments on the Evaluation

GLOBAL ASSESSMENT OPTION:

Students who choose the GLOBAL assessment should request it within the period and in the manner stipulated by the Center. This information will be available to all students before the start of the teaching period. To pass the subject, they must complete and pass the Laboratory Practices evaluation (30% of the final mark) with a score equal to or greater than 5

points over 10. In addition, they must achieve at least 5 points out of 10, in a test on all the contents of the subject, which will account for 70% of the final mark, both in the ordinary and in the extraordinary opportunity.

Laboratory: Attendance at laboratory classes is mandatory, therefore in the case of unjustified absences, you will not be entitled to recover this methodology, neither in the global evaluation modality nor in the extraordinary opportunity (July call). The mark obtained in laboratory will only be valid during one course.

Seminars: The mark obtained in seminars will only be valid during one course. Students from previous courses must take the tests and submit the proposed problems, again. In the case of GLOBAL assessment, the 30% corresponding to this methodology will be included in the final test.

Extraordinary opportunity (2nd Opportunity): In the case of continuous assessment, in the official test, only the recovery of the problems exam of the ordinary call can be made (40%). Students who have NOT exceeded 5 points over 10 of the seminars mark and the laboratory practice report, will be able to improve it in the extraordinary opportunity (July call).

Other considerations:

Date, time and place of the official exams will be published in the official web of Marien Sciences Faculty:

<http://mar.uvigo.es/alumnado/examenes/>

Students are strongly requested to fulfil a honest and responsible behaviour. It is considered completely unacceptable any alteration or fraud (i.e., copy or plagiarism) contributing to modify the level of knowledge and abilities acquired in exams, evaluations, reports or any kind of teacher's proposed work. Fraudulent behaviour may cause failing the course for a whole academic year. An internal dossier of these activities will be built and, when reoffending, the university rectorate will be asked to open a disciplinary record.

Sources of information

Basic Bibliography

M. Alonso y E.J. Finn, **Física, Vol. 1**, Ed. Addison Wesley Iberoamericana, 2000

S. Burbano de Ercilla, E. Burbano y C. Gracia, **Problemas de Física**, Ed. Tébar, 2006

R. A. Serway y J. W. Jewett, **Física para Ciencias e Ingeniería**, Ed. Thomson, 2005

P. A. Tipler y G. Mosca, **Física para la Ciencia y la Tecnología, Vol. 1**, Ed. Reverté, 2006

Complementary Bibliography

Recommendations

Subjects that continue the syllabus

Physics: Physics II/V10G061V01203

Subjects that are recommended to be taken simultaneously

Mathematics: Mathematics I/V10G061V01104

Statistics/V10G061V01107

Other comments

It is recommended to attend and use the tutorial groups to resolve any questions related to the subject, to clarify the concepts of the theory and to help solving problems. The schedule will be Monday and Tuesday from 11:00 a.m. to 2:00 p.m.

IDENTIFYING DATA				
Geology: Geology 1				
Subject	Geology: Geology 1			
Code	V10G061V01103			
Study programme	Grado en Ciencias del Mar			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Basic education	1st	1st
Teaching language	#EnglishFriendly Spanish Galician			
Department				
Coordinator	Nombela Castaño, Miguel Angel			
Lecturers	Gil Lozano, Carolina Marino , Gianluca Nombela Castaño, Miguel Angel			
E-mail	mnombela@uvigo.es			
Web	http://webs.uvigo.es/c10/webc10/ficha.php?id=6			
General description	Geology I focuses on the processes occurring within the interior of our planet and is scheduled for the first semester of the first year of the Degree in Marine Sciences. The course explores the Earth's internal structure and composition, as well as the physicochemical processes that govern them. It covers key geological disciplines such as mineralogy, petrology, and tectonics.			
	English-Friendly Subject: International students may request the following from the instructors: a) course materials and bibliographic references in English, b) tutoring sessions in English, c) exams and other assessments in English.			

Training and Learning Results	
Code	
A1	Students have demonstrated knowledge and understanding in a field of study that builds upon their general secondary education, and is typically at a level that, whilst supported by advanced textbooks, includes some aspects that will be informed by knowledge of the forefront of their field of study
A2	Students can apply their knowledge and understanding in a manner that indicates a professional approach to their work or vocation, and have competences typically demonstrated through devising and sustaining arguments and solving problems within their field of study
B1	Know and use vocabulary, concepts, principles and theories related to oceanography and apply everything learned in a professional and/or research environment.
B4	Manage, process and interpret the data and information obtained both in the field and in the laboratory.
C12	Acquire knowledge about processes and products related to internal and external geological cycles.
D1	Develop the search, analysis and synthesis of information skills oriented to the identification and resolution of problems.
D5	Sustainability and environmental commitment. Equitable, responsible and efficient use of resources.

Expected results from this subject				
Expected results from this subject	Training and Learning Results			
1. Know the internal structure and composition of the Earth	A2	B1		
2. Know and relate the internal processes with the Plate Tectonic.	A1	B4	C12	
3. Recognise tectonic structures and the processes that generate them.	A1	B4	C12	
4. Handle of representation systems of deformation structures.		B1 B4		D5
5. Know the interpretation of geological profiles.	A2	B1 B4		D1 D5
6. Identify the main minerals and igneous and metamorphic rocks.	A1		C12	D1 D5
7. Skill in the management of the geological information related with the inner geological processes, capacity of synthesis and team work	A1	B4	C12	D1 D5

Contents	
Topic	
Presentation Geology I (Internal Geological Processes)	The sub-topics correspond with the topic.

Subject 1. Introduction: Origin of the Earth, Principles of the Geology and the Geological Time	The sub-topics correspond with the topic.
Subject 2. Structure of the Earth and his materials: minerals and rocks	The sub-topics correspond with the topic.
Subject 3. Units of the Terrestrial Relief-Oceanic Bottoms: types and origin of margins.	The sub-topics correspond with the topic.
Subject 4. Crust deformation: fragile and ductile	The sub-topics correspond with the topic.
Subject 5. Plate Tectonics: introduction and mechanisms	The sub-topics correspond with the topic.
Subject 6. Magmatism, Ígneous rocks and Plate Tectonic.	The sub-topics correspond with the topic.
Subject 7. Vulcanism and Plate Tectonic.	The sub-topics correspond with the topic.
Subject 8. Metamorphism, metasomatism, metamorphic rocks and Plate Tectonic.	The sub-topics correspond with the topic.
Subject 9. Seismicity and Plate Tectonic.	The sub-topics correspond with the topic.
Subject 10. Synthesis: economic and environmental consequences of the Inner Geological system.	The sub-topics correspond with the topic.
Seminars	Seminar I Stereographic Projection Seminar II Models of deformation Seminar III Identification of margins and basins
Practices	Practice I Introduction to the field trip. Use of the geological compass Practice II Introduction to the geological maps Practice III Interpretation of geological cross sections Practice IV Recognition and classification of mineral Practical V Recognition and classification of igneous and metemrphic rocks
Field trip	Field trip I Determination of geological structures

Planning

	Class hours	Hours outside the classroom	Total hours
Introductory activities	1	0.75	1.75
Lecturing	18	36	54
Seminars	6	24	30
Laboratory practical	13	22.75	35.75
Studies excursion	4.5	9	13.5
Problem and/or exercise solving	1	4	5
Laboratory practice	2	3.5	5.5
Report of practices, practicum and external practices	0.5	1	1.5
Objective questions exam	1	2	3

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

Methodologies

	Description
Introductory activities	The way in which the classes will be taught, the form of evaluation, the field trips, the practical classes and the seminars will be presented. The agenda will be distributed, as well as the necessary material for practical classes and seminars.
Lecturing	The student will be exposed to the theoretical contents that will be evaluated in a final exam.
Seminars	The stereographic projection will be used to represent data of geological structures. Practical work on types of deformations. Identification of large tectonic structures through geographic representation systems. Introduction to the field trip and use of a geological compass.
Laboratory practical	Students will learn to deal with topographic maps, to order rocks and geological processes in time from geological sections. In addition, the student will learn to recognize the most common minerals and types of igneous and metamorphic rocks in nature. An introduction to dating methods in geology will be presented.
Studies excursion	The student will learn to handle the geological compass, recognize rocks and geological structures in the field, their implications for internal processes, and their applied consequences.

Personalized assistance

Methodologies	Description
Lecturing	The student may be assisted both during master sessions, if it does not significantly affect their development, and during tutorial hours (Monday, Tuesday and Wednesday from 12:00 to 14:00). To optimize time, it is necessary for students to contact the teacher sufficiently in advance.

Introductory activities	The student may be assisted during the introductory activities, if it does not significantly affect their development, such as during tutorial hours (Monday, Tuesday and Wednesday from 12:00 to 14:00). To optimize time, it is necessary for students to contact the teacher sufficiently in advance.
Seminars	The student may be assisted both during the seminars, if it does not significantly affect their development, and during tutorial hours (Monday, Tuesday and Wednesday from 12:00 to 14:00). To optimize time, it is necessary for students to contact the teacher sufficiently in advance.
Laboratory practical	The student may be assisted both during practices, if it does not significantly affect their development, and during tutorial hours (Monday, Tuesday and Wednesday from 12:00 to 14:00). To optimize time, it is necessary for students to contact the teacher sufficiently in advance.
Studies excursion	The student may be assisted both during field practices, if it does not significantly affect their development, and during tutorial hours (Monday, Tuesday and Wednesday from 12:00 to 14:00). To optimize time, it is necessary for students to contact the teacher sufficiently in advance.
Tests	Description
Problem and/or exercise solving	The student may be assisted both during the seminars, if it does not significantly affect their development, and during tutorial hours (Monday, Tuesday and Wednesday from 12:00 to 14:00). To optimize time, it is necessary for students to contact the teacher sufficiently in advance.
Laboratory practice	The student may be assisted both during practices, if it does not significantly affect their development, and during tutorial hours (Monday, Tuesday and Wednesday from 12:00 to 14:00). To optimize time, it is necessary for students to contact the teacher sufficiently in advance.
Report of practices, practicum and external practices	The student may be assisted both during field practices, if it does not significantly affect their development, and during tutorial hours (Monday, Tuesday and Wednesday from 12:00 to 14:00). To optimize time, it is necessary for students to contact the teacher sufficiently in advance.
Objective questions exam	The student may be assisted both during master sessions, if it does not significantly affect their development, and during tutorial hours (Monday, Tuesday and Wednesday from 12:00 to 14:00). To optimize time, it is necessary for students to contact the teacher sufficiently in advance.

Assessment						
	Description	Qualification	Training and Learning Results			
Lecturing	Attendance to theoretical classes will be evaluated with up to 0.5/10 if at least 85% attend.	0	A1	B1 B4	C12	D5
Problem and/or exercise solving	Given its experimental nature, attendance at the seminars is mandatory. Both the quality of the deliverables and the attitude (participation, involvement, etc.) will be evaluated. Deliverables will be made at the end of each seminar.	20	A1 A2			D1 D5
Laboratory practice	Given its experimental nature, attendance at laboratory practices is mandatory. Both the quality of the deliverables and the attitude (participation, involvement, etc.) will be evaluated. The deliverables will be made at the end of each laboratory practice session.	30	A2	B1 B4		D1
Report of practices, practicum and external practices	Given the experimental nature, attendance at study outings is mandatory. Both the quality of the deliverable and the attitude (participation, involvement, etc.) will be evaluated. The deliverable will be made at the end of the study exit.	10	A2	B1 B4	C12	
Objective questions exam	The knowledge acquired in the lectures will be evaluated with short questions, and/or multiple choice questions, and/or true/false type questions. In order to add the rest of the tests, in the exam you have to have at least a 4.0/10. In order to take the exam, attendance at theoretical classes must be at least 85%	40	A1	B1 B4	C12	D5

Other comments on the Evaluation

The assessment follows a **continuous assessment** method, comprising the following components: seminars (20%), laboratory practicals (30%), field trip (10%), and the final exam (40%).

Attendance of at least 85% of lectures, as well as full attendance (100%) at all laboratory sessions, seminars, and the field trip, is mandatory to achieve the course's learning outcomes. This requirement applies **regardless of the type of assessment** (continuous or final) or the **exam session** (ordinary or extraordinary). Failure to meet the attendance requirement will result in the **course not being passed**.

The final grade includes the exam mark. A minimum score of **5/10** must be achieved in problem-solving activities and/or

exercises, laboratory practicals, and the practical report. Additionally, to incorporate the other components into the final grade, students must obtain **at least 4/10 in the final exam**.

Students who do not pass the course during the 2025/2026 academic year **will not be required to retake** the laboratory practicals, seminars, or field trip; the grades obtained in these components will be retained.

Requests to opt for a **final (global) assessment** must be submitted **within the deadline and following the procedure established by the Faculty**, which will be announced prior to the start of the academic year.

For communication with the teaching staff, students are encouraged to use the **□messaging□ tool on the MooVi platform**, as well as their institutional email address (@alumnos.uvigo.es).

Students enrolled in the **Universidade de Vigo's University Programme for Older Adults** who take this course as part of the Integration Cycle must attend **at least 80% of lectures and at least 80% of other teaching activities** (seminars, laboratory work, and fieldwork). Furthermore, their degree of integration with undergraduate students will be considered.

The use of mobile phones during class is prohibited, except when required for activities directly related to the course.

Other considerations

The date, time and place of the evaluation tests will be published on the official website of the Faculty of Marine Sciences:

<http://mar.uvigo.es/alumnado/examenes/>

Students who take this subject are required to behave responsibly and honestly. Any form of fraud (copying or plagiarism) aimed at distorting the level of knowledge and skills achieved in any type of test, report or work will be considered inadmissible. Fraudulent conduct may mean failing the subject for a full course. An internal record of these actions will be kept so that, in case of recidivism, request the opening of a disciplinary file to the rector.

Sources of information

Basic Bibliography

Davis, G.H., Reynolds, S.J., Kluth, C., **Structural geology of rocks and regions**, 3rd Edition, Wiley, 839 pp., 2012

Frisch, W., Meschede, M. & Blakey, R.C., **Plate Tectonics: continental drift and mountain building**, Springer Nature Switzerland, 245 pp., 2022

Kearey, P., Klepeis, K.A., Vine, F.J., **Global Tectonics**, 3rd Edition. Chichester England: Wiley-Blackwell, 482 pp., 2009

Leeder, M.R., Pérez Arlucea, M., **Physical processes in Earth and Environmental Sciences**, Malden Massachusetts: Blackwell, 321 pp., 2006

Tarback, E.J., Lutgens, F.K., **Ciencias de la Tierra: una introducción a la geología física**, Pearson, 686 pp., 2015

Complementary Bibliography

Anguita Virella, F., Moreno Serrano, F., **Procesos geológicos internos**, Rueda, 232 pp., 1991

Azañón Hernández, J.M., **Geología física**, Paraninfo, 302 pp., 2002

Monroe, J.S., Wicander, R., Pozo Rodríguez, M., **Geología: dinámica y evolución de la Tierra**, Paraninfo, 726 pp., 2008

Wicander, R., Monroe, J.S., **Historical geology: evolution of Earth and life through time**, 7th Edition. Australia etc., Brooks/Cole, 432 pp.,

Recommendations

Subjects that continue the syllabus

Geology: Geology 2/V10G061V01108

IDENTIFYING DATA				
Mathematics: Mathematics I				
Subject	Mathematics: Mathematics I			
Code	V10G061V01104			
Study programme	Grado en Ciencias del Mar			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Basic education	1st	1st
Teaching language	#EnglishFriendly Galician			
Department				
Coordinator	Alonso Álvarez, José Nicanor			
Lecturers	Alonso Álvarez, José Nicanor García Cutrín, Francisco Javier			
E-mail	jnalonso@uvigo.es			
Web	http://moovi.uvigo.gal			
General description	Mathematics I, in the degree of Grao in Sciences of the Sea, has as primary function to provide students with language, skills and basic mathematical techniques that will require both training and non-professional.			
	In addition, it should contribute to develop logical reasoning for problem solving, data analysis skills, interpretation of results and synthesis of conclusions. Participation, collaboration and a critical spirit will be encouraged.			
	The understanding and management of the fundamental concepts and techniques of linear algebra and calculus will be sought, as well as its application to various areas of study of the marine environment.			
	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	
A1	Students have demonstrated knowledge and understanding in a field of study that builds upon their general secondary education, and is typically at a level that, whilst supported by advanced textbooks, includes some aspects that will be informed by knowledge of the forefront of their field of study
A2	Students can apply their knowledge and understanding in a manner that indicates a professional approach to their work or vocation, and have competences typically demonstrated through devising and sustaining arguments and solving problems within their field of study
A3	Students have the ability to gather and interpret relevant data (usually within their field of study) to inform judgments that include reflection on relevant social, scientific or ethical issues
A4	Students can communicate information, ideas, problems and solutions to both specialist and non-specialist audiences
A5	Students have developed those learning skills that are necessary for them to continue to undertake further study with a high degree of autonomy
C1	know at a general level the fundamental principles of sciences: Mathematics, Physics, Chemistry, Biology and Geology.
C2	Acquire basic knowledge of mathematics (differential and integral calculation) and statistics.
D1	Develop the search, analysis and synthesis of information skills oriented to the identification and resolution of problems.
D2	Acquire the ability to learn autonomously, continuously and collaboratively, organizing and planning tasks over time.
D3	Understanding the meaning and application of the gender perspective in different fields of knowledge and in professional practice with the aim of achieving a more just and equal society.
D4	Ability to communicate orally and in writing in Galician language.
D5	Sustainability and environmental commitment. Equitable, responsible and efficient use of resources.

Expected results from this subject			
Expected results from this subject	Training and Learning Results		
Understand some basic concepts of differential calculus: partial derivatives, continuously differentiable function, chain rule, implicitly defined function, extreme/optimal of scalar functions.	A1	C1	D1
	A2	C2	D2
	A2	C24	D3
	A3		D4
	A3		D5
	A4		D11
	A5		
	A5		

Use the mechanics of calculating partial derivatives of any order, applying the chain rule, deriving implicitly defined functions, as well as techniques for calculating optimal/extremes with and without equality constraints. Apply the previous techniques to solve optimization problems.	A1		C1	D1
	A2		C2	D2
	A3			D3
	A4			D4
	A5			D5
To know the primitives of elementary functions and the main techniques to calculate these. Understand the mechanics of calculating double integrals.	A1	B1	C1	D1
	A2		C1	D1
	A3		C2	D2
	A4			D3
	A5			D4
Handle the mechanics of calculation of primitives and double integrals of simple functions. Know how to apply integral calculus to determine areas, volumes, centers of gravity, moments of inertia, etc.	A1	B1	C1	D1
	A1	B3	C2	D2
	A2	B4	C29	D3
	A2	B6	C33	D4
	A3	B7	C34	D5
	A4	B8	C35	
	A4	B10	C36	
	A5	B11		
Use a symbolic calculation computer program to solve problems related to the subject.		B12		
	A1	B6	C4	D1
	A1	B7	C26	D2
	A2	B8	C28	D3
	A2	B9		D4
	A3	B11		D5
	A3			
A4				
A5				

Contents

Topic	
Matrix calculus	Matrices and determinants. Discussion and resolution of systems of linear equations.
Differential calculus	Introduction to the functions of several variables. Differentiable functions. Chain rule. Extremes and conditional extremes of scalar functions.
Integral calculus.	Riemann integral. The fundamental theorem of integral calculus. Application to the calculation of areas.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	26	52	78
Problem solving	16	32	48
Practices through ICT	4	8	12
Essay questions exam	6	6	12

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

Methodologies

	Description
Lecturing	Exposure of the theoretical bases and orientation, by the teaching staff, on the contents of the subject.
Problem solving	Activities focused on work on a specific topic, which allow deepening or expanding the contents of the discipline. They will be used as a complement to the theoretical classes.
Practices through ICT	Use of a scientific calculator to help solve the exercises proposed in the seminars and master sessions. They take place in computer classrooms.

Personalized assistance

Methodologies	Description
Problem solving	Students who wish may attend personal tutorials to resolve doubts, mainly at the times indicated on the faculty website and/or on the MOOVI platform. In order to better optimize the procedure, the student is requested to contact the teacher in advance by email, with reasonable notice.
Practices through ICT	Students will demand from the teachers the clarifications they deem appropriate to better understand the subject and successfully carry out the proposed tasks. The individual work of the student will also be monitored.

Assessment						
	Description	Qualification	Training and Learning Results			
Problem solving	Test that will consist of theoretical questions and exercises that the student will answer by organizing and presenting, in an extensive way, the knowledge they have on the subject. There will be three tests, each counting 19 percent of the grade.	57	A1 A2 A3 A4 A5	C1 C2	D1 D2 D3 D4 D5	
Practices through ICT	Test in which students must solve some exercises using the computer program used in the classroom.	3	A5		D1	
Essay questions exam	It will be carried out as part of a final test that will take place at the end of the course, and will have a value of 40 percent of the final grade.	40	A1 A2 A3 A4 A5	C1 C2	D1 D2 D3 D4 D5	

Other comments on the Evaluation

Students who do not wish to follow the subject regularly may choose the global assessment option. The request for this option must be submitted at the time and in the manner determined by the Center, which will be published prior to the academic start. In the case of opting for the global evaluation, all the matter will be evaluated in a single test that will correspond to 100% of the final grade.

For the second opportunity, the students who follow the continuous evaluation will maintain the qualification obtained in it. For the remaining students, the test will correspond to 100% of the final grade.

2nd Opportunity: Students who follow the continuous assessment will maintain the grade obtained in it. For the remaining students the test will correspond to 100% of the final grade.

The date, time and place of the evaluation tests will be published on the official website of the Faculty of Marine Sciences: <http://mar.uvigo.es/alumnado/examenes/>

Students are strongly requested to fulfil a honest and responsible behaviour. It is considered completely unacceptable any alteration or fraud (i.e., copy or plagiarism) contributing to modify the level of knowledge and abilities acquired in exams, evaluations, reports or any kind of teacher's proposed work. Fraudulent behaviour may cause failing the course for a whole academic year. An internal dossier of these activities will be built and, when reoffending, the university rectorate will be asked to open a disciplinary record.

Sources of information

Basic Bibliography

Besada, M.; García, F.J.; Mirás, M.A.; Quinteiro, C.; Vázquez, C., **Mareáticas**, 2024

Larson, R.; Hostetler, R. e Edwards, B. H., **Cálculo (volumes I e II)**, MacGraw Hill, 2000

Complementary Bibliography

Adams, R.A., **Cálculo**, Pearson, 2009

Besada, M.; García, J.; Mirás, M.; Quinteiro, C. e Vázquez, C., **Matlab: todo un mundo**, 2007

Recommendations

Subjects that continue the syllabus

Mathematics: Mathematics II/V10G061V01109

IDENTIFYING DATA				
Chemistry: Chemistry I				
Subject	Chemistry: Chemistry I			
Code	V10G061V01105			
Study programme	Grado en Ciencias del Mar			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Basic education	1st	1st
Teaching language	#EnglishFriendly Spanish Galician			
Department				
Coordinator	Otero Martínez, Nicolás Alonso Gómez, José Lorenzo			
Lecturers	Alonso Gómez, José Lorenzo Álvarez Leirós, Carla Losada Barreiro, Sonia Otero Martínez, Nicolás Pérez Lorenzo, Moisés Rey Losada, Francisco Jesús			
E-mail	lorenzo@uvigo.es nom05@uvigo.es			
Web				
General description	The Chemical I subject introduces first-year students in the Degree in Marine Sciences to the basic concepts of intermolecular interactions, chemical thermodynamics, chemical equilibria, chemical kinetics, and an introduction to organic chemistry.			
	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	
A1	Students have demonstrated knowledge and understanding in a field of study that builds upon their general secondary education, and is typically at a level that, whilst supported by advanced textbooks, includes some aspects that will be informed by knowledge of the forefront of their field of study
A5	Students have developed those learning skills that are necessary for them to continue to undertake further study with a high degree of autonomy
B3	Recognize and implement good practices in measurement and experimentation, and work responsibly and safely both in field surveys and in the laboratory.
B4	Manage, process and interpret the data and information obtained both in the field and in the laboratory.
C1	know at a general level the fundamental principles of sciences: Mathematics, Physics, Chemistry, Biology and Geology.
C6	Acquire the fundamentals and terminology of chemical processes.
D1	Develop the search, analysis and synthesis of information skills oriented to the identification and resolution of problems.
D2	Acquire the ability to learn autonomously, continuously and collaboratively, organizing and planning tasks over time.

Expected results from this subject

Expected results from this subject	Training and Learning Results			
- Chemical nomenclature.	A1 A5	B4	C1 C6	D1 D2
- Know the functional groups describing the structure of the organic molecules and their reactivity.	A1 A5			
- Predict the properties of substances based on the intermolecular forces presence.	A1 A5			
- Calculate solution concentrations.	A1 A5			
- Identify chemical reactions of interest in the marine environment.	A1 A5			
- Definition of concepts such as enthalpy, standard enthalpy, calorimetry, heat of solution and heat of reaction, as well as how to calculate them.	A1 A5			
- Know how to use the expressions of chemical equilibrium to calculate the distribution of substances involved. Know the factors that affect equilibrium and how to apply the Le Chatelier principle.	A1 A5			

- Definition of pH and pOH, acidity/basicity constants, and hydrolysis constants, as well as their calculation.	A1 A5			
- Learn about buffer solutions and the different types of acid-base reactions, as well as how to use them.	A1 A5			
- Definition of concepts such as solubility and solubility product, as well as how to calculate them.	A1 A5			
- Understand what an oxidation-reduction process is and be able to define REDOX potential and standard potentials, as well as how they are calculated.	A1 A5			
- Understand the principles of operation of an electrochemical cell and predict the products of an electrochemical cell.	A1 A5			
- Define reaction rate and rate equation, and know how to use them.	A1 A5			
- Learn and know how to use the main methods of analyzing kinetic data.	A1 A5			
- Calculate the effect of temperature on the reaction rate.	A1 A5			
- Know the general characteristics of catalysis and their types.	A1 A5			
- Differentiate between chemically-controlled and diffusion-controlled reactions.	A1 A5			
- Understand the basic rules of laboratory work and the risks of handling dangerous chemical substances.	A5	B3 B4	C6	D1 D2

Contents

Topic	
Introduction to Organic Chemistry	Functional groups. Structure. Basic stereochemistry: chirality and configurational stereochemistry.
Intermolecular forces	Molecular geometry and polarity. Types of intermolecular forces: electrostatic, inductive, dispersion, and hydrogen bonding.
Thermochemistry, Spontaneity, and Gibbs Energy	Internal energy. Heat, work and the first law of thermodynamics. Enthalpy, standard enthalpy. Determination of heat of reaction: calorimetry. Entropy and Gibbs energy.
Principles of Chemical Equilibrium	Chemical equilibrium. Equilibrium constant. Temperature dependence of the equilibrium constant. Factors affecting equilibrium: Le Chatelier's principle.
Acids and Bases. Acid-Base Equilibrium	Theories of acids and bases. pH scale. Strength of acids and bases. Acid-base equilibrium. Hydrolysis reactions. Buffer solutions. Acid-base reactions. Acid-base titrations.
Solubility Equilibrium	Solubility and solubility product. Disturbance of the solubility equilibrium: Common-ion effect. Complex formation equilibrium.
Oxidation-Reduction Processes	Oxidation-reduction reactions. Electrochemical cells. Galvanic cells. Electrode potential. Nernst equation. Electrolytic cells.
Chemical Kinetics	Reaction rate. Rate equation. Analysis of kinetic data. Effect of temperature on the reaction rate. Catalysis.
Laboratory Practices	Application of experimental techniques related to the subject matter. Practical application in the laboratory of the knowledge acquired in the topics of thermochemistry, chemical equilibrium, and chemical kinetics.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	26	30	56
Problem solving	14	45	59
Laboratory practical	12	5	17
Objective questions exam	0	6	6
Problem and/or exercise solving	0	6	6
Self-assessment	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	They will consist of the instructor presenting the fundamental aspects of each topic, based on the material available on the online learning platform(s). Conceptual and/or numerical problems will be posed to help students understand and reinforce the concepts, laying the groundwork for them to solve exercises independently during the seminar sessions.

Problem solving	Seminar classes will be devoted to problem-solving by the students, during which the teacher will supervise and assist with aspects of the topics that present the greatest difficulties for the students.
Laboratory practical	Conducting laboratory experiments related to the course, under the professor's supervision but independently. Experiments will generally be conducted in pairs. Well in advance, students will have access to the experiment protocols on the corresponding platform. The protocol will outline the essential elements for conducting the experiment, as well as the basic points of its theoretical foundation and data analysis. Upon completion of the lab sessions, assessment will consist of a written exam, submission of a report, and/or an oral exam, at the instructor's discretion. Attendance at lab sessions IS MANDATORY.

Personalized assistance

Methodologies	Description
Lecturing	During tutorial sessions, any questions students may have that arise throughout the course during theory classes will be addressed on an individualized and more personal basis. Questions will be addressed using a blended model (in-person and/or online), depending on what is best for the students. Students must arrange the date and time of the in-person or online tutoring session in advance with the instructor teaching the relevant content.
Laboratory practical	During tutorial sessions, the teacher supervising the student's laboratory group will provide individualized and more personalized assistance in addressing any questions that may arise throughout the course while conducting laboratory experiments or preparing the corresponding reports, if required. Questions will be addressed through a blended format (in-person and/or online), depending on what is most convenient for the students. Students must arrange the date and time of the in-person or online tutorial in advance with the instructor teaching the relevant course content.
Problem solving	During tutorial sessions, any questions students may have throughout the course will be addressed on an individualized and more personal basis during problem-solving seminars. Questions will be addressed using a blended model (in-person and/or online) based on the students' preferences. Students must arrange the date and time of the in-person or online tutoring session in advance with the instructor teaching the corresponding course content.

Assessment

	Description	Qualification	Training and Learning Results			
Lecturing	Prior notice, during the sessions of theory, the students will have to answer a series of conceptual questions proposals by the teacher.	10	A1 A5	C1 C6	D1 D2	
Problem solving	Resolution of practical exercises of application of the concepts developed in the sessions of theory. Prior notice, the student, individually, will have to make the delivery of resolution of problems proposed by the teacher for his evaluation.	15	A1 A5	C1 C6	D1 D2	
Laboratory practical	It marks here together with the effort and the attitude, the skills and the competitions developed by the student during the realisation of the distinct practical. The assistance to the sessions of practices is compulsory and, therefore, is not possible to approve the matter in the case of not to have made. -It remains to the educational criterion to make an evaluation by means of an oral proof and/or written on the last day of practicing.	15	A1 A5	B3 B4	C1 C6	D1 D2
Objective questions exam	When finalising the semester, will make a proof on all the contents of the matter by means of conceptual questions. It requires obtain a minimum qualification of 4,0 points.	25	A1 A5	C1 C6	D1 D2	
Problem and/or exercise solving	For each subject or block of subjects, the students, on an individual basis, will have to solve one or several problems or exercises proposed by teachers, that will submitted to evaluation.	35	A1 A5	C1 C6	D1 D2	

Other comments on the Evaluation

CONTINUOUS EVALUATION OPTION

ORDINARY CALL

To pass the course, the following requirements must be met:

- Achieve a minimum grade of 4.0 out of 10 on each exam(s) covering all course content through conceptual questions.
- Achieve a minimum grade of 4.0 out of 10 on each exam(s) covering all course content through numerical questions.

- Achieve a grade of 5.0 out of 10 on the laboratory practicals. The maximum grade recorded on the transcript if the practicals are not completed will be 2.0. If the minimum score on the laboratory assessment (5.0) is not achieved, the grade recorded on the transcript will be the lower of the laboratory practicals grade and the average of the exams.

- Achieve a minimum grade of 5.0 out of 10 on the weighted sum of the assessment components. If this score is not achieved, the grade recorded on the transcript will be solely the weighted grade of the exams. If the course is passed, the grade on the transcript will be the weighted sum of all assessment components.

Completion of any assessment component will result in a "submitted" status and, therefore, the assignment of a grade in accordance with this course guide.

Grades for "Laboratory Practicum" may be carried over for a maximum of three consecutive academic years. Grades for all other assessment components are not carried over.

EXTRAORDINARY CALL

Grades obtained during the semester for the various assessment components will be retained. To pass the course during this session, students must earn a minimum grade of 4.0 out of 10 on the exam—which covers all course content—and achieve a minimum weighted average of 5.0 across all assessment components.

To find out the dates of the assessment exams: <https://mar.uvigo.es/docencia/examenes/>

GLOBAL EVALUATION OPTION

The application for this assessment option must be submitted in the manner and within the timeframe determined by the Center, which will be published prior to the start of the academic year.

Given the experimental nature of the Marine Sciences degree program and the laboratory practicals for the Chemistry I course, attendance at these practicals is mandatory in order to be eligible for this assessment option. Failure to attend the practicals with a valid excuse will result in a maximum grade of 2.0 on the grade reports for both the regular and make-up exam sessions.

To pass this course in this format, students must complete and pass the Laboratory Practicum assessment (15% of the overall grade) with a grade of 5.0 or higher out of 10. In addition, they must earn at least 5.0 out of 10 on an exam covering all course content, which will account for 85% of the final grade, both during the regular and make-up exam periods. If students do not pass the laboratory practicals, their official grade will be the lower of the laboratory grade and the grade on the aforementioned exam for the corresponding exam periods.

Other considerations

Students enrolled in this course are required to demonstrate responsible and honest conduct.

Any form of cheating (copying and/or plagiarism) intended to misrepresent the level of knowledge or skill demonstrated in any type of exam, report, or assignment is considered unacceptable. Cheating will result in failure of the course for an entire academic year with a grade of zero (0). An internal record of such incidents will be kept to request that the university administration initiate disciplinary proceedings in the event of a repeat offense.

Sources of information

Basic Bibliography

PETRUCCI R.H., **Química General: principios y aplicaciones modernas**, (11ª edición), Ed. Pearson Educación, 2017

LÓPEZ CANCIO, J.A., **Problemas de química**, (1ª edición), Ed. Prentice-Hall, 2000

CHANG, R., GOLDSBY, K. A., **Química**, (12ª edición), Ed. McGraw-Hill, 2016

Complementary Bibliography

RILEY, J.P., CHESTER, R., **"Introducción a la Química Marina"**, (1ª edición), Ed. A.G.T, 1989

Recommendations

Subjects that continue the syllabus

Chemistry: Chemistry 2/V10G061V01110

Subjects that are recommended to be taken simultaneously

Physics: Physics I/V10G061V01102

Mathematics: Mathematics I/V10G061V01104

Other comments

Stoichiometry, the laws of mass, different ways of expressing concentration, and basic chemical nomenclature will be used frequently when solving numerical problems and can be considered fundamental tools in this course.

IDENTIFYING DATA				
Biology: Biology 2				
Subject	Biology: Biology 2			
Code	V10G061V01106			
Study programme	Grado en Ciencias del Mar			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Basic education	1st	2nd
Teaching language	#EnglishFriendly Spanish			
Department				
Coordinator	Souza Troncoso, Jesús			
Lecturers	López Pérez, Jesús Souza Troncoso, Jesús			
E-mail	troncoso@uvigo.es			
Web				
General description	It is the first approach of the student to the Zoology and Ecology. 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	
A1	Students have demonstrated knowledge and understanding in a field of study that builds upon their general secondary education, and is typically at a level that, whilst supported by advanced textbooks, includes some aspects that will be informed by knowledge of the forefront of their field of study
C9	Acquire basic knowledge about the structural and functional organization and the evolution of marine organisms.
C10	Know the biological diversity and functioning of marine ecosystems.
C11	Apply the knowledge and techniques acquired to the characterization and sustainable use of living resources and marine ecosystems.
D1	Develop the search, analysis and synthesis of information skills oriented to the identification and resolution of problems.
D2	Acquire the ability to learn autonomously, continuously and collaboratively, organizing and planning tasks over time.

Expected results from this subject

Expected results from this subject	Training and Learning Results		
1. Know, comprise, measure and value the importance of the biodiversity of the organisms in the half marine.	A1	C9 C10 C11	D1 D2
2. Comprise the bases of the diversity and the evolutionary history of the animal species.	A1	C9 C10 C11	D1 D2
3. Know the basic terminology of the zoological science.	A1	C9 C10 C11	D1 D2
5. Know the situation of the *filos zoological in the marine ecosystems (*zooplankton, *necton, *bentos).	A1	C9 C10 C11	D1 D2
6. Know the adaptations *morfológicas that condition the situation of the zoological groups in the marine ecosystems coastlines, *neríticos and deep.	A1	C9 C10 C11	D1 D2
7. Know recognize the main *filos zoological belonging to the half marine.	A1	C9 C10 C11	D1 D2
8. Know recognize the offshore species more common.	A1	C9 C10 C11	D1 D2
9. Know and comprise the basic ecological principles that determine the structure and the operation of the marine ecosystems.	A1	C9 C10 C11	D1 D2
10. Acquire basic knowledge on autoecología. Adjustment go in the organisms and the environment. Environmental factors. Analysis of the effects and answers of the organisms the distinct Factors. Conditions and resources.	A1	C9 C10 C11	D1 D2

11. Purchase the capacity to relate processes *abióticos and *bióticos in the half marine.	A1	C9 C10 C11	D1 D2
12. Purchase skill in the analysis and interpretation of data.	A1	C9 C10 C11	D1 D2
13. Purchase the skill to transmit information of form written, verbal and graphic.	A1	C9 C10 C11	D1 D2

Contents

Topic

□ The diversity of the marine organisms. The tree of life. The zoological Topic coincides with Sub-topics.

□ The five kingdoms. Unicellular and multicellular organisms. idem

□ The multicellular organisms: the animal kingdom. idem

□ Origin of metazoas, levels of organisation. Analogy and homology. The symmetry. Classifying animals. The biological nomenclature. Systematics. Filogeny. idem

□ Introduction to the Phyla on marine environment. idem

□ The invertebrates protostomes. Lophotrochozoa and ecdysozoa. idem

□ The invertebrates deuterostomes: xenoturbellida, equinodermata and hemichordata. idem

Introduction to the Phylum chordata. Characteristics of the subphyla urochordata and cephalochordata. idem

The subphylum Craniata (vertebrates). Agnatha and gnathostomata. idem

Marine condrichthyes, osteichthyes, birds and mammalia. idem

- Vertebrates with accidental presence on marine environment: amphibia and reptilia. idem

- Field of study of the ecology: The biological macroscopic systems: The ecology how science of synthesis; historical review. Levels of organisation; hierarchy and emergent properties. General theory of systems. System to level supra organismic. The ecosystem. The parts (diversity) and it all (energetic). The ecological topics coincides with Sub-topics.

- The paper of the environment in the evolution of the organisms: Adaptation; concept and critical. Biological efficacy. Natural selection and genetic drift. Speciation. Convergences and parallelisms. Ecotypes and genetic polymorphisms. idem

- Decomposition of the environment factors: conditions and resources. Limiting factors. Limits of tolerance and optimal physiological. Ecological indicators. Ecological niche. Ecological profiles. idem

- Environmental factors: The space, Temperature, Salinity, luminous Radiation, Nutrients, Gases dissolved, others. idem

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	29	59	88
Seminars	7	24	31
Laboratory practical	8	12	20
Studies excursion	6	3	9
Objective questions exam	0.5	0	0.5

Essay questions exam	0.5	0	0.5
Presentation	0.5	0	0.5
Laboratory practice	0.5	0	0.5

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

Methodologies	
	Description
Lecturing	Explain to the students the theoretical contents that will be evaluated in a final examination.
Seminars	By means of the preparation of oral exhibitions on scientific texts selected, the students will show his skills, the team work, oral exhibition regard a scientific subject. After the exposure we will open a debate to evaluate the capacity of synthesis and the understanding of the subject proposed.
Laboratory practical	Recognize the answers of the organisms to the environmental factors. Besides to recognize the most commons marine organisms on our coasts.
Studies excursion	The students will learn to recognize the marine organisms more common of the European coasts.

Personalized assistance	
Methodologies	Description
Lecturing	Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation.
Seminars	It Will do a continuous assessment of the academic performance of the student during the Seminars by means of the observation of the his active participation, so much during the phase of preparation, manufacture, exhibition, back debate as well as the resources to bibliography used.
Laboratory practical	The professors of the subject will realize a continuous assessment of the performance of the student, in base to the participation in the practices and to the intervention in the distinct activities offered.
Studies excursion	Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation.
Tests	Description
Objective questions exam	The professor will be present at the exam.
Essay questions exam	The professor will be present at the exam.
Presentation	The professor will be present at the exposition.
Laboratory practice	The professor will be present at the laboratory.

Assessment		Qualification		Training and Learning Results	
	Description				
Lecturing	They Will evaluate the contents with questions type test and/or short questions.	2	A1	C9 C10 C11	D1 D2
Seminars	It Will qualify the preparation of the subject and his exhibition. It will evaluate the participation debate us of all the Seminars. Due to the experimental nature, attendance is mandatory.	5	A1	C9 C10 C11	D1 D2
Laboratory practical	It Will value the realization and participation in the practical. Due to the experimental nature, attendance is mandatory.	10	A1	C9 C10 C11	D1 D2
Studies excursion	It Will evaluate the realization and the participation in the trip. Due to the experimental nature, attendance is mandatory.	5	A1	C9 C10 C11	D1 D2
Objective questions exam	It will qualify the basic concepts in Zoology and Ecology.	19	A1	C9 C10 C11	D1 D2
Essay questions exam	It will qualify the basic concepts in Zoology and Ecology.	19	A1	C9 C10 C11	D1 D2
Presentation	Attendance is mandatory during the seminar to give the presentation. It will qualify the presentation and discussion.	15	A1	C9 C10 C11	D1 D2
Laboratory practice	Attendance is mandatory to prepare the results book. It will qualify the laboratory results book.	25	A1	C9 C10 C11	D1 D2

Other comments on the Evaluation

Continuous assesment: Master class/Lecturer attendance: 0.2 points. Exam zoology: 3.4 points. Exam ecology: 3.4 points. Seminars and technical visit: 1.5 points. Practices: 1.5 points.

2nd Opportunity (July call): In the 2nd chance exam, students will be able to recover up to a maximum of 3.4 points in zoology and 3.4 points in ecology.

In case of not passing the subject, the grades of the activities passed are saved for the following academic years.

Global assessment: The application for this evaluation must be submitted in the time and manner determined by the Center, which will be published prior to the academic start. Given the experimental nature of the practices, attendance at them is mandatory to be eligible for this evaluation option. Failure to attend the practices, with no justified cause invalidates this possibility, as well as the opportunity for extraordinary evaluation (2nd opportunity).

Date, time and place of exams will be published in the official web of Marine Sciences Faculty:

<http://mar.uvigo.es/alumnado/examenes/>

Students are strongly requested to fulfil a honest and responsible behaviour. It is considered completely unacceptable any alteration or fraud (i.e., copy or plagiarism) contributing to modify the level of knowledge and abilities acquired in exams, evaluations, reports or any kind of teacher's proposed work. Fraudulent behaviour may cause failing the course for a whole academic year. An internal dossier of these activities will be built and, when reoffending, the university rectorate will be asked to open a disciplinary record.

Sources of information

Basic Bibliography

Susan Keen, Jr. Hickman, Cleveland, Allan Larson, David Eisenhour, Helen I'Anson, **Integrated Principles of Zoology**, 16, McGraw-Hill Education, 2015

Richard C. Brusca, **Invertebrates**, Sinauer, 2016

Peter Castro, Michael Huber, **Marine Biology**, 9, McGraw-Hill Higher Education, 2012

Trigo, J.E., et al., **Guía de los Moluscos Marinos de Galicia**, 1, UVIGO - Soc. Esp. Malcologia, 2018

Complementary Bibliography

Recommendations

Subjects that it is recommended to have taken before

Biology: Biology I/V10G061V01101

Other comments

The key to success is to take part in all activities.

IDENTIFYING DATA				
Statistics				
Subject	Statistics			
Code	V10G061V01107			
Study programme	Grado en Ciencias del Mar			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	1st	2nd
Teaching language	#EnglishFriendly Spanish Galician			
Department				
Coordinator	Rodríguez Álvarez, María José			
Lecturers	Rodríguez Álvarez, María José			
E-mail	mxrodriguez@uvigo.es			
Web				
General description	Subject destined to the knowledge and use of the fundamental statistical techniques for the treatment of and analysis of experimental data.			
	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				
A2	Students can apply their knowledge and understanding in a manner that indicates a professional approach to their work or vocation, and have competences typically demonstrated through devising and sustaining arguments and solving problems within their field of study			
A3	Students have the ability to gather and interpret relevant data (usually within their field of study) to inform judgments that include reflection on relevant social, scientific or ethical issues			
A4	Students can communicate information, ideas, problems and solutions to both specialist and non-specialist audiences			
A5	Students have developed those learning skills that are necessary for them to continue to undertake further study with a high degree of autonomy			
B2	Plan and execute surveys in the field and laboratory work, applying basic tools and techniques for sampling, data acquisition and analysis in the water column, sea bottom and marine substratum.			
B4	Manage, process and interpret the data and information obtained both in the field and in the laboratory.			
C2	Acquire basic knowledge of mathematics (differential and integral calculation) and statistics.			
D1	Develop the search, analysis and synthesis of information skills oriented to the identification and resolution of problems.			
D2	Acquire the ability to learn autonomously, continuously and collaboratively, organizing and planning tasks over time.			

Expected results from this subject				
Expected results from this subject	Training and Learning Results			
Know the importance of information and be able to assess and classify it in each decision area.	A2	B2	C2	D1
Know how to correctly apply and interpret the basic descriptive techniques for the analysis of unidimensional and bidimensional variables.	A3	B4		D2
	A4			
	A5			
Understand the concept of hypothesis testing.	A3		C2	D1
	A5			D2
Understand the principles of multivariate analysis.	A3		C2	D1
	A5			D2
Effectively solve problems and issues of each of the lessons using the appropriate quantitative method.	A5	B2		D1
				D2
Introduce the students in the manage of computer packages related to statistics: R and RStudio.	A3	B2		D1
And so favor a positive attitude towards the quantitative methods, in general, and statistics, in particular, as well as their computer manipulation.	A5	B4		D2
Understand the importance of statistical analysis when taking decisions and learn when to apply each technique and interpret the results obtained.	A3	B2		D1
	A4			D2
To awaken the taste for the use and study of statistics, seeing it as a tool that allows us to learn more about our own field of knowledge and to start carrying out our own research.	A3			D1
	A5			D2

Contents				
Topic				

1. Introduction to statistics. Basic concepts.	Population. Individual. Sample. Random variable. Types of variables: qualitative and quantitative. Descriptive and inferential statistics.
2. Descriptive statistics and exploratory data analysis.	- One-dimensional case: frequency distribution. Measures of location (mean, median, mode and quantiles), dispersion (range, interquartile range, standard deviation and variance) and shape (skewness). - Two-dimensional case: double-entry frequency tables. Correlation. Measures of centralization and dispersion by subgroups. - One-dimensional and two-dimensional graphical representations.
3. Introduction to probability theory, random variables and main probability distributions.	Basic concepts: sample space, events and elementary events, basic rules of probability, main probability theorems, conditional probability and independence, probability distribution. Probability mass function. Distribution and density function. Main discrete probability distributions: Bernoulli, binomial, Poisson. Main continuous probability distributions: normal, exponential.
4. Introduction to statistical inference.	Point estimation: properties of estimators. Confidence intervals: construction. Hypothesis testing: main concepts. Types of error. Critical level or p-value.
5. Comparison of means	Comparison of two means: dependent and independent samples. Non-parametric tests. Comparison of more than two means: analysis of variance (ANOVA) of one factor. Non-parametric tests.
6. Regression and correlation	Simple linear regression model. The regression line. Goodness of fit and residual analysis. Hypothesis tests for the simple linear regression model Non-linear regression: logarithmic and exponential models.
7. Qualitative data analysis	Contingency tables. Measures of association. Chi-square goodness-of-fit test and Chi-square test of independence.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	33	55	88
Problem solving	7	0	7
Autonomous problem solving	0	21	21
Practices through ICT	15	15	30
Objective questions exam	2	0	2
Objective questions exam	0	2	2

*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 contents of the course will be presented in a lecture session and practical exercises will be solved.
Problem solving	Resolution of practical exercises of the course
Autonomous problem solving	Autonomous resolution of practical exercises of the course.
Practices through ICT	Data processing and statistical analyses using the free software R and RStudio. Application of the contents presented in the lecture sessions. Given their practical nature, attendance is compulsory (except for duly justified reasons).

Personalized assistance

Methodologies	Description
Problem solving	In all the methodologies foreseen in this subject, personalized attention is contemplated, both in the classroom and through voluntary tutorials. Students who wish may attend personal tutorials to resolve doubts and/or uncertainties, mainly at the times indicated on the faculty website and/or on the MOOVI platform. To better optimize the procedure, the student is requested to contact the teacher in advance by email, with reasonable anticipation.
Lecturing	In all the methodologies foreseen in this subject, personalized attention is contemplated, both in the classroom and through voluntary tutorials. Students who wish may attend personal tutorials to resolve doubts and/or uncertainties, mainly at the times indicated on the faculty website and/or on the MOOVI platform. To better optimize the procedure, the student is requested to contact the teacher in advance by email, with reasonable anticipation.

Autonomous problem solving	In all the methodologies foreseen in this subject, personalized attention is contemplated, both in the classroom and through voluntary tutorials. Students who wish may attend personal tutorials to resolve doubts and/or uncertainties, mainly at the times indicated on the faculty website and/or on the MOOVI platform. To better optimize the procedure, the student is requested to contact the teacher in advance by email, with reasonable anticipation.
Practices through ICT	In all the methodologies foreseen in this subject, personalized attention is contemplated, both in the classroom and through voluntary tutorials. Students who wish may attend personal tutorials to resolve doubts and/or uncertainties, mainly at the times indicated on the faculty website and/or on the MOOVI platform. To better optimize the procedure, the student is requested to contact the teacher in advance by email, with reasonable anticipation.

Assessment					
Description		Qualification	Training and Learning Results		
Practices through ICT	Throughout the course, students will be required to solve several practical case studies of data analysis using R software. Given its practical nature, attendance is mandatory (except for duly justified reasons) and practicals by non-attendees will not be evaluated.	30	A2 A3 A4 A5	B2 B4	D1 D2
Objective questions exam	Written test to be held during the course on the contents of topics 1, 2 and 3. It may include multiple-choice questions, short-answer questions, development questions, exercises and/or problems.	35	A2 A3 A4 A5	C2	D1
Objective questions exam	Written test to be held on the official examination date on the remaining course contents. It may include multiple-choice questions, short-answer questions, development questions, exercises and/or problems.	35	A2 A3 A4 A5	C2	D1

Other comments on the Evaluation

Continuous assessment: The final mark for the course will be based on the following tests and activities:

- A written test with development questions on topics 1, 2 and 3, which will account for 35% of the final mark.
- A written test, to be held on the official examination date, covering the remaining topics of the course, which will account for 35% of the final mark.
- ICT-supported practical work, which will account for 30% of the final mark. This practical work will consist of tests carried out throughout the course, in which students will be required to solve several practical data analysis cases using the R software.

To pass the course through continuous assessment, the average mark of the two written tests must be higher than 3.5 out of 10. If this minimum mark is not achieved, the mark recorded in the official transcript will be the lower of 4.9 and the weighted final mark.

Second assessment opportunity: In the second assessment opportunity, the same assessment system as in the continuous assessment will be applied. The mark obtained in the ICT-supported practical work, accounting for 30% of the final mark, will be maintained. The remaining 70% will correspond to a written test, to be held on the official date of the second assessment opportunity, which will include content from all course topics. This test will have two parts: one corresponding to topics 1, 2 and 3, with a weight of 35%, and another corresponding to the remaining topics, with a weight of 35%. To pass the course in the second assessment opportunity, the average mark of the two parts of the written test must be higher than 3.5 out of 10. If this minimum mark is not achieved, the mark recorded in the official transcript will be the lower of 4.9 and the weighted final mark.

Global evaluation: Alternatively to the continuous assessment system, students may choose to be evaluated with a final exam that will represent 100% of the qualification. In this case, it will be necessary to obtain a grade higher than 5 points (out of 10) to pass the course. For students enrolled in the course for the first time, the request for global evaluation does not exempt them from mandatory attendance at the practical sessions supported by ICT. If attendance requirements are not met, the course will not be passed, regardless of the final exam grade. The request for this evaluation option must be submitted in the time and manner determined by the Center, which will be published prior to the start of the academic year.

Other considerations:

The date, time and place of the final exams will be published on the official website of the Faculty of Marine Sciences.

<http://mar.uvigo.es/alumnado/examenos/>

Students are strongly requested to fulfill a honest and responsible behavior. It is considered completely unacceptable any alteration or fraud (i.e., copy or plagiarism) contributing to modify the level of knowledge and abilities acquired in exams, evaluations, reports or any kind of teacher's proposed work. Fraudulent behavior may cause failing the course for a whole academic year. An internal dossier of these activities will be built and, when reoffending, the university rectorate will be asked to open a disciplinary record.

The communication between students and teachers must be done using: (1) the Moovi platform; or (2) the institutional email (@alumnos.uvigo.gal). Likewise, this email is the one that must appear in the Moovi platform.

Sources of information

Basic Bibliography

Mirás Calvo M.A., Sánchez Rodríguez E., **Técnicas estadísticas con hoja de cálculo y R : azar y variabilidad en las ciencias naturales**, 1, Servizo de Publicacións da Universidade de Vigo, 2018

Susan Milton J., **Estadística para la biología y las ciencias de la salud**, 3, McGraw-Hill Interamericana, 2007

Whitlock, M.C. e Schluter, D., **The Analysis of Biological Data**, 3, WH Freeman, 2020

Complementary Bibliography

Fowler F., Cohen L., Jarvis P., **Practical Statistics for Field Biology**, 2, John Wiley and Sons, 2013

Miller J.N., Miller, J.C., **Estadística y Quimiometría para Química Analítica**, 4, Prentice Hall, 2002

Çetinkaya-Rundel, M. e Hardin, J., **Introduction to Modern Statistics**, OpenIntro, 2021

Recommendations

IDENTIFYING DATA				
Geology: Geology 2				
Subject	Geology: Geology 2			
Code	V10G061V01108			
Study programme	Grado en Ciencias del Mar			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Basic education	1st	2nd
Teaching language	#EnglishFriendly Spanish Galician			
Department				
Coordinator	Rubio Armesto, María Belén			
Lecturers	Copete Hernández, María Fernanda Rey García, Daniel Rubio Armesto, María Belén			
E-mail	brubio@uvigo.es			
Web	http://https://mar.uvigo.es/			
General description	Geology II is a theoretical subject-practical that treats of the understanding of the scientific principles that *infuyen in our planet, in his evolution, in his trainings in the atmosphere and in the oceans. It treats to purchase the basic knowledges of the geological processes that act on the terrestrial surface, the called external geological processes. Like this, it integrates the action and the results of the external geological processes on the rocks and sediments that constitute the surface of the planet Tierra. Matter of the program *English *Friendly: The/ace international students will be able to request to the *profesorado: to) material and bibliographic references for the follow-up of the matter in English, *b) attend the *tutorías in English, *c) proofs and evaluations in English.			

Training and Learning Results				
Code				
A1	Students have demonstrated knowledge and understanding in a field of study that builds upon their general secondary education, and is typically at a level that, whilst supported by advanced textbooks, includes some aspects that will be informed by knowledge of the forefront of their field of study			
A2	Students can apply their knowledge and understanding in a manner that indicates a professional approach to their work or vocation, and have competences typically demonstrated through devising and sustaining arguments and solving problems within their field of study			
A5	Students have developed those learning skills that are necessary for them to continue to undertake further study with a high degree of autonomy			
B1	Know and use vocabulary, concepts, principles and theories related to oceanography and apply everything learned in a professional and/or research environment.			
B3	Recognize and implement good practices in measurement and experimentation, and work responsibly and safely both in field surveys and in the laboratory.			
B4	Manage, process and interpret the data and information obtained both in the field and in the laboratory.			
C1	know at a general level the fundamental principles of sciences: Mathematics, Physics, Chemistry, Biology and Geology.			
C12	Acquire knowledge about processes and products related to internal and external geological cycles.			
D1	Develop the search, analysis and synthesis of information skills oriented to the identification and resolution of problems.			
D2	Acquire the ability to learn autonomously, continuously and collaboratively, organizing and planning tasks over time.			
D5	Sustainability and environmental commitment. Equitable, responsible and efficient use of resources.			

Expected results from this subject				
Expected results from this subject	Training and Learning Results			
Identify the main mineral constituents and biological in sediments and in rocks *sedimentarias by means of observations of *visu in field and laboratory.	A1 A5	B1 B4	C1 C12	D1 D2 D5
Identify and differentiate the external geological agents, processes and his products.	A1 A2 A5	B1 B3	C1 C12	D1 D2
Recognise the forms of the relief.	A1 A2 A5	B1 B3 B4	C1 C12	D1 D2

Handle the proportionate information in the geological maps and the systems of cartographic representation	A1 A2 A5	B1 B3 B4	C1 C12	D1 D2
Integrate pertinent information of distinct sources and disciplines and use the suitable vocabulary to elaborate reports.	A1 A2 A5	B1 B3 B4	C1 C12	D1 D2 D5
Handle the principles and basic instruments of positioning and georeferences	A1 A2 A5	B1 B3 B4	C12	D1 D2

Contents

Topic	
Subject 0: Presentation	Presentation of the subject. General explanation of theoretical contents-practical and of the system of evaluation.
Subject 1: The earth like object of study	Evolution of the Earth. Geological and petrological cycles.
Subject 2: The systems of the Earth	Atmosphere: origin, composition, structure and dynamic. Hidrosphere: Oceanic waters and its circulation. Continental waters: the hydrological cycle. Groundwater and karstic systems.
Subject 3: External Geological Cycle	Weathering and erosion, types and speeds. Soils: formation and types. Diagenesis and sedimentary rocks.
Subject 4: Geological Processes in continental environments	Fluvial, lacustrine, deserts and glacier environments.
Subject 5: geological Processes in marine environments	Coastal zone: agents and processes. Marine and oceanic Zones: morphological and Sedimentary marine environments.
Seminars	Seminar 1: Systems of reference of coordinates and scales. Elaborate topographical profiles and calculations of pending. Relate the relief with geological and coastal processes. Seminar 2: Space representation: maps of isolines and isopacas, roses of the winds. Seminar 3: Interpretation of networks of drainage, divisional of waters and basins of drainage. Risks of flood.
Practices	Practice 1: Determination of the content in calcic carbonate of the sediments. Practice 2: Recognition of sedimentary rocks. Practice 3: Analysis of maps and geological cut. Calculations of directions, dip and thicknesses of layers. Practical unconformities . 4: Recognition of sedimentary environments by GIS
Field trip	Geological inspection of the itinerary Vigo-Ramalloso-Baiona to recognise the control that exerts the geology, the marine and fluvial dynamics in the coastal geomorphology. Recognition of the main types of rocks and of the main sedimentary environments: mechanisms of performance during the Quaternary. Potential geological risks and anthropogenic impacts.

Planning

	Class hours	Hours outside the classroom	Total hours
Laboratory practical	12	12	24
Seminars	7	10	17
Studies excursion	8	4	12
Lecturing	20	60	80
Essay questions exam	2	0	2
Report of practices, practicum and external practices	0	10	10
Problem and/or exercise solving	0	5	5

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

Methodologies

Description

Laboratory practical	Given the experimental character, the practical will be of compulsory assistance. Practice 1. Determination of the content in calcic carbonate of the sediments. Practice 2: Recognition of sedimentary rocks. Practice 3: Analysis of geological maps. Calculations of directions, dips and thicknesses of layers. Unconformities. Practice 4: Recognition of sedimentary environments by means of systems of geographic information
Seminars	Given the experimental character, the seminars will be of compulsory assistance. Seminar 1: Systems of reference of coordinates and scales. Preparation of topographical profiles and calculations of slopes. Relate the relief with geological and coastal processes Seminar 2: space Representation: maps of isolines and isopacas, roses of the winds. Seminar 3: Interpretation of networks of drainage, divisional of waters and hydrographic basins. Risks of flood.
Studies excursion	Given the experimental and practical character, the exit of study is of compulsory assistance. This exit contemplates the geological inspection in the itinerary: Vigo-*Ramalloso-*Baiona. It treats to recognise the control that exerts the geology and the marine and fluvial dynamics in the morphology of the coast. Recognition of the main types of rocks and of the main sedimentary environments; mechanisms of performance during the Quaternary. Potential geological risks.
Lecturing	Classes centred in theoretical contents with predominance of the exhibition, but boosting the participation of the student by means of questions. It will value positively the participation of the students during the masterclasses.

Personalized assistance

Methodologies	Description
Seminars	The *estudiantado that wish it will be able to formulate questions during the development of the seminars. Pay attention *individualizada, is necessary that the *estudiantado contact with the *profesorado with *antelación sufficient by email.
Studies excursion	The *estudiantado will receive explanations during the development of the exit.
Lecturing	The *estudiantado that wish it will be able to formulate questions during the development of the masterclasses. Also it will be able to attend to the *tutorías personalised to resolve doubts. It is necessary that the student contact with the professor with *antelación sufficient by email.
Laboratory practical	The *estudiantado that wish it will be able to formulate questions during the development of the practices. Also it will be able to attend to the *tutorías personalised to resolve doubts. It is necessary that the student contact with the professor with *antelación sufficient by email.
Tests	Description
Essay questions exam	The *estudiantado that wish it will be able to attend to the *tutorías personalised to resolve doubts related with this methodology. It is necessary that the *estudiantado contact with the professor with *antelación sufficient by email.
Report of practices, practicum and external practices	The *estudiantado that wish it will be able to attend to the *tutorías personalised to resolve doubts related with the preparation of the report of seminars. It is necessary that the *estudiantado contact with the professor with *antelación sufficient by email.

Assessment

	Description	Qualification	Training and Learning Results			
			A1	B1	C1	D1
Laboratory practical	Given his experimental character, the assistance to the practical is compulsory.	0	A2	B3	C12	D2
			A5	B4		D5
Seminars	Given his experimental character, the assistance to the seminars is compulsory.	25	A1	B1	C1	D1
			A2	B3	C12	D2
			A5	B4		D5
Studies excursion	Given his experimental character, the assistance to the exit of field is compulsory.	5	A1	B1	C1	D1
			A2	B3	C12	D2
			A5	B4		D5
Essay questions exam	They will make in an examination with specific questions related with the theoretical contents developed in the masterclasses.	40	A1	B1	C1	
			A5		C12	

Report of practices, It contemplates the delivery of the questions or resolution of the practicum and external exercises posed in each one of the seminars. practices	30	A1 A2 A5	B1 B3 B4	C1 C12	D1 D2 D5
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Given the compulsory and face-to-face character will not evaluate deliveries of the no assistants.

Other comments on the Evaluation

EVALUATION IN FIRST OPPORTUNITY: The evaluation in first opportunity will be of continuous character. Students that have not assisted in his whole-except cause properly justified (see regulation*) to the practices of laboratory, seminars and exit of field, given his experimental character, will not be able to opt to continuous evaluation, neither global evaluation, neither present to the evaluation in second opportunity. The final qualification of the material in first opportunity will be the sum of the note obtained in each one of the methodologies proposed as long as they give the three following conditions: the qualification of the examination of questions of development was equal or upper to 5/10, the corresponding qualification to seminars was equal or upper 5/10 and the practical corresponding qualification was equal or upper to the 5/10. In case of not reaching said 5/10 in any of these three proofs, the final note will be equal to the average *ponderada final, multiplied by 0.5.

EVALUATION IN SECOND OPPORTUNITY: The evaluation in second opportunity will have the same conditions that in first opportunity. In the case that some student have not surpassed practise or seminars will be able to examine of the same in this second opportunity.

REPEATING STUDENTS: Students who took de subject in the 2025/2026 academic year and carried out the practices during the quoted academic course but not surpassed the subject, will not have to make them if they had surpassed them in the previous course. The qualifications obtained in the previous course will keep in the academic course 2026/2027 and will consider part of the continuous evaluation. Nevertheless, if like this they wished it they could repeat them. For previous courses will have to repeat them.

GLOBAL EVALUATION OPTION: The application for this option of evaluation will have to present in the time and form that determine the Centre, that will be published prior to the academic start. Nevertheless, only it will be able to request if it fulfils the assistance to all the compulsory activities (practical, seminars and exits of field) or presents the corresponding justification. The global evaluation will consist in an only examination of theoretical character-practical that *contabilizará 100% of the qualification.

GENERAL CONSIDERATIONS: Its requires by the students to have a responsible behaviour, respectful and honest with the mates and with the teachers. Considers inadmissible any form of fraud (copy and/or plagiarism) directed to Fake the level of knowledge or skill reached by one/to student/the in any type of proof, report or work. The fraudulent behaviours will be able to suppose suspend the subject during a complete course. It will carry an internal register of these performances so that, in case of *reincidencia, request the opening to the rector of a disciplinary file. The use of mobile telephones for distinct ends to the educational, is not allowed during the length of the face-to-face activities. The communication by email of the *estudiantado with the teachers will have to do employing only the institutional post (@students.*uvigo.*gal). Likewise, this post is the one who has to appear in the platform of *teledocencia MOOVI.

Once established the groups of practices will not be able to change of group except cause justified and after presenting the Proof of incompatibility. They do not admit changes by "trips programmed", or attending to the generic formula "personal reasons" or others that are not collected in the *REGULAMENTO ON To *AVALIACIÓN, To QUALIFICATION And To *CALIDADE GIVES TEACHING And *DO PROCESS OF *APRENDIZAXE *DO *ESTUDANTADO (Approved no *clastro, 18 April 2023).

The date, hour and place of realisation of the proofs of evaluation are the official and published in the official web of the Faculty of Sciences of the Sea: <http://mar.uvigo.es/index.php/es/alumnado/examenes/>.

Sources of information

Basic Bibliography

Wicander and Monroe, **Geology, Earth in Perspective**, Australia : Cengage, 2021

Gary Nichols, **Sedimentology and Stratigraphy**, Wiley-Blackwell, 2009

Joseph Holden, **An Introduction to Physical Geography and the Environment**, Pearson, 2008

Tarback, E.J., Lutgens, F. K., **Ciencias de la Tierra. Una introducción a la Geología Física**, Pearson, 2022

Monroe, J. S., Wicander, R., Pozo, M., **Geología. Dinámica y evolución de la Tierra**, Paraninfo, 2008

Pozo et al., **Geología Práctica**, Pearson,

Complementary Bibliography

Recommendations

Subjects that continue the syllabus

Coastal and marine sedimentary habitats/V10G061V01207

Subjects that it is recommended to have taken before

IDENTIFYING DATA				
Mathematics: Mathematics II				
Subject	Mathematics: Mathematics II			
Code	V10G061V01109			
Study programme	Grado en Ciencias del Mar			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Basic education	1st	2nd
Teaching language	#EnglishFriendly Spanish Galician			
Department				
Coordinator	Hervés Estévez, Javier			
Lecturers	Hervés Estévez, Javier Yousfi Khoumsi, Mouhcine			
E-mail	javihermes@uvigo.es			
Web	http://moovi.uvigo.gal			
General description	Basic course of line and surface integrals and differential equations. 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				
A5	Students have developed those learning skills that are necessary for them to continue to undertake further study with a high degree of autonomy			
C1	know at a general level the fundamental principles of sciences: Mathematics, Physics, Chemistry, Biology and Geology.			
C2	Acquire basic knowledge of mathematics (differential and integral calculation) and statistics.			
D2	Acquire the ability to learn autonomously, continuously and collaboratively, organizing and planning tasks over time.			

Expected results from this subject				
Expected results from this subject		Training and Learning Results		
□ Understand the concepts of curl and divergence of a vector field. Understand the importance of line and surface integrals and how to use them in the study of the potential energy and other physical questions.		A5	C1 C2	D2
□ Formulate and solve first and second order differential equations.		A5	C1	D2
□ Use a computer program to solve problems related to integral calculus and differential equations.		A5	C1 C2	D2

Contents	
Topic	
Line integrals. Conservative fields.	Regular curves. Integral along a curve. Work done by a field. Conservative fields. Curl. Divergence.
Double integration. Surfaces.	Integration in rectangles. Integration in general areas. Change of variable. Polar coordinates. Green's Theorem. Parametric and regular surfaces. Orientation of a surface.
Surface integrals. Triple integration.	Flow rate. Stoke's theorem. Triple integrals. Spherical and cylindrical coordinates. Gauss' Theorem.
First order differential equations.	Solution of a differential equation. Separable equations. Exact equations. Linear equations.
Higher order linear differential equations.	N-order linear equations. Solutions. Second-Order Equations with Constant Coefficients. General solution to a homogeneous equation. Particular solution to a complete equation.
Laboratory topics	Integration and differential equations problem solving using computer software.

Planning			
	Class hours	Hours outside the classroom	Total hours
Lecturing	26	26	52
Seminars	18	18	36
Practices through ICT	4	2	6
Autonomous problem solving	0	10	10

Collaborative Learning	4	0	4
Essay questions exam	4	14	18
Problem and/or exercise solving	2	6	8
Problem and/or exercise solving	2	6	8
Problem and/or exercise solving	2	6	8

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

Methodologies	
	Description
Lecturing	Explanation of the theoretical basis and resolution of exercises and basic examples.
Seminars	Activities focused to individual work or in group to solve problems in order to expand and deepen the contents. They are used as a complement to the theoretical lectures.
Practices through ICT	Learning a computer program for calculation and graphic representation.
Autonomous problem solving	Students must solve problems using the methodology and information available and be able to interpret the results.
Collaborative Learning	Specific teamwork activities..

Personalized assistance

Methodologies	Description
Seminars	Students will ask the professor about clarifications for a better understanding of the subject and successfully carry out the proposed tasks.
Practices through ICT	Students will ask the professor about clarifications for a better understanding of the subject and successfully carry out the proposed tasks.
Collaborative Learning	Students may attend office hours to ask for extra help or seek clarification of the material presented in class. It is necessary to contact the teacher in advance by e-mail to schedule an appointment.

Assessment

	Description	Qualification	Training and Learning Results		
Practices through ICT	Students are required to solve some exercises with the software used in the laboratory sessions.	15	A5	C2	D2
Essay questions exam	At the end of the course there will be a final test with multiple choice questions, short answer questions and/or problems.	40	A5	C1 C2	D2
Problem and/or exercise solving	Oral presentation or written assignment in which the student must solve a series of problems under the conditions and time set by the teacher.	15	A5	C1 C2	D2
Problem and/or exercise solving	Oral presentation or written assignment in which the student must solve a series of problems under the conditions and time set by the teacher.	15	A5	C1 C2	D2
Problem and/or exercise solving	Oral presentation or written assignment in which the student must solve a series of problems under the conditions and time set by the teacher.	15	A5	C1 C2	D2

Other comments on the Evaluation

The date, time and location of the final test will be published on the official website of the Faculty of Marine Sciences: <http://mar.uvigo.es/alumnado/examenos/>

The assessment system will select the best grade between the following:

- the one obtained from the five previous items with their respective weights.
- the one obtained in the final exam with a weight of 100%.

For this reason, the students of this subject will not have to choose between continuous or global assessment since the system selects the most convenient for them.

Students who do not pass the subject in the ordinary call, and intend to do so in the extraordinary call, will maintain the grades obtained during the course.

The students of the extraordinary "fin de carrera" call will be evaluated with an exam that will count 100% of the grade. Students are required to take this course responsible and honest behavior. Any form of fraud (copying or plagiarism) aimed at falsifying the level of knowledge and skills achieved in all types of evidence, reports or work is considered inadmissible. Fraudulent conduct may mean failing the subject for a full course.

Sources of information

Basic Bibliography

Besada, M.; García Cutrín, J.; Mirás Calvo, M.A.; Quinteiro, C.; Vázquez, C., **Mareáticas. Contidos matemáticos para os estudos universitarios de ciencias**, 978-84-1188-007-7, Servizo de publicacións da Universidade de Vigo, 2024

Besada, M.; García Cutrín, J.; Mirás, M.; Quinteiro, C.; Vázquez, C., **Matlab: todo un mundo**, Servizo de publicacións da Universidade de Vigo, 2007

Larson, R.; Edwards, B., **Cálculo. Vol 1 e 2.**, 9ª, McGraw-Hill, 2010

Adams, R., **Cálculo**, 6ª, Pearson, 2009

Complementary Bibliography

Thomas, George B. Jr., **Cálculo, varias variables**, 12ª, Pearson, 2010

Campbel, S.; Haberman, R., **Introducción a las ecuaciones diferenciales**, McGraw-Hill, 1998

Bradley, G.; Smith, K., **Cálculo de varias variables (Volume 2)**, Prentice Hall, 1998

Recommendations

Subjects that it is recommended to have taken before

Mathematics: Mathematics I/V10G061V01104

Other comments

It recommends to had studied the subject of Mathematical II of the second course of high school.

IDENTIFYING DATA				
Chemistry: Chemistry 2				
Subject	Chemistry: Chemistry 2			
Code	V10G061V01110			
Study programme	Grado en Ciencias del Mar			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Basic education	1st	2nd
Teaching language	#EnglishFriendly Spanish			
Department				
Coordinator	Prieto Jiménez, Inmaculada Vázquez González, Margarita			
Lecturers	Álvarez Leirós, Carla Blanco Formoso, María Hervés Pardavila, Adrián Pérez Olivares, Cristina Prieto Jiménez, Inmaculada Rodríguez da Silva, Sara Vázquez González, Margarita			
E-mail	margarita.vazquez@uvigo.es iprieto@uvigo.es			
Web	http://moovi.uvigo.gal			
General description	The subject "Chemistry II" corresponds to first year of Chemistry in the Degree of Marine Sciences at the University of Vigo. It aims to introduce students to the thermodynamic vision of Chemistry. For this, a review of principles will be carried out with the rigorous definition and meaning of the state functions, such as those of Gibbs and Helmholtz, in addition to the chemical potential. From them it will be defined the equilibrium conditions and apply them to the study of phases and chemical processes. It will be also consider the study of ideal and real solutions and colligative properties. The teaching is divided into three parts. The first will present the theoretical part of the subject and some examples or theoretical applications of it. The second will consist of seminars for the resolution of exercises stimulating the participation/performance on the part of the students. The third part corresponds to the laboratory practices, where real applications (experimental sessions) of what has been studied in the other two parts will be dealt with and that will help the students assimilate the dynamics of work in a Chemistry laboratory. Subject of the English Friendly program: International students may request from the faculty: a) materials and bibliographical references to follow the subject in English, b) attend tutorials in English, c) tests and assessments in English.			

Training and Learning Results				
Code				
A1	Students have demonstrated knowledge and understanding in a field of study that builds upon their general secondary education, and is typically at a level that, whilst supported by advanced textbooks, includes some aspects that will be informed by knowledge of the forefront of their field of study			
A5	Students have developed those learning skills that are necessary for them to continue to undertake further study with a high degree of autonomy			
B4	Manage, process and interpret the data and information obtained both in the field and in the laboratory.			
C6	Acquire the fundamentals and terminology of chemical processes.			
D1	Develop the search, analysis and synthesis of information skills oriented to the identification and resolution of problems.			
D2	Acquire the ability to learn autonomously, continuously and collaboratively, organizing and planning tasks over time.			

Expected results from this subject				
Expected results from this subject	Training and Learning Results			
Knowledge and employment of basic concepts of thermodynamics. Knowledge of the processes of transfer of heat and the processes of mixture in marine means.	A1	B4	C6	D1 D2
Knowledge and understanding of the phase equilibrium and the phase changes.		B4		D1 D2
Knowledge of the model of ideal solutions and colligative properties. Apply the colligative properties to the water of the sea.	A5	B4	C6	D2

Knowledge of the properties of the real and electrolyte solutions. Knowledge and application of the concept of activity. Knowledge of the description of the sea water as an aqueous electrolyte solution and analysis of related properties.	A5	B4	C6	D1 D2
Application of the concept of chemical equilibrium to real and electrolyte solutions. Knowledge of the influence of the characteristics of sea water in chemical reactions in that medium.	A5	B4	C6	D1 D2

Contents

Topic	
1. Principles of thermodynamics	The internal energy and the first principle. Enthalpy. Heat capacities. Ideal gases and first principle. Entropy and second principle. Calculation of entropy differences. Entropy, reversibility and irreversibility.
2. Thermodynamic functions	Gibbs and Helmholtz functions. Gibbs equations. Calculation of changes in state functions. Partial molar magnitudes. Chemical potential.
3. Phase equilibrium in one-component system	Phase equilibrium conditions. The phase rule. Phase diagram of water. The equations of Clapeyron and Clausius-Clapeyron.
4. Thermodynamics of ideal solutions	Chemical potential of an ideal gas. Ideal solutions. Vapor pressure. Ideal diluted solutions. Colligative properties: their influence on sea water. Solubility of gases in liquids. Gases dissolved in seawater.
5. Thermodynamics of real solutions and electrolyte solutions	Deviations from Raoult's Law. Activity and activity coefficient. Determination of activities and activity coefficients. Chemical potential in electrolyte solutions and their activity coefficient. Debye-Hückel's theory. Thermodynamics of solvation of ions. Sea water as an electrolyte solution. Quantitative treatment of polyelectrolyte solutions.
Thermodynamics of chemical equilibrium	Chemical equilibrium and degree of progress of a reaction. Variation of the equilibrium constant with temperature. Chemical equilibrium in real solutions. Chemical equilibrium in electrolyte solutions. Effect of ionic strength on equilibrium.
Laboratory practices	Practices related to the following topics will be carried out: Heat. Heat capacity. Integral and differential heat. Solution and neutralization heat. Method of solubility: enthalpy. Calorimetric method. Enthalpy, heat, heat of reaction, thermal capacity. Chemical potential. Study of the liquid-vapor equilibrium of mixtures of two liquids. Enthalpy of vaporization. Phase diagram. Rule of the phases. Raoult's Law. Ebullioscopic increase. Activity. Coefficient of activity. Chemical equilibrium. Ionic strength and its effect on the equilibrium constant. Solubility product. Effect of ionic strength on solubility.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	20	25	45
Flipped Learning	3	7	10
Seminars	14	22	36
Laboratory practical	15	5	20
Essay questions exam	0	5	5
Essay questions exam	3	15	18
Problem and/or exercise solving	0	10	10
Self-assessment	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	Sessions will introduce the basic content, emphasizing the most important and challenging topics. Numerical problems could also be solved. Additionally, they will be able to complete assigned activities to review and delve deeper into the material covered. The necessary materials for these classes will be available on the Moovi platform.
Flipped Learning	Some learning activities will take place outside the classroom. These activities will be complemented by the teacher's presence to facilitate and enhance other processes of knowledge acquisition and practice. Prior to the class sessions, students will be provided with various materials through the virtual classroom to prepare for the class. Students will also be required to complete an application exercise using the concepts presented in the materials. Detailed information and deadlines for assignments will be communicated by the instructors in advance. During the class sessions, various activities will be conducted to review, clarify, and apply the concepts studied. Some of these tasks and activities may be graded.

Seminars	This activity is designed to address problems and/or exercises related to the subject. The necessary materials will be provided through the Moovi platform. Additionally, students will work on assigned problems and exercises, following guidelines established by the instructors, which may be graded.
Laboratory practical	Application of laboratory techniques to practical problems related to the subject matter. Laboratory manuals and procedures will be provided through the Moovi platform.

Personalized assistance

Methodologies	Description
Lecturing	Sessions in which professors solve the doubts and queries related to the subject, and with the activities carried out during the course. Students may attend personalized tutorials to resolve doubts. To optimize time, it is convenient to agree with professors on the date and time of the tutorial in advance.
Seminars	Ídem
Laboratory practical	Ídem
Flipped Learning	
Tests	Description
Essay questions exam	Ídem
Problem and/or exercise solving	Ídem

Assessment

	Description	Qualification	Training and Learning Results			
Laboratory practical	In this section could be valued: - The work carried out by the students in the laboratory. - The report on the laboratory experiments carried out by the students. - Test about the work developed. Completion of laboratory practices is mandatory to pass the subject, as well as achieving at least 50% of the maximum possible score for this activity.	15	B4	D2		
Essay questions exam	A written exam will be held to assess the level of theoretical knowledge and problem-solving skills. A score of 4.0 or higher out of 10.0 on this exam will allow to be exempt from the course. It will take place halfway through the semester. See "Other comments"	30	A1 A5	B4 C6	D1 D2	
Essay questions exam	Written test that will assess the level of theoretical knowledge and problem-solving skills. It will take place on the date set by the Faculty Board. See "Other comments on the evaluation"	30				
Problem and/or exercise solving	The resolution of problems and proposed exercises, in the classroom and/or on the Moovi platform, will be assessed according to the guidelines established by the teaching staff in the classes and seminars of the subject.	25	A1	C6	D1 D2	

Other comments on the Evaluation

The final grade for the course will be determined by the weighted sum of the grades obtained in each section of the assessment, provided the minimum passing grade is achieved in each section. To pass the course, a score of 5.0 or higher out of 10 is required in this assessment.

Completion of the laboratory sessions is mandatory to pass the course, as is achieving at least 50% of the maximum possible score for this activity. Students who only complete the laboratory sessions will receive a grade based on the percentage applied to this section. Students who took the course in the previous year may retain their grade for the laboratory sessions, provided they achieve the minimum passing grade for that section.

The grade for the written exams will be the average of the grades obtained in both the written and practical exams, provided a score of 4.0 or higher out of 10 is achieved. If the required score is not achieved, the grade recorded will be the average of the test scores, with no other sections being counted.

Student participation in any of the course's assessment activities will be considered "present" and will therefore result in a grade for the course. This will be based on attendance at practical sessions (two or more), submission of exercises assigned by the instructors (20%), and completion of at least one of the written tests.

If a student's final grade is higher than 7 points, it may be normalized so that the highest possible grade can reach a maximum of 10 points.

The participation of students in any of the evaluation activities of the subject will imply the status of "presentado" and, therefore, the assignment of a grade in the subject. Regarding this point, attendance at the laboratory sessions (two or more), realization of exercises proposed by the teaching staff (20%) and completion of one of the written tests will be taken into account.

Assessment in the extraordinary session (2nd opportunity)

The final grade in this examination session will be the weighted sum of the grades for each section of the assessment. To pass the course, students must obtain the minimum required grade in each section and achieve a final grade of 5.0 or higher out of 10.

In this examination session, the previous weighting percentages will apply, retaining the grades obtained in the practical exercises and in problem-solving and/or exercises. Students may recover the grade corresponding to the essay exams (60%) by taking a comprehensive exam. To pass the course, students must achieve a grade of 4.0 or higher out of 10 on this exam. If this score is not achieved, only the grade for the comprehensive exam will be recorded; the grades for the other sections will not be counted.

Global assessment

Students wishing to opt for the global assessment (GA) must apply within the timeframe and according to the procedure established by the Faculty. This information will be available to students before the start of the academic term.

To pass the course in this format, students opting for the GA must complete the laboratory sessions and achieve at least 50% of the maximum possible score for this activity (15% of the overall grade). If students took the course in the previous academic year, they may retain their grade for the laboratory sessions, provided they achieve the minimum required score.

In addition, these students will take a comprehensive exam covering all course content on the date set by the Faculty Board. In the comprehensive assessment format, this exam will constitute 85% of the course grade, both in the regular examination period and in the second attempt. In this case, to pass the course, a grade of 5 or higher out of 10.0 is required on this test. If this score is not achieved, only the grade for the overall test will be recorded; the other sections will not be counted.

Other considerations

Assessment procedures
The course instructors may establish rules regarding different aspects of the course assessments. This information will be communicated to students well in advance.

The assessment schedule can be found at: <http://mar.uvigo.es/alumnado/examenes/>

VERY IMPORTANT

Students taking this course are required to conduct themselves responsibly and honestly. Any form of fraud (i.e., copying and/or plagiarism) aimed at falsifying the level of knowledge or skill achieved by a student in any type of test, report, or assignment designed for this purpose is unacceptable. This fraudulent conduct will be punished with the firmness and rigor established by current regulations.

Sources of information

Basic Bibliography

P. W. Atkins, J. de Paula, **Química Física**, 8ª Ed., Médica Panamericana, 2008

I. N. Levine, **Fisicoquímica**, 5ª Ed., McGraw-Hill, 2004

I. N. Levine, **Problemas de Fisicoquímica**, 6ª Ed., McGraw-Hill, 2014

Complementary Bibliography

J. A. Rodríguez Renuncio, J. J. Ruiz Sánchez, J. S. Urieta Navarro, **Termodinámica Química**, Síntesis, 1999

J. A. Rodríguez Renuncio, J. J. Ruiz Sánchez, J. S. Urieta Navarro, **Problemas resueltos de termodinámica química**, Síntesis, 2000

J. Pellicer, J. A. Manzanares, **100 Problemas de Termodinámica**, Síntesis, 1996

P. A. Rock, **Termodinámica Química**, Vicens-Vives, 1989

K. J. Laidler, J. H. Meiser, B. C. Sanctuary, **Physical Chemistry**, 5th Ed., Houghton Mifflin, 2002

D. Eisenberg, D. Crothers, **Physical Chemistry with Applications to the Life Sciences**, Benjamin/Cummings Publishing Company, 1979

W. Stumm, J. J. Morgan, **Aquatic Chemistry (Chemical equilibria and rates in Natural Waters)**, 3rd Ed., John Wiley & Sons, 1995

Recommendations**Subjects that continue the syllabus**

Chemical oceanography I/V10G061V01204

Chemical oceanography II/V10G061V01209

Subjects that are recommended to be taken simultaneously

Mathematics: Mathematics II/V10G061V01109

Subjects that it is recommended to have taken before

Physics: Physics I/V10G061V01102

Chemistry: Chemistry I/V10G061V01105

Mathematics: Mathematics I/V10G061V01104

IDENTIFYING DATA				
Biochemistry				
Subject	Biochemistry			
Code	V10G061V01201			
Study programme	Grado en Ciencias del Mar			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	2nd	1st
Teaching language	#EnglishFriendly Spanish			
Department				
Coordinator	San Juan Serrano, María Fuencisla			
Lecturers	San Juan Serrano, María Fuencisla			
E-mail	fsanjuan@uvigo.es			
Web				
General description	Basic concepts on the structure and function of biomoléculas, integration and regulation of their metabolism and transmission and expression of the genetic information.			
	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	
A2	Students can apply their knowledge and understanding in a manner that indicates a professional approach to their work or vocation, and have competences typically demonstrated through devising and sustaining arguments and solving problems within their field of study
A3	Students have the ability to gather and interpret relevant data (usually within their field of study) to inform judgments that include reflection on relevant social, scientific or ethical issues
A4	Students can communicate information, ideas, problems and solutions to both specialist and non-specialist audiences
B1	Know and use vocabulary, concepts, principles and theories related to oceanography and apply everything learned in a professional and/or research environment.
B3	Recognize and implement good practices in measurement and experimentation, and work responsibly and safely both in field surveys and in the laboratory.
B4	Manage, process and interpret the data and information obtained both in the field and in the laboratory.
C9	Acquire basic knowledge about the structural and functional organization and the evolution of marine organisms.
C11	Apply the knowledge and techniques acquired to the characterization and sustainable use of living resources and marine ecosystems.
D1	Develop the search, analysis and synthesis of information skills oriented to the identification and resolution of problems.
D2	Acquire the ability to learn autonomously, continuously and collaboratively, organizing and planning tasks over time.

Expected results from this subject

Expected results from this subject	Training and Learning Results			
Acquisition of basic concepts about biomolecules structure, metabolic reactions, the main processes of obtaining and utilisation of energy and transmission and expression of the genetic information.		B1	C9	
		B3		
Approach of the biological phenomena in molecular terms, relating the structure of each biomolecules family with the biological function that exert	A2	B1	C9	
	A3			
Acquisition and appropriate utilisation of concepts and biochemical terminology	A4	B1	C9	
			C11	
Resolution of questions of quantitative biochemistry	A2			D1 D2
Familiarisation with use of basic instrumental and equipment of a biochemical laboratory	A2	B3		
Knowledge and application of simple techniques of separation and quantification of biomolecules	A2	B3		D1
		B4		
Development of scientific thinking style	A2	B1		D1 D2
	A3			
	A4			

Contents

Topic	
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Inorganic components from living organisms:	Importance of no covalent interactions. Role of the water in the biological processes. Interactions of the macromolecules in solution.
Nucleic acids	Composition of nucleosides and nucleotides. Deoxyribonucleic acid. Ribonucleic acids.
Amino acids and proteins:	Classification and properties of the amino acids. Peptidic bond Peptides and proteins: structure, function and classification.
Carbohydrates:	General characteristics and classification. Monosaccharides, oligosaccharides and polysaccharides. Structure, importance and function.
Lipids:	General characteristics and biological importance. Classification: fatty acids; simple lipids; complex lipids; isoprenoid lipids; eicosanoids.
Enzymes:	Concept, active site, and classification. Enzymatic catalysis. Kinetic enzymatic. allosteric Enzymes.
Introduction to Metabolism:	Metabolic pathways. Anabolism and catabolism. Energy from biological processes. Metabolism regulation.
Carbohydrate metabolism:	Digestion of polysaccharides. Glycolysis. Pyruvate fates. Fermentation processes. Pentose phosphate pathway. Gluconeogenesis. Glycogen metabolism. Regulation of carbohydrate metabolism.
Central pathways of intermediary metabolism	Krebs cycle. Electronic transport chain and oxidative phosphorylation. NADH shuttles.
Lipid metabolism:	Digestion and absorption of lipids. Beta oxidation of fatty acids. Ketone bodies. Biosynthesis of fatty acids.. Regulation of fatty acids metabolism. Biosynthesis of triacylglycerols and phospholipids. Membrane lipids, steroids, isoprenoids and eicosanoids.
Metabolism of nitrogenous compounds:	Proteolysis. Amino acid catabolism. Nitrogen excretion and urea cycle. Catabolism of carbon skeletons of amino acids. Amino acid biosynthesis. Regulation of amino acids metabolism. Nucleotide metabolism.
Transmission and expression of genetic information	DNA Replication. Information restructuring: restriction, repair and recombination. Information transfer: Transcription. Information decoding: Translation.
Practice: Enzymology	Preparation of enzyme extract. Measurement of enzyme activity. Kinetic characterisation.

Planning			
	Class hours	Hours outside the classroom	Total hours
Lecturing	41.5	74.7	116.2
Seminars	4	9	13
Laboratory practical	6	1.5	7.5
Objective questions exam	3	0	3
Problem and/or exercise solving	0	8.3	8.3
Report of practices, practicum and external practices	0	2	2
*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 professor will give fundamental notions needed to understand and prepare the contents of the matter.
Seminars	The seminars will be carry out collaborative way. Students will prepare some of the contents of program and some related subject of interest. The completion of the Seminars is mandatory to pass the subject.
Laboratory practical	The practices will familiarise students with some basic methods and techniques of extraction, separation and quantification of biomolecules, the measure of the enzyme activity and kinetical parameters. The completion of Laboratory practices is mandatory to pass the subject.

Personalized assistance

Methodologies	Description
Lecturing	Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation.
Seminars	Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation.
Laboratory practical	Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation.
Tests	Description
Objective questions exam	Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation.
Problem and/or exercise solving	Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation.

Assessment

	Description	Qualification	Training and Learning Results			
Seminars	In the realization of the seminars values the capacity to relate and apply the concepts purchased, to identify and understand problems, the appropriate utilization of the terminoloxía biochemical, his capacity to transmit the information. How transversal competitions value the initiative, the capacity of autonomous learning, the work in team, the capacity of organization, the critical capacity and the skill in the research of information and handle of the computer. Given its experimental nature, attendance is mandatory.	20	A2 A3 A4	B1 C9 C11	D1 D2	
Laboratory practical	To the finalizar the practices will realize an examination or will deliver a report to value the knowledge and handle of the technicians instrumentais used, the application of the theoretical knowledges to the practice, the capacity of analysis, procesamiento and interpretation of the results obtained. Given its experimental nature, attendance is mandatory.	20	A2 A3 A4	B1 B3 B4	C9 C11	D1 D2
Objective questions exam	Test: It asses, in a general way, the knowledge acquired of the course program Short answer: It asses the knowledge acquired, the ability to relate them and the proper use of concepts and biochemical terminology.	40	A2 A3 A4	B1 C9		
Problem and/or exercise solving	Finalized the theoretical exhibition of each subject or group of subjects related, the students will resolve individualment the problems or exercises proposed by the teacher, as well as the tests provided on the Moovi platform.	20	A2 A3 A4	B1 B4 C9 C11	D1 D2	

Other comments on the Evaluation

The student will have to complimantar a identification card in the platform MOOVI, attaching a recognizable photograph. This requirement is indispensable for the realization of the practices, seminars and different tests.

It is advised to the students use a e-mail adress of the University of Vigo to contact the professor by this way, identifying theirself (name and surnames, course and titulación) and indicating the subject.

It is advised the assistance to the professor lectures.

Resolution of problems and/or exercises: The average score of all problems/exercises must be equal or upper 5 (out of 10) to be taken into consideration in the final assessment.

Seminars: realization of the seminars is compulsory for passing the subject. The average score of seminars must be equal or upper 5 (out of 10) to be taken into consideration in the final assessment.

Laboratory Practices: realization of the practices and the exam and/or report of them is mandatory for passing the subject. The average score of the practices must be equal or upper 5 (out of 10) to be taken into account in the final evaluation.

The final exam will consist of a test of true/false questions and several questions or problems about all topics of the subject.

The average score of the final exam must be equal or upper 5 (out of 10) to passing the subject.

2nd Opportunity (July call): Students who do not pass the final exam and must attend to the 2nd opportunity call, will keep the score of the parts tests that they passed during the course.

Global assessment option: The application for this evaluation option must be submitted in the time and manner determined by the Center, which will be published prior to the academic start. Failure to carry out the mandatory probes (Seminars and Laboratory Practices), without justification, eliminates the options of **the global assesment and the 2nd opportunity to recover the content and the % corresponding to said activities.**

The update oficial calendar of the final exams can be found at: <http://mar.uvigo.es/alumnado/examenes/>

It is deemed inadmissible any form of fraud (i.e. copy and / or plagiarism) in any type of test or report designed to evaluate the level of knowledge or skill achieved by a student. Any fraud on the part of the student will result in failing the course; further fraud will lead to start disciplinary actions in front of the Rectorate

Sources of information

Basic Bibliography

Feduchi E., Blasco I., Romero C.S. y Yáñez E., **Bioquímica. Conceptos esenciales**, 4ª Ed, 2025

Nelson D.L. and Cox M.M., **Lehninger. Principios de Bioquímica**, 7ª Edición, 2019

Tymoczko J.L., Berg J.M. y Stryer L., **Bioquímica. Curso básico**, 2ª Edición, 2014

Voet D., Voet J.G. y Pratt C.W., **Fundamentos de Bioquímica. La vida a nivel molecular**, 4ª Edición, 2016

Complementary Bibliography

Blas Pastor J.R., **bqTest: 1000 preguntas tipo test de bioquímica para universitarios.**, 2013

Herrera E., **Bioquímica Básica. Base molecular de los procesos fisiológicos**, 1ª Ed, 2014

Mathews C.K., Van Holde, K.E., Appling D.R. y Anthony-Cahill S.J., **Bioquímica**, 4ª Edición, 2013

McKee T. y McKee J.R., **Bioquímica. La base molecular de la vida**, 7ª Edición, 2020

Salway J.G., **Una ojeada al metabolismo**, 2ª Edición, 2002

Stryer L., Berg J.M. y Tymoczko J.L., **Bioquímica.**, 7ª Edición, 2013

Recommendations

Subjects that continue the syllabus

Physiology of marine organisms/V10G061V01305

Subjects that it is recommended to have taken before

Biology: Biology I/V10G061V01101

Chemistry: Chemistry 2/V10G061V01110

Biology: Biology 2/V10G061V01106

Chemistry: Chemistry I/V10G061V01105

IDENTIFYING DATA				
Marine botany				
Subject	Marine botany			
Code	V10G061V01202			
Study programme	Grado en Ciencias del Mar			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	2nd	1st
Teaching language	#EnglishFriendly Spanish Galician English			
Department				
Coordinator	Sánchez Fernández, José María			
Lecturers	Navarro Echeverría, Luis Quintela Sabarís, Celestino Sánchez Fernández, José María			
E-mail	jmsbot@uvigo.es			
Web	http://https://mar.uvigo.es/			
General description	Study of the main marine plant groups, classification, life habits and interactions with other groups and the environment. 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	
A2	Students can apply their knowledge and understanding in a manner that indicates a professional approach to their work or vocation, and have competences typically demonstrated through devising and sustaining arguments and solving problems within their field of study
A3	Students have the ability to gather and interpret relevant data (usually within their field of study) to inform judgments that include reflection on relevant social, scientific or ethical issues
A4	Students can communicate information, ideas, problems and solutions to both specialist and non-specialist audiences
A5	Students have developed those learning skills that are necessary for them to continue to undertake further study with a high degree of autonomy
B1	Know and use vocabulary, concepts, principles and theories related to oceanography and apply everything learned in a professional and/or research environment.
B3	Recognize and implement good practices in measurement and experimentation, and work responsibly and safely both in field surveys and in the laboratory.
B5	Develop, implement and write basic or applied projects in oceanography from a multidisciplinary perspective.
C9	Acquire basic knowledge about the structural and functional organization and the evolution of marine organisms.
C10	Know the biological diversity and functioning of marine ecosystems.
C11	Apply the knowledge and techniques acquired to the characterization and sustainable use of living resources and marine ecosystems.
D1	Develop the search, analysis and synthesis of information skills oriented to the identification and resolution of problems.
D2	Acquire the ability to learn autonomously, continuously and collaboratively, organizing and planning tasks over time.
D3	Understanding the meaning and application of the gender perspective in different fields of knowledge and in professional practice with the aim of achieving a more just and equal society.
D5	Sustainability and environmental commitment. Equitable, responsible and efficient use of resources.

Expected results from this subject

Expected results from this subject	Training and Learning Results			
To know the origin and evolution of the marine plants and the features of the main groups	A2 A3 A4 A5	B1	C9 C10	D3 D5
To acquire the skills to collect, prepare, analyze, identify and preserve plant samples		B3		D1 D2
To acquire the capacity to deepen in the autonomous learning on the problems related to the Marine Botany, and to communicate that knowledge in an efficient way	A3 A4 A5	B5	C11	D1 D2 D3 D5

Contents	
Topic	
1. Introduction to Botany	1.1. Definition of Botany 1.2. Groups of plants 1.3. Relationship with the degree
2. Plant reproduction	2.1. Asexual reproduction 2.2. Sexual reproduction
3. Procariotic algae	3.1. Main feautres of Cyanophyta 3.2. Main features of Prochlorophyta
4. Introduction to the eukaryotic algae	4.1. Origin of the main lines of photosynthetic organisms 4.2. Glaucophyta
5. Unicellular algae; main features of the main groups	5.1. Euglenophyta 5.2. Cryptophyta 5.3. Haptophyta 5.4. Pyrrophyta
6. Phylum Ochrophyta (Heterokontophyta) I	Main features and groups
7. Phylum Ochrophyta (Heterokontophyta) II	7.1. Bacillariophyceae
8. Phylum Ochrophyta (Heterokontophyta) III	8.1. Class Phaeophyceae. Main features
9. Phylum Rhodophyta (red algae)	9.1. Bangiophyceae 9.2. Floridophyceae
10. Phylum Chlorophyta (green algae)	10.1. Prasinophyceae 10.4. Main features of Ulvophyceae
11. Introduction to the flowering plants	11.1. Main features and life cycle 11.2. Adaptations to the coastal environment
12. Coastal vegetation	12.1. Introduction to the study of algal and plant communities

Planning			
	Class hours	Hours outside the classroom	Total hours
Laboratory practical	9	9	18
Field practice	4	10	14
Seminars	3	0	3
Mentored work	2	23	25
Lecturing	25	25	50
Problem and/or exercise solving	2	10	12
Problem and/or exercise solving	2	0	2
Report of practices, practicum and external practices	1	5	6
Case studies	0	3	3
Essay	3	14	17

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

Methodologies	
	Description
Laboratory practical	Study and identification of the main groups of algae
	Attendance at this activity IS MANDATORY
Field practice	"In situ" study of the main algal communities and coastal vegetation of the Atlantic Coast of Galicia
	Attendance at this activity IS MANDATORY
Seminars	Guidelines for the elaboration of a scientific report. Approach to the phylogenetic analysis in marine plants.
Mentored work	Planification and elaboration of a bibliographic or experimental work by the students
Lecturing	Master class of each lesson of the theory program, supported on infographic materials

Personalized assistance	
Methodologies	Description
Lecturing	Students will be able to ask the questions they consider during each session,. Students can attend personalized tutorials to solve doubts, mainly at the times indicated for each lecturer.
Laboratory practical	Students will be able to ask the questions they consider during each session, both to the lecturer and collaboratively among themselves. Students can attend personalized tutorials to solve doubts, mainly at the times indicated for each lecturer.

Field practice	Students will be able to ask the questions they consider during each session, both to the lecturer and collaboratively among themselves. Students can attend personalized tutorials to solve doubts, mainly at the times indicated for each lecturer.
Seminars	Students will be able to ask the questions they consider during each session, to the lecturer during the explanation of the activity, and collaboratively among themselves while performing the task. Students can attend personalized tutorials to solve doubts, mainly at the times indicated for each lecturer.
Mentored work	Students can attend personalized tutorials to solve doubts, mainly at the times indicated for each lecture

Assessment						
	Description	Qualification	Training and Learning Results			
Problem and/or exercise solving	Exam relating to the theoretical part of the course	40	A2 A5	B1	C9 C10	
Problem and/or exercise solving	Three QUESTIONNAIRES (tests) related to the main blocks of the subject. The questionnaires do not "discount contents", are only an aid to the study. The grades obtained will only be considered in the First Opportunity; in the Second Opportunity the evaluation of the theoretical part will be exclusively through an Exam.	15	A2 A5	B1	C9 C10	
Report of practices, practicum and external practices	Evaluation of QUESTIONNAIRES or INDIVIDUAL or small-group REPORTS referring to the activities on the practical classes in the field and laboratory. Attitude and an active participation will be taken into account. In case of not passing this part in the First Opportunity, a practice exam must be taken in the Second Opportunity.	25	A5	B3	C11	D3
Case studies	Evaluation of the exercises carried out to address the case study proposed and developed in the Seminars. If necessary, recovery in the Second Chance will be carried out through a test Exam	5	A2 A3 A4	B5	C11	D1 D2
Essay	Preparation of a written report, and public presentation and defense of the supervised works. In case of not passing this part in the First Opportunity, a new report must be done and defended for the Second Opportunity.	15	A2 A3 A4 A5	B5	C11	D3 D5

Other comments on the Evaluation

FIRST OPPORTUNITY

The final grade will be the sum of the partial grades obtained in each of the proposed tests, but only if the grade of each one of them is greater than 40% of the maximum grade for that test. If that minimum is not reached, the final grade will be FAIL.

Students who do not attend the final Theory Exam or the practice test will be qualified as NOT PRESENTED.

Attendance at practical classes IS MANDATORY, and therefore that student who does not attend to all classes without a just cause cannot be evaluated in this part and will not be able to recover this part in the Second Opportunity.

SECOND OPPORTUNITY

In the Second Opportunity the results already approved in the First Opportunity will be preserved, except for the Theory questionnaires: since they do not 'discount contents' all the Theory content must be recovered together in the Exam, which increases its weight in the final grade up to 55%.

In the Second Opportunity, the practical grade can be recovered with a practice exam, with the same weight in the final grade (25%).

In the Second Opportunity, those students who do not reach half of the grade of the Collaborative Essay in the First Opportunity (0.7), must repeat the Work individually, with the same weight in the final grade (1.5).

In the Second Opportunity, the seminars grade (5%) can be recovered through an "Exam of objective questions" (test).

As in the First Opportunity, the final grade will be the sum of the partial grades obtained in each of the proposed tests, but only if the grade of each one of them is greater than 40% of the maximum grade for that test.

In case of not passing the course, the qualifications of the seminars and the supervised works may be kept from one course to the next, but only once.

Global assessment option

The application for this evaluation option must be submitted in the time and manner determined by the Center, which will be published prior to the academic start. Given the experimental nature of the practices, attendance at them is mandatory to be eligible for this evaluation option. The weight of practices will be the same as for the continuous assessment (25%), and the rest of the grade can be obtained with the final exam. In any case, at least half of the qualification must be obtained for each part (practice and theory) in order to pass the course. **Failure to attend the practices, with no justified cause invalidates this possibility, as well as the opportunity for extraordinary evaluation (2nd opportunity).**

It is required that the students in this course behave in a responsible and honest way.

It is deemed inadmissible any form of fraud (i.e. copy and / or plagiarism) in any type of test or report designed to evaluate the level of knowledge or skill achieved by a student. Any fraud on the part of the student will result in failing the course; further fraud will lead to start disciplinary actions in front of the Rectorate

Sources of information

Basic Bibliography

Izco, J. (Ed.), **Botánica**, 2, McGraw-Hill/Interamericana,
Graham, J.E., Wilcox, L.W., Graham, L.E., **Algae**, 2, Benjamin Cummings,
Lee, R.E., **Phycology**, 4, Cambridge University Press,

Complementary Bibliography

van den Hoek, C., **Algae**, 1, Cambridge University Press,
Dawes, C.J., **Marine Botany**, 2, Wiley,
Varios, **Articles from scientific journals and other academic sources**,

Recommendations

Subjects that continue the syllabus

Marine Ecology/V10G061V01206

Subjects that it is recommended to have taken before

Biology: Biology I/V10G061V01101
Biology: Biology 2/V10G061V01106

Other comments

This Guide will be detailed further in the MOOVI platform at the beginning of the course.

IDENTIFYING DATA				
Physics: Physics II				
Subject	Physics: Physics II			
Code	V10G061V01203			
Study programme	Grado en Ciencias del Mar			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Basic education	2nd	1st
Teaching language	#EnglishFriendly #PortuguêsAmigável Galician			
Department				
Coordinator	Lugo Latas, Luis			
Lecturers	Lugo Latas, Luis Sánchez Carnero, Noela Belén			
E-mail	luis.lugo@uvigo.gal			
Web	http://mar.uvigo.es/			
General description	Physics, as a science, deals with the description of matter and its interactions, developing theories in accordance with empirical knowledge. From this definition one can study nature from the smallest scales (subatomic) to the macroscopic scale, hence the different branches of Physics. Physics is the base of an uncountable number of scientific and technological applications, and in particular for the Sea Sciences student it's a basic tool to understand other theories and subjects in the following years of the grade. The knowledge and application of laws and principles studied in Physics allows the interpretation of the marine environment and the development of models related with it. Furthermore, it is important to understand the fundamental physics concepts to understand how the instruments work and to know how to use and control them.			
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	
A5	Students have developed those learning skills that are necessary for them to continue to undertake further study with a high degree of autonomy
B1	Know and use vocabulary, concepts, principles and theories related to oceanography and apply everything learned in a professional and/or research environment.
B3	Recognize and implement good practices in measurement and experimentation, and work responsibly and safely both in field surveys and in the laboratory.
C1	know at a general level the fundamental principles of sciences: Mathematics, Physics, Chemistry, Biology and Geology.
C4	Know, analyze and interpret the physical properties of the ocean according to current theories, as well as to know the most relevant sampling tools and techniques.
C5	Formulate the mass, energy and moment conservation equations for geophysical fluids and solve them in basic oceanic processes.
D1	Develop the search, analysis and synthesis of information skills oriented to the identification and resolution of problems.
D2	Acquire the ability to learn autonomously, continuously and collaboratively, organizing and planning tasks over time.

Expected results from this subject				
Expected results from this subject	Training and Learning Results			
1.- Know the fundamental principles of the Thermodynamic and know applied to realize global analyses of thermodynamic systems of interest in Sciences of the Sea. Comprise and know use the relations and *diagramas *termodinámicos that describe the different properties of the substances. Know the cycles *termodinámicos basic of thermal machine and *refrigeración and his main applications in Sciences of the Sea. Know collaborate in the work with other people of communicative and constructive form in the manufacture of experiments *termodinámicos.	A5	B1 B3	C1 C4 C5	D2
2.- Resolve problems of theory of fields and equations of the physical-mathematical chords with the paper of the fields in Sciences of the Sea. Argue the resolution of problems by means of it logical scientist and the scientific methodology.	A5	B1 B3	C1 C4 C5	D1 D2
3.- Understand the fundamental principles of fluid mechanics and be able to apply them to the analysis of physical processes occurring in the ocean. Solve basic problems in hydrostatics and fluid dynamics using the continuity, Bernoulli, and Navier-Stokes equations, identifying conservation mechanisms in fluid systems relevant to Marine Sciences. Justify the solution of problems through scientific reasoning and methodology, interpreting the results obtained and assessing their relevance in oceanographic contexts.	A2 A5	B1 B5	C3 C4 C5 C23	D1 D2

4.- Identify the parameters that characterize a wave. Resolve problems envelope to *propagación of waves and his incidence envelope the means. Know resolve the implications of *emisores or receiving of wave in movement. Know collaborate in the work with other people of communicative and constructive form in the manufacture of one experience of waves.	A5	B1 B3	C1 C4 C5	D1 D2
5.- Determine the physical parameters that define the behaviour of the subject in witnesses of electric fields *y magnetic. Identify the #phenomenon of *inducción electromagnetic. Identify the understanding of the *electromagnetismo through the *invarianza of the *ecuaciones of Maxwell. Identify the parameters that characterize an electromagnetic wave. Resolve problems envelope to *propagación and radiation of electromagnetic waves in distinct means. Distinguish the *particularidades behavioural of the electromagnetic fields. Identify differentiate and basic similarities between electromagnetic wave and acoustic wave/mechanics.	A5	B1 B3	C1 C4 C5	D1 D2
6.- Know and identify the physical properties more *relevantes in the water of the sea so much from a fundamental point of view how to realize oceanographic studios. Be able of *recabar and #analyze the necessary information to carry out *tareas where the physical behaviour of the water of the sea was *relevante.	A5	B1 B3	C1 C4 C5	D1 D2

Contents

Topic

1.- Thermodynamics	1.- Introduction. Extensive and intensive magnitudes. Definitions. 2.- Thermal balance and zeroth law of thermodynamics. 3.- Heat. capacity and specific heat. Phase change and latent heat. 4.- Thermal exchanges of energy: conduction, convection and radiation. 5.- First law. Internal energy. 6.- The ideal gase. 7.- Heat engine and refrigerator. 8.- Entropy.
2.- Elementary theory of fields	1.- Introduction and concept of field. Types of fields 2.- Gradient of a scalar field. 3.- Circulation of a vector field. 4.- Flow and divergence of a vector field. Gauss' theorem. Solenoidal fields. 5.- Curl of a vector field. Stokes' theorem. Conservative fields.
3.- Basic principles of fluid mechanics	1.- Fluid characterization. Pressure and density. 2.- Fluid statics. Archimedes' principle. 3.- The continuity equation. Bernoulli's equation. 4.- The viscous fluid. 5.- Navier-Stokes' equation. 6.- Energy equation.
4.- Waves	1.- Types of wave. Wave interference. Diffraction, reflection and refraction of waves. 2.- Wave phenomena. 3.- Doppler effect. 4.- Introduction to ocean waves.
5.- Basics of electromagnetism.	1.- Electric charge. Electric field. Magnetic field. Maxwell's laws. 2.- Electromagnetic waves 3.- The spectrum of electromagnetic radiation 4.- Interaction with matter. 5.- The black body radiation. Stefan-Boltzmann's law.
6.- Basic properties of the sea water.	1. Mechanical properties: density, viscosity, surface tension and compressibility. 2. Thermal properties: changes of phase, specific and latent heats, thermal conductivity and thermal dilatation. 3. Electromagnetic properties: conductivity and refraction index.

Planning

	Class hours	Hours outside the classroom	Total hours
Laboratory practical	15	15	30
Seminars	7	0	7
Lecturing	30	13	43
Problem and/or exercise solving	0	30	30
Report of practices, practicum and external practices	0	15	15
Portfolio / dossier	0	25	25

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

Methodologies	
Methodologies	Description
Laboratory practical	Realización de diversas prácticas de laboratorio en las que el alumnado adquirirá los conocimientos básicos del procedimiento experimental en física, así como el cálculo de incertidumbres en las variables físicas determinadas. La asistencia a las prácticas de laboratorio y la entrega, en tiempo y forma, de la memoria correspondiente es obligatoria para superar la materia en el año en curso.
Seminars	Resolución de diversos ejercicios y problemas relacionados con lo analizado en las sesiones magistrales y que presenten más dudas o que sean de mayor dificultad. Organización del trabajo realizado en el e-portfolio. Se propondrán boletines de problemas que el alumno debe resolver por sí mismo.
Lecturing	Exposición y explicación de los diversos conceptos físicos y de las distintas leyes con las que se relacionan, mostrando la manera de alcanzar los objetivos y haciendo hincapié en aquellos aspectos que resulten más problemáticos y dificultosos y resolviendo distintos ejemplos/problemas. Se propondrán distintas referencias bibliográficas.

Personalized assistance

Methodologies	Description
Seminars	Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables to be indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation.
Laboratory practical	Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables to be indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation.
Lecturing	Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables to be indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation.

Assessment

Description		Qualification Training and Learning Results		
Problem and/or exercise solving	It will evaluate the assimilation of knowledges of the students with a test based on problems related with the subject. The exam will be developed according to the official calendar: http://mar.uvigo.es/index.php/en/alumnado-actual-2/examenes-3	40	A5	C1 D1 C4 D2 C5
Report of practices, practicum and external practices	It will qualify the realization of the laboratory experimets and the report in groups of two students. It must be remembered that the attendance at laboratory practices and the corresponding report, in due time and form, is mandatory to approve the matter.	25	A5	B1 C1 D2 B3 C4
Portfolio / dossier	Developing and presentation of a "porfolio" based on the subject in groups of two students.	35	A5	B1 C1 D1 B3 C4 D2

Other comments on the Evaluation

Date, time and place of exams will be published in the official web of Marien Sciencies Faculty:
<http://mar.uvigo.es/alumnado/examenes/>

In the evaluation of the second call, it will be possible to recover the individual written test corresponding to the resolution of problems and/or exercises that will have a weight of 40%, while the "joint" note derived from the rest of the methodologies obtained in the first call will be maintains.

Global assessment option: The application for this evaluation option must be submitted in the time and manner determined by the Center, which will be published prior to the academic year start. Given the experimental nature of the practices, attendance at them is mandatory to be eligible for this evaluation option. Failure to attend the practices, with no justified cause invalidates this possibility, as well as the opportunity for extraordinary evaluation (2nd opportunity). The global evaluation will be carried out through a single exam (75%) on all the contents of the subject. Likewise, the student will have to create and carry out a practice in the physics laboratory (25%) to determine a physical property, analysed in the matter, of a given material.

Students are strongly requested to fulfil a honest and responsible behaviour. It is considered completely unacceptable any alteration or fraud (i.e., copy or plagiarism) contributing to modify the level of knowledge and abilities acquired in exams, evaluations, reports or any kind of teacher's proposed work. Fraudulent behaviour may cause failing the course for a whole academic year. An internal dossier of these activities will be built and, when reoffending, the university rectorate will be

asked to open a disciplinary record.

Sources of information

Basic Bibliography

Young, Freedman, **Física Universitaria**, Pearson, 14ª ed., (2 vols.), 2018

R. A. Serway y J.W. Jewett, **Física para Ciencias e Ingeniería**, Thomson, 10ªEd., 2019

Complementary Bibliography

P.A. Tipler y G. Mosca, **Física para la Ciencia y la Tecnología**, Reverté, 6ª ed., (2 vols.), 2010

Jou, Llebot, Perez, **Física para ciencias de la vida**, McGraw-Hill, 2ª ed., 2008

R.A. Varela y G. Rosón, **Métodos en Oceanografía Física**, Edit. Anthias, 2008

W.E. Gettys, F.J. Keller y M.J. Skove, **Física clásica y moderna**, McGraw-Hill, 1992

A. H. Cromer, **Física para las ciencias de la vida**, Editorial Reverté, 2ª Ed., Barcelona, 2009

Recommendations

Subjects that it is recommended to have taken before

Physics: Physics I/V10G061V01102

Other comments

The continued use of tutorials is recommended to solve any doubt about the subject, and also to help solve the problems.

IDENTIFYING DATA				
Chemical oceanography I				
Subject	Chemical oceanography I			
Code	V10G061V01204			
Study programme	Grado en Ciencias del Mar			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	2nd	1st
Teaching language	#EnglishFriendly Spanish Galician			
Department				
Coordinator	Sousa Castillo, Ana			
Lecturers	Blanco Formoso, María Sousa Castillo, Ana			
E-mail	ana.sousa@uvigo.es			
Web	http://https://mar.uvigo.es/			
General description	The subject "Chemical Oceanography I" aims to explain processes that take place in the marine environment, from the point of view of physical chemistry. With this objective, the behavior of systems in different media and interfaces will be studied.			
	English Friendly subject: International students may request from the teachers: a) materials and bibliographic references in English, b) tutoring sessions in English, c) exams and assessments in English.			

Training and Learning Results

Code	
A2	Students can apply their knowledge and understanding in a manner that indicates a professional approach to their work or vocation, and have competences typically demonstrated through devising and sustaining arguments and solving problems within their field of study
A4	Students can communicate information, ideas, problems and solutions to both specialist and non-specialist audiences
A5	Students have developed those learning skills that are necessary for them to continue to undertake further study with a high degree of autonomy
B1	Know and use vocabulary, concepts, principles and theories related to oceanography and apply everything learned in a professional and/or research environment.
B3	Recognize and implement good practices in measurement and experimentation, and work responsibly and safely both in field surveys and in the laboratory.
B4	Manage, process and interpret the data and information obtained both in the field and in the laboratory.
C6	Acquire the fundamentals and terminology of chemical processes.
C7	Apply to the marine and coastal environment the principles and methods used in Chemistry.
D1	Develop the search, analysis and synthesis of information skills oriented to the identification and resolution of problems.
D2	Acquire the ability to learn autonomously, continuously and collaboratively, organizing and planning tasks over time.

Expected results from this subject

Expected results from this subject	Training and Learning Results			
Describe the composition and behavior of materials present in seawater.	A2 A4 A5	B1	C6 C7	D1 D2
Explain the main properties of water, electrolyte solutions and seawater from a physicochemical point of view.	A2 A4 A5	B1 B4	C6 C7	D1 D2
Recognize and interpret the transport phenomena of solutes.	A2 A5	B1 B4	C6 C7	D1 D2
Distinguish the types of estuaries based on water circulation and identify their characteristics.	A2 A5	B1	C6 C7	D1 D2
Use quantitative models to study the water circulation and calculate residence times in estuaries.	A2 A5	B1 B4	C6 C7	D1 D2
Explain the characteristics of the air-sea interface, the processes that take place and the factors that control them.	A2 A4 A5	B1	C6 C7	D1 D2
Describe the gas solubility in the seawater and apply the models to estimate gas exchange across the air-sea interface.	A2 A4 A5	B1 B4	C6 C7	D1 D2

Explain the characteristics of the seawater-solid interface, the processes that occur in it and identify the factors that determine them.	A2 A4 A5	B1 B3 B4	C6 C7	D1 D2
Interpret the properties and behavior of particulate matter and colloids present in seawater.	A2 A5	B1 B3 B4	C6 C7	D1 D2
Use appropriate experimental techniques to study the adsorption processes and apply the models at the solid-solution interface.	A2 A5	B1 B3 B4	C7	D1 D2
Explain the characteristics and composition of interstitial waters.	A2 A4 A5	B1	C6 C7	D1 D2

Contents

Topic

1. Composition and physicochemical properties of seawater.	Introduction. - Ion-solvent interactions. - Ion-ion interactions. - Physicochemical properties of seawater. - Salinity.
2. Transport phenomena.	- Non-ionic transport phenomena: Heat conductivity, viscosity and diffusion. - Advection-diffusion equation. - Electrical conductivity.
3. Mixing processes in coastal systems.	- Introduction. - Estuaries: Classification and types. Description. - Mixing processes in estuaries: Models. Quantitative models.
4. Liquid-gas interface.	- Interfacial thermodynamics: Surfaces and interfaces. Surface tension. Superficial excess. - Gas solubility in seawater. - Models for estimating gas exchange at the gas-liquid interface. - Nonconservative gases. - Oxygen in seawater. - Alkalinity of natural waters.
5. Solid-liquid interface	- Introduction. - Double layer. Models. - Adsorption at the solid-liquid interface: Physisorption and chemisorption. Adsorption isotherms. - Behavior of particulate and colloidal material in sea water. - Diagenesis and interstitial waters.
Laboratory experiment 1	Determination of physicochemical properties of water in the Vigo Estuary
Laboratory experiment 2	Determination of the surface tension of organic compounds and influence of related factors.
Laboratory experiment 3	Study of adsorption from solution at the solid-liquid interface.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	23	35	58
Problem solving	14	32	46
Laboratory practical	15	10	25
Essay questions exam	3	18	21

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

Methodologies

	Description
Lecturing	Classes in which the faculty gives a global vision of the contents of the subject, focusing in a special way on the most relevant aspects and that are more difficult to understand for the students. The material will be placed in Moovi.
Problem solving	Activity where it is exposed some aspects related to the development of the topics covered in the subject, also solving problems, exercises and / or issues. In addition, the students must work on proposed exercises and issues, according to the guidelines established by the professor in the classes or seminars of the subject.

Laboratory practical	The students will perform different experiments in the laboratory over several sessions. In order to be able to have previous knowledge of the practices to be carried out, students will have the corresponding material in Moovi. After each practical lesson, students must do a questionnaire. Once it is finished, students will have to answer some questions related to the work developed.
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Personalized assistance

Methodologies	Description
Lecturing	Sessions in which the faculty will resolve the questions and queries of the students related to the study and / or subjects related to the subject and the activities developed during the course. Students may attend personalized tutorials to resolve doubts. It must agree in advance date and time of the tutoring.
Laboratory practical	Idem
Problem solving	Idem
Tests	Description
Essay questions exam	Idem

Assessment

	Description	Qualification	Training and Learning Results			
Problem solving	After completing the problems, exercises, and questions proposed for each topic, in accordance with the guidelines established by the professor during the classes and seminars, a small evaluative test will be conducted. The final grade will be the average of these tests.	20	A2 A4 A5	B1 B4	C6	D1 D2
	Attendance at the seminars is mandatory. In this section there is not minimum mark.					
Laboratory practical	This section will be graded as follows: Part 1: - The work completed by students in the lab. - The questionnaire completed by students at the end of the lab sessions. Part 2: - A test with questions related to the work completed during the lab sessions. This test will be conducted during the final exam. Attendance at the lab sessions is mandatory. To pass the module, students must earn at least 50% of the maximum possible score on each part (Parts 1 and 2) of this activity.	20	A2 A4 A5	B3 B4	C7	D1 D2
Essay questions exam	Written tests to evaluate skills acquired throughout the course. It will be valued: - A midterm exam, no eliminatory (20%) - The final exam (40%) The qualification will be the weighted addition of the marks for the two exams. To apply the weighted average, the student must obtain at least 3.5 out of 10 points.	60	A2 A4 A5	B1 B4	C6	D1 D2

Other comments on the Evaluation

Student participation in any of the assessment activities for this course will result in the assignment of a final grade. Attendance at practical sessions and seminars is mandatory. Unjustified absence from any of these sessions will result in those parts of the course not being assessed.

The weighted addition of the marks for all the sections, provided that the required minima are reached. If the exam score is lower than required minimum, the final grade will be the one obtained for "Question exam" (60%).

The final grade, if higher than 7 points, can be standardized so that the highest mark can reach a value of up to 10 points.

In July

In the call for the subject in July, the evaluation will be similar, maintaining the marks obtained by the students through the problems and/or issues solving during the course and the laboratory experiments.

The exams section can be repeated in July. It will be carried out a global test in which the competences acquired will be evaluated. The student must achieve a minimum mark of 3.5 points out of 10 so that the result of this test will be taken into account in the global mark of the subject. This result will substitute the marks obtained for the tests carried out during the semester.

The final grade of the subject will be the weighted addition of the marks for all the sections, as long as the required minima are reached. If this is not the case, the final mark for the subject will be the one obtained for global test multiplied by 0.6.

In case that the mark in July was lower than the one obtained in the end of semester evaluation, the official mark will be this last one.

If the student does not pass the course, the mark obtained in the laboratory practices will be retained for future enrollments.

Global assessment option

The application for this evaluation option must be submitted in the time and manner determined by the Center, which will be published prior to the academic start. Given the experimental nature of the practices and seminars, attendance at them is mandatory to be eligible for this evaluation option. **Failure to attend the practices, with no justified cause invalidates this possibility, as well as the opportunity for extraordinary evaluation (2nd opportunity).**

Date, time and place of exams will be published in the official web of Marine Sciences Faculty:

<http://mar.uvigo.es/alumnado/examenes/>

Finally, students are strongly requested to fulfil a honest and responsible behaviour. It is considered completely unacceptable any alteration or fraud (i.e., copy or plagiarism) contributing to modify the level of knowledge and abilities acquired in exams, evaluations, reports or any kind of teacher's proposed work. Fraudulent behaviour may cause failing the course for a whole academic year. An internal dossier of these activities will be built and, when reoffending, the university rectorate will be asked to open a disciplinary record.

Sources of information

Basic Bibliography

P.W. ATKINS, "**Química Física**", 8ª Ed., Editorial Médica Panamericana, 2008

S. M. LIBES, "**Introduction to Marine Biogeochemistry**", 2ª Ed., Academic Press, 2009

Complementary Bibliography

I.N. LEVINE, "**Principios de Fisicoquímica**", 6ª Ed., Mc Graw Hill Interamericana, 2014

F. J. MILLERO, M. L. SOHN, "**Chemical Oceanography**", 4ª Ed., CRC Press, 2013

J. P. RILEY, R. CHESTER, "**Chemical Oceanography**", Academic Press, 1989

Recommendations

Subjects that continue the syllabus

Chemical oceanography II/V10G061V01209

Subjects that it is recommended to have taken before

Chemistry: Chemistry 2/V10G061V01110

Chemistry: Chemistry I/V10G061V01105

IDENTIFYING DATA				
Sedimentology				
Subject	Sedimentology			
Code	V10G061V01205			
Study programme	Grado en Ciencias del Mar			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	2nd	1st
Teaching language	#EnglishFriendly Spanish Galician English			
Department				
Coordinator	Rey García, Daniel Marino , Gianluca			
Lecturers	Marino , Gianluca Nombela Castaño, Miguel Angel Rey García, Daniel Rubio Armesto, María Belén			
E-mail	gianluca.marino@uvigo.es danirey@uvigo.es			
Web	http://193.146.32.240/tema1112/claroline/course/index.php			
General description	Sedimentology is a building block of Marine Geology. Studying this subject is essential to: (i) achieve a comprehensive understanding of how the marine (sedimentary) basins operate and evolve through time; and (ii) unravel the complex interactions between the sediments and the climatic and/or tectonic processes that contribute to shape the Earth's surface. Sedimentology pertains to the study of the marine sediments and of the processes that govern their formation, such as erosion, transport, deposition, and diagenesis.			
The course contributes essential insights into the methods and analytical technics that are most commonly used in the study and recognition of the different types of sediments and sedimentary rocks. These are key for the analysis of the sedimentary facies and sequences, for their paleoenvironmental interpretation (e.g., palaeoclimatology, palaeoceanography), and for deciphering the sedimentary record and help the prospection and exploration of natural resources (e.g., petroleum, ore deposits).				
The course also sheds light on the importance of the marine sediments and on their relationship with the physical, chemical, biological, and hydrodynamic processes that shape the Earth's surface and control the dynamics of the ocean basins on a range of timescales. It is therefore essential to identify those processes that arise from anthropogenic activity versus those that exclusively reflect natural processes.				
Through the knowledge of the sedimentary record, the sedimentology course contributes critical knowledge of the past processes, ongoing evolution, and expected future trends of the marine environment due to changes in the natural and/or anthropogenic forcing. This is central to the understanding and management of the environment that surrounds us, such as the marine and coastal environments that are targeted by the courses of the following semester, as well as the Geological Oceanography I and II of the following year. This basic knowledge will be then expanded and applied in the optative course 'Basin Analysis' that students can choose in the following year.				
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	
A5	Students have developed those learning skills that are necessary for them to continue to undertake further study with a high degree of autonomy
B1	Know and use vocabulary, concepts, principles and theories related to oceanography and apply everything learned in a professional and/or research environment.
B2	Plan and execute surveys in the field and laboratory work, applying basic tools and techniques for sampling, data acquisition and analysis in the water column, sea bottom and marine substratum.
B3	Recognize and implement good practices in measurement and experimentation, and work responsibly and safely both in field surveys and in the laboratory.
B4	Manage, process and interpret the data and information obtained both in the field and in the laboratory.
C1	know at a general level the fundamental principles of sciences: Mathematics, Physics, Chemistry, Biology and Geology.
C12	Acquire knowledge about processes and products related to internal and external geological cycles.
C13	Acquire the basic sedimentological, geochemical and geophysical techniques and methodologies used in identification, use and sustainability of the natural resources of coastal and marine environments.
C14	Know basic concepts and events of global change obtained from geological records.

- D1 Develop the search, analysis and synthesis of information skills oriented to the identification and resolution of problems.
- D2 Acquire the ability to learn autonomously, continuously and collaboratively, organizing and planning tasks over time.

Expected results from this subject

Expected results from this subject	Training and Learning Results			
Recognise and identify the processes of physical and chemical weathering and their connection with sediment composition;	A5		C1 C12 C13	
2. Develop a basic knowledge of principles in sediment dynamics and master the concepts of erosion, transport, and deposition of (mostly siliciclastic) sediments;	A5		C1 C12 C13	
3. Characterise sediment's texture and mineralogy;	A5		C1 C13	
4. Recognise and identify the most common sedimentary structures in (mostly) siliciclastic settings;	A5		C13	
5. Identify the relationship(s) between sedimentary structures and depositional processes;	A5		C12 C13	
6. Comprehend the relationship between chemical weathering and seawater chemistry and characterise the exchange of (geo)chemical properties between the land, the ocean, and sediments on the seafloor;	A5	B1	C1 C12 C13	
7. Understand carbonate minerals, the basic chemistry of the carbonate system, and the carbonate factory;	A5	B1	C1 C12 C13	
8. Identify post-depositional alterations, i.e., the diagenesis of (e.g., siliciclastic, carbonate) sediments and understand the tools available to decipher diagenetic processes;	A5		C1 C12 C13	
9. Recognise and identify the different types of sediments;	A5		C12 C13	D1
10. Interpret the sedimentological data and understand the difference between how siliciclastic sediments and carbonate sediments are formed;	A5		C1 C12 C13	D1
11. Develop an understanding of the factors that control sedimentation in the marine environment;	A5	B1	C1 C12 C13	D1
12. Comprehend the concepts of facies, depositional environment, and sedimentary sequence;	A5		C1 C12 C13	D1
13. Use the sedimentological analysis to decipher the dynamics and evolutive trends of the sedimentary environment(s);	A5		C1 C12 C13 C14	D1
14. Become skilled in applying the analytical and investigative methods to perform sedimentological work in the marine environment;	A5	B2 B3 B4	C13	D1 D2
15. Apply the knowledge developed during the course to address (sedimentological) problems in the marine environment.		B4	C13	D1 D2

Contents

Topic	
Topic 0. Presentation of the subject	0.1. Aims of the course; 0.2. List of lectures and topics addressed by the course; 0.3. List of Laboratory seminars and practical; 0.4. Fieldwork; 0.5. Tests; 0.6. Tutorials; 0.7. Assessment; 0.8. Etiquette.
Topic 1. Basic concepts	1.1. Sediments and sedimentary rocks and their relevance to other disciplines; 1.2. The geological cycling of sediments and rocks; 1.3. Sediment source, routing, and sink; 1.4. Sediment residence time; 1.5. Interplay between tectonics, climate, biology, geochemistry, and the formation and deposition of sediments.

Topic 2. Methods	2.1. Overview of the methods used to collect sediment samples and investigate the formation, erosion, transport, deposition, and diagenesis of sediments in the marine realm and their lithification into sedimentary rocks; 2.2. Sampling campaigns: strategy and planning; 2.3. Characterization of sediments based on: (i) physical; (ii) chemical; and (iii) other properties; 2.4. Examples and case studies.
Topic 3. Rock weathering and the transport of solid and solute load into the ocean	3.1. Water-rock interaction: chemical and physical breakdown of rocks at the Earth's surface; 3.2. Mechanisms, rates, and extent of weathering and its interactions with climate and tectonics; 3.3. Weathering products and the transport of solid and solute load into the ocean; 3.4. Impacts of weathering on ocean chemistry.
Topic 4. Siliciclastic sediments I: general fluid flow characteristics	4.1. Transport environments; 4.2. Physical properties of fluids; 4.3. Relevant concepts of fluid dynamics, such as the laminar and turbulent flows, the boundary layer, and the bottom effects; 4.4. Types of flow: (i) unidirectional; (ii) oscillatory; (iii) gravitational; and (iv) liquefied.
Topic 5. Siliciclastic sediments II: sediment transport and bedforms	5.1. Forces acting on a sediment particle: the Bernoulli effect; 5.2. Sedimentologically significant types of flows: the Reynolds Number; 5.3. Entrainment and transport: shear stress; boundary layer; and viscous sublayer; 5.4. Deposition: the Stokes' law. Transport modes: the Hjlstrom's and Shields' curves; 5.5. Bedforms under unidirectional flows: (i) terminology; (ii) sequence of formation; and (iii) stability; 5.6. Cross-stratification: (i) types; (ii) bedforms under oscillatory flows; (iii) stability; and (iv) relationships with the flow regime; 5.7. Other bedforms.
Topic 6. Siliciclastic sediments III: description and classification	6.1. Description: texture and structure; 6.2. Classification according to the grain size; 6.3. Shape; 6.4. Origin and composition; 6.5. Classification according to the sediment composition; 6.6. Concepts of textural and compositional maturity; 6.7. Diagenesis of siliciclastic sediments and lithification into siliciclastic sedimentary rocks.
Topic 7. Siliciclastic sediments IV: grain-size distribution and fabric of siliciclastic sediments	7.1. Grain-size analysis and statistics: theory and practical examples; 7.2. Fabric and texture; 7.3. Porosity and permeability; 7.4. Structures nonrelated to flows: biological; postsedimentaries; diagenetic; 7.5. Bedform interpretation: temporal and spatial scales of the siliciclastic sedimentary processes.
Topic 8. Chemical and biochemical sediments I: ocean chemistry and (bio)chemical sedimentation	8.1. Overview and key examples of chemical and biochemical sediments 8.2. Processes controlling ocean chemistry and its evolution through time 8.3. Relationships between (bio)chemical sedimentation, climate, and continental weathering 8.4. Ocean carbonate chemistry: carbonate species and carbonate precipitation in seawater 8.5. Carbonate minerals and their stability in marine settings 8.6. Carbonate saturation state, lysocline, and carbonate compensation depth (CCD): controls and evolution through time, including links to weathering and sea-level change
Topic 9. Chemical and biochemical sediments II: carbonate sedimentary environments	9.1. The carbonate factory: production and controlling factors 9.2. Carbonate depositional systems: from shallow-water platforms to the deep ocean 9.3. Physical controls on carbonate production and facies distribution in marine environments 9.4. Chemical controls on carbonate production and facies distribution in marine environments 9.5. Case studies from modern carbonate systems

Topic 10. Chemical and biochemical sediments III: description and classification of carbonate sediments	10.1. Allochemical carbonate components 10.2. Orthochemical carbonate components 10.3. Classification of carbonate sediments and rocks and their depositional environments 10.4. Diagenesis of carbonate sediments and lithification into carbonate rocks
Topic 12. Sediment accumulation through space and time	12.1. The contribution of siliciclastic, carbonate, and other sediments to the sedimentary record and their relationship with the various oceanic, climatic, and tectonic settings; 12.2. How sediments fill a basin: basic concepts of sequence stratigraphy; 12.3. How sediment bodies are defined: basic concepts of sedimentary facies and facies types.
Seminars	Seminar 1: Grain-size determination and statistics; Seminar 2: Sediment transport processes in a sedimentation channel; Seminar 3: Quantitative analysis of carbonate sedimentation in the ocean.
Laboratory practical	Optical sedimentary petrology.
Fieldwork	Fieldtrip 1. Southern Margin of the Ría of Vigo; Fieldtrip 2. Galician beaches of Montalvo and Pociñas.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	25	24	49
Studies excursion	15	10	25
Laboratory practical	5	7	12
Mentored work	0	20	20
Seminars	7	17	24
Problem and/or exercise solving	0	20	20

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

Methodologies

	Description
Lecturing	Lectures on the 11 topics of the program. Coverage of the topics will be flexible to address questions and issues that may arise over the duration of the course.
	Attendance is mandatory (80% lectures).
Studies excursion	It includes the 2 fieldtrips of 7 hours each (Vigo and Pontevedra Rias), which are aimed at carrying out direct observations on specific sedimentary environments and evaluate their main sedimentological features.
	Attendance is mandatory.
Laboratory practical	5 hours of laboratory practical, using a petrographic microscope as a fundamental tool to perform petrographic investigation of sediments and sedimentary rocks.
	Attendance is mandatory.
Mentored work	Reports to be presented after seminars, laboratory practicals, and fieldtrips.
Seminars	Seminars of 2:20 hours each in the laboratory, during which main analytical techniques and approaches are illustrated and applied. Seminars will centre on: (1) Grain-size determination and statistics; (2) Sediment transport processes in a sedimentation channel; and (3) Quantitative analysis of carbonate sedimentation in the ocean.
	Attendance is mandatory.

Personalized assistance

Methodologies	Description
Lecturing	Questions and doubts that may arise during lectures will be addressed during tutorials. Tutorials will take place on Monday to Friday between 13:00 to 14:00, unless the professor has other commitments and duties that cannot be either cancelled or postponed. Students and/or group of students that are willing to attend the tutorials should contact the professor well in advance in order to efficiently schedule the tutorial.
Mentored work	Questions and doubts related to the mentored work will be addressed during tutorials. Tutorials will take place on Monday to Friday between 13:00 to 14:00, unless the professor has other commitments and duties that cannot be either cancelled or postponed. Students and/or group of students that are willing to attend the tutorials should contact the professor well in advance in order to efficiently schedule the tutorial.

Assessment						
	Description	Qualification	Training and Learning Results			
Lecturing	Continuous evaluation related to lecturing consists of, e.g., short questions and topical questionnaires (30%). Written, final exam is mandatory (40%). Final, written exam may include questions that need to be developed more broadly, the resolution of a problem, and/or the interpretation of images and the construction of diagrams.	70	A5	B1	C1 C12 C13 C14	D1 D2
Studies excursion	Written reports and/or questionnaires related to the information acquired during the fieldtrips. Aspects of the topics dealt with during the fieldtrips may be asked during the final exam.	5	A5	B1	C1 C12 C13 C14	D1 D2
Laboratory practical	Written report and/or questionnaires related to the activity that was developed during the laboratory practical. Aspects of the topics dealt with during the laboratory practical may be asked during the final exam.	5	A5	B1	C1 C12 C13 C14	D1 D2
Seminars	Reports and/or questionnaires related to the information acquired during the seminars. Aspects of the topics dealt with during the seminars may be asked during the final exam.	20	A5	B1	C1 C12 C13 C14	D1 D2
Problem and/or exercise solving	Topical questionnaires related to lectures, seminars and field trips. Its weight on both continuous and final evaluation is included in the methodologies listed above. For example, in the evaluation of the lecture topics, the questionnaires account for 30% as opposed to the 40% of the final exam.	0	A5	B1	C1 C12 C13 C14	D1 D2

Other comments on the Evaluation

Calculation of Final Grades

1. Grading from Continuous Assessment (60%)

Field Trips and Laboratory Practicals (10%)

Seminars (20%)

Topical Questionnaires (30%)

2. Final Exam (40%)

Requirements for Passing:

Continuous Assessment:

The average grade for each section (1a, 1b, 1c) must be at least 5.00.

Individual assignments within these sections must each have a grade of at least 4.00.

Final Exam:

Can be either written or oral.

To pass the course on the first attempt, the final exam grade must be at least 4.00.

This grade will then be averaged with the continuous assessment grades.

Second Opportunity:

If needed, the second chance will be a written or oral exam covering any part of the subject.

Attendance

Attendance at fieldtrips, seminars, and laboratory practicals is mandatory an essential requirement to be admitted to the final exam. Attendance at less than 80% of the lectures, and/or failing to take part to even one of the above mentioned activities will preclude admission to the final exam. Students that cannot attend one or more of these activities are expected

to provide a proper justification for their absence. If not, failure to attend them precludes the option to sit the 2nd opportunity exam.

Global assessment option

The application for this evaluation option must be submitted in the time and manner determined by the Center, which will be published prior to the academic start. Given the experimental nature of the practicals, seminars and field trips their attendance is mandatory to be eligible for this evaluation option. Failure to attend the practices, with no justified cause invalidates this possibility, as well as the opportunity for extraordinary evaluation (2nd opportunity).

Partial grade recovery is achieved by reaching a minimum of 4 out of 10 on the relevant second opportunity questions.

Failing the final exam implies that none of the partial marks (i.e., those obtained for the seminar essays and fieldtrip reports) will be kept for the following academic year.

Date, time and place of the exams will be published in the official web of Marine Sciences Faculty:

<http://mar.uvigo.es/alumnado/examenes/>

The students are strongly requested to have an honest and responsible conduct.

It is considered completely unacceptable any alteration or fraud (i.e., copy and/or plagiarism) that are aimed at modifying the level of knowledge and skills acquired during the course and that are evaluated during exams, essays, reports or any kind of work requested by the course's lecturers. Fraudulent behaviour may result in failing the course for a whole academic year. An internal dossier of these activities will be made. In case of a repeat offence, the university rectorate will be asked to open a disciplinary file.

Sources of information

Basic Bibliography

Adams, A. E., **A Colour Atlas of Carbonate Sediments and Rocks Under the Microscope**, Manson, 1998

Allen, J.R.L., **Principles of Physical Sedimentology**, Netherlands: Springer, 1985

Arche, A., **Sedimentología**, Ed CSIC, 2010

MacKenzie, W.S., Adams, A.E., **Rocks and Minerals in Thin Section: A Colour Atlas**, Manson, 1994

Schlager, W., **Carbonate Sedimentology and Sequence Stratigraphy**, SEPM (Society for Sedimentary Geology), 2005

Tucker, M. E., **Sedimentary Petrology. An Introduction to the origin of sedimentary rocks**, 3, Blackwell Science Ltd., 2001

Tucker, M. E., **Techniques in Sedimentology**, Blackwell Scientific Publications, 1988

Zeebe, R.E., Wolf-Gladrow, D.A., **CO₂ in Seawater: Equilibrium, Kinetics, Isotopes.**, Amsterdam: Elsevier Oceanography Series, 2001

Complementary Bibliography

Tucker, M.E., Wright, V.P., **Carbonate Sedimentology**, Blackwell Science Ltd, 1990

<http://www.iasnet.org/>,

<http://clasticdetritus.com/>, **clastic detritus**,

<http://www.sedimentologists.org/>, **International Association of Sedimentologist**,

<http://www.aapg.org/about/petroleum-geology/geology-and-petroleum/sedimentology-and-stratigraphy#424>, **American Association of Petroleum Geologist (AAPG)**,

Recommendations

Subjects that continue the syllabus

Coastal and marine sedimentary habitats/V10G061V01207

Subjects that are recommended to be taken simultaneously

Mathematics: Mathematics II/V10G061V01109

Subjects that it is recommended to have taken before

Geology: Geology 2/V10G061V01108

Geology: Geology 1/V10G061V01103

Other comments

REMINDER: GRADING INSTRUCTIONS

It is emphasized that attendance at lectures, seminars, and laboratory practicals is mandatory. Should attendance to these activities be less than 80% the student will not be allowed to sit the final exam. Fieldwork activities are also mandatory and

100% attendance is in order.

Every student must reach at least 40% mark in each of the activities to be able to pass the exam. Minimum score to pass each block = 5.

None of the marks will be kept for the following academic year.

DELIVERY FORMATS

Unless otherwise stated, all submissions must be made electronically by uploading the documents in the form of PDFs to the MOOVI platform. Accordingly, submissions by email and/or in paper will not be accepted or assessed.

DEADLINES

It is important to bear in mind that submission deadlines must be met by each of the students and for each of the activities of the course, and deadline extensions will not be allowed. Every submission must be made within one week of completion of the relevant activity. All deadlines expire at 23:59 of the day that is indicated in the TEMA platform. No submission will be accepted nor evaluated beyond the submission deadline.

AUTHORSHIP

Submission of any teamwork is responsibility of the student who has been designed as the coordinator of the team. The coordinator takes full responsibility of overseeing the number of co-authors (if a limit is set) of the essay, the contribution of each co-author (if any is repeated or missing) of the essay, and of ensuring that the deadline of submission of the essay is met.

No authors can be added after the essay has been submitted.

Authors that appear in more than one essay will not be accepted.

Plagiarized papers, either in full or in part, will not be accepted.

THE PLATFORM TEMA IS THE FORMAL METHOD OF COMMUNICATION

What is stated in the communications made via the TEMA platform will always prevail over any other form of communication.

HONORABILITY

It is expected that the students who attend this course will have a responsible and honest conduct.

It is deemed inadmissible any form of fraud (e.g., copy and/or plagiarism) aimed to alter the level of knowledge or skills achieved by a student in any type of test, essay, or report. This fraudulent conduct will be punished with firmness and rigor established in current regulations.

IDENTIFYING DATA				
Marine Ecology				
Subject	Marine Ecology			
Code	V10G061V01206			
Study programme	Grado en Ciencias del Mar			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	2nd	2nd
Teaching language	#EnglishFriendly Spanish English			
Department				
Coordinator	Fernández Suárez, Emilio Manuel Martínez García, Sandra			
Lecturers	Blanca Sújar, Rocío Clerencia Izquierdo, Mar Fernández Suárez, Emilio Manuel García-Boente Soto, Mariana Lasa Gonzalez, Aide Martínez García, Sandra Olabarria Uzquiano, Celia Román Geadá, Marta			
E-mail	sandra@uvigo.es esuarez@uvigo.es			
Web	http://https://mar.uvigo.es/			
General description	Marine ecology is the first subject entirely focussed on Ecology in the Marine Science studies at the University of Vigo. The subject describes the main metabolic pathways in the biosphere, analyze how energy flows drive cycles of matter, introduces models of population dynamics and the interactions between populations and finally assesses the factors controlling the structure and functioning of marine ecosystems. The effect of anthropogenic perturbations on the functioning of marine ecosystems is introduced horizontally in the different units. 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				
A2	Students can apply their knowledge and understanding in a manner that indicates a professional approach to their work or vocation, and have competences typically demonstrated through devising and sustaining arguments and solving problems within their field of study			
A3	Students have the ability to gather and interpret relevant data (usually within their field of study) to inform judgments that include reflection on relevant social, scientific or ethical issues			
A4	Students can communicate information, ideas, problems and solutions to both specialist and non-specialist audiences			
A5	Students have developed those learning skills that are necessary for them to continue to undertake further study with a high degree of autonomy			
B1	Know and use vocabulary, concepts, principles and theories related to oceanography and apply everything learned in a professional and/or research environment.			
B2	Plan and execute surveys in the field and laboratory work, applying basic tools and techniques for sampling, data acquisition and analysis in the water column, sea bottom and marine substratum.			
B4	Manage, process and interpret the data and information obtained both in the field and in the laboratory.			
C10	Know the biological diversity and functioning of marine ecosystems.			
C11	Apply the knowledge and techniques acquired to the characterization and sustainable use of living resources and marine ecosystems.			
D1	Develop the search, analysis and synthesis of information skills oriented to the identification and resolution of problems.			
D2	Acquire the ability to learn autonomously, continuously and collaboratively, organizing and planning tasks over time.			
D5	Sustainability and environmental commitment. Equitable, responsible and efficient use of resources.			

Expected results from this subject				
Expected results from this subject	Training and Learning Results			
Capacity to understand and analyse the basic processes of the interactions between organisms.	A2	B1	C10	D1
	A3		C11	
	A4			
	A5			

Capacity to understand the bases of diversity and the the factors controlling organization and structure of the ecosystems	A2 A3 A4 A5	B1	C10 C11	D1 D5
To design, analyze, interpret and present experimental results	A2 A3 A4 A5	B1 B2 B4	C10 C11	D1 D2
To use software typically used in Marine Ecology	A2 A3 A4 A5	B2 B4	C11	D1 D2
To use the basic bibliography related to the ecological concepts	A2 A3 A4 A5	B1 B2	C10 C11	D1

Contents

Topic	
Ecology and environmental crisis	Ecology in an anthropic biosphere. Planetary boundaries. Socio-ecological systems. Ecosystem services. Presentation of the subject.
Metabolic diversity of the biosphere	Energy in the ecosystem. Cycles of matter and flows of energy. Input of energy in the ecosystem. Metabolic pathways. Interaction of metabolic pathways.
Circulation of matter in the ecosystem	Compartments, mass balance and residence time. Oxygen: distribution and redox gradients. Reactions of carbon: warming and acidification. Reactions of nitrogen: eutrophication. Reactions of phosphorus: dynamics in the water-sediment interface. Reactions of sulphur: interaction with the atmosphere
Primary production	Concept and magnitudes. Control of primary production: irradiance and nutrients. Hydrodynamic control of primary production: Sverdrup's model. Spatial and temporal variability of primary production in the marine environment.
Secondary production and remineralización of matter	Secondary production. Herbivorous and decomposers pathways. Efficiencies. Decomposition and remineralización of organic matter. Microbial heterotrophic production.
Ecology of populations: strategies of life	Concept of individual and population. Unitary and modular organisms. Characteristics of the populations. Life strategy traits: parity, fecundity, reproductive effort. Trade-offs. Life strategies and environment.
Dynamics of isolated populations	Fundamental equation of the populational growth. Growth in populations with age structure: Life tables, population projection matrix, survivor curves. Model of population growth. Discreet and continuous models. Deterministic and stochastic models. Density-independent growth: exponential model. Density-dependent Growth: logistical model. Variations of the logistical model: Temporal delay, Allee effect.
Interactions between species	Interspecific competition. Experimental evidences of the competition. Competition and ecological niche. Lotka and Volterra competition model. Predation. Functional and numerical responses. Lotka and Volterra predation model. Variations of the Lotka and Volterra model: self-limitation. Positive interactions: mutualism and comensalism.
Community structure	Assembling and filters. Specific diversity, biodiversity, specific wealth and functional diversity. Abundance distribution models. Diversity indexes. Diversity in space: spectra and gradients. Relation between diversity and ecosystem functioning.
Processes controlling community structure	Colonisation and extinction: dynamics of insular communities. Are, distance, rescue and target effects. Implications on habitat reduction and fragmentation. Equilibrium and non-equilibrium: community organisation. Community regulation in equilibrium conditions: effect of the competition; effect of predation. Role on positive interactions: facilitation. Community regulation in non-equilibrium conditions: perturbations. Intermediate perturbation hypothesis. Density-independent models: variable recruitment hypothesis.
Temporal changes in community structure	Succession and fluctuation. Explanatory models of succession. Succession and diversity. Succession and energy flow.
Food webs	Topology of food webs. Conectance, diversity and stability. Key species and trophic cascades. Top-down vs bottom-up control. Examples of pelagic and benthic food webs.

Planning			
	Class hours	Hours outside the classroom	Total hours
Lecturing	30	60	90
Seminars	7	14	21
Laboratory practical	8	24	32
Problem and/or exercise solving	1	0	1
Project	3	0	3
Essay questions exam	2	0	2
Objective questions exam	1	0	1

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

Methodologies	
	Description
Lecturing	Plenary lectures will be the main methodology used in the theoretical part of this subject.
Seminars	Seminars will aim at a more personalized approach for the students to acquire complex concepts and tools in order to provide data analysis capacities that will be used in the experimental work The contents of these seminars will be: Seminar 1: experimental Design. Design of the experimental work. Seminar 2: Data Analysis I: ANOVA in Ecology. Practical case. Seminar 3: Data Analysis II. ANOVA. Anova in Ecology. Practical case. Seminar 4: Analysis of data of the experimental work. Presentation of scientific results. In the seminars 2, 3 and 4 will be necessary the utilisation of the statistical programs *R and *RStudio.
Laboratory practical	The experimental work consists in the design, taking of samples, experimentation, processed of samples, analysis of data, preparation and discussion of results and, finally, presentation of the same by part of the students. They will develop , therefore, all the phases of an investigation. The experimental work will make in groups of 5 people that will work of autonomous form, *tutelados by the *profesorado. The results of the work will present in format poster. The phase of laboratory of the experimental work will make inside the period of 10 February to 13 March and will have an approximate length of a week. The students of each experimental group will have to his disposal the laboratory of practices of Ecology in these dates. The sessions of seminars will tackle the necessary practical contents for the preparation of the experimental work. With the end to guarantee the suitable organisation and development of the experimental work, urges to respect of strict form the following recommendations: 1. All the phases of the experimental work have to be made by all the members of the group, by what his constitution has to take into account the schedules of his members. 2. In the *tutorías destined to make the design of the experiment, as well as in the centred in the analysis and interpretation of results has to assist the whole of the members of the group. 3. In the case of the seminar 1, is necessary the assistance of all the members of a group to the same session.

Personalized assistance	
Methodologies	Description
Laboratory practical	All planned methodologies in this matter contemplates a personalised attention through voluntary tutorials. The schedule of personalized tutorials is the following: Monday, Wednesday and Thursday from 9 to 11 h. Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation.
Seminars	All planned methodologies in this matter contemplates a personalised attention through voluntary tutorials. The schedule of personalized tutorials is the following: Monday, Wednesday and Thursday from 9 to 11 h. Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation.

Lecturing	All planned methodologies in this matter contemplates a personalised attention through voluntary tutorials. The schedule of personalized tutorials is the following: Monday, Wednesday and Thursday from 9 to 11 h. Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation.
Tests	Description
Problem and/or exercise solving	In all the planned methodologies in this matter contemplates a personalised attention. In the case of the sessions magistrales, these will develop through tutorías voluntary. The schedule of tutorías planned is the following: Monday, Wednesday and Thursday of 9 to 11 h. The students that wish it will be able to attend to *tutorías personalised to resolve doubts, mainly in the schedules that indicate . To optimise the time, is necessary that the students contact with the professor with antelación sufficient since this schedule can vary on time when the professor have other educational obligations, researchers or of management that attend.
Project	In all the planned methodologies in this matter contemplates a personalised attention. In the case of the sessions magistrales, these will develop through tutorías voluntary. The schedule of tutorías planned is the following: Monday, Wednesday and Thursday of 9 to 11 h. The students that wish it will be able to attend to tutorías personalised to resolve doubts, mainly in the schedules that indicate . To optimise the time, is necessary that the students contact with the professor with antelación sufficient since this schedule can vary on time when the professor have other educational obligations, researchers or of management that attend.
Essay questions exam	In all the planned methodologies in this matter contemplates a personalised attention. In the case of the sessions magistrales, these will develop through tutorías voluntary. The schedule of tutorías planned is the following: Monday, Wednesday and Thursday of 9 to 11 h. The students that wish it will be able to attend to tutorías personalised to resolve doubts, mainly in the schedules that indicate. To optimise the time, is necessary that the students contact with the professor with antelación sufficient since this schedule can vary on time when the professor have other educational obligations, researchers or of management that attend.
Objective questions exam	In all the planned methodologies in this matter contemplates a personalised attention. In the case of the sessions magistrales, these will develop through tutorías voluntary. The schedule of tutorías planned is the following: Monday, Wednesday and Thursday of 9 to 11 h. The students that wish it will be able to attend to tutorías personalised to resolve doubts, mainly in the schedules that indicate . To optimise the time, is necessary that the students contact with the professor with antelación sufficient since this schedule can vary on time when the professor have other educational obligations, researchers or of management that attend.

Assessment

	Description	Qualification	Training and Learning Results
Problem and/or exercise solving	The qualification of the seminars will be carried out by means of an examination in which the students will resolve practical cases and questions related with the contents of this section of the subject. The examination of seminars will consist in the resolution of problems using *R and *Rstudio. Besides, a proof will be conducted during the development of the seminars in which it will have to answer to questions on diverse aspects treated in the seminars. The proof will be announced ahead. The assistance to the seminars is compulsory. The relative contribution of both proofs to the final qualification will be of 15% (12% the examination of seminars and 3% the proof). To pass the subject will be necessary to reach a qualification of 5, considering all the activities. Additionally, a minimum value of 4 over 10 is required in the joint qualification of seminars and experimental work. The qualifications of the seminar and experimental work sections obtained in the two previous courses will be maintained provided they are equal or higher that 4 over 10.	15	A2 B4 D1 A3 D2 A4 A5

Project	The qualification of the experimental work will base in the quality so much regarding his design, as to the preparation of the results and the presentation of the same, and in the level of knowledge reached on the contents of the poster elaborated. The professors will contribute a rúbrica that will fix the criteria of evaluation of the work.	35	A2 B1 C10 D1 A3 B2 C11 D2 A4 B4 A5
	The evaluation will consist of two sections. First, the presentation of the poster made by each one of the groups will be evaluated. Each group will defend his work in oral mode and the professors will ask questions to the members of the group on any aspect of the work. Secondly, in the same session each student will make individually a short proof on the contents of the poster that he/she has elaborated.		
	The realisation of the experimental work, including the preparation and presentation of the poster, is compulsory. The relative weight of this part will be of 35% of the total qualification of the subject. The assessment of the poster will represent 60% of the qualification of the experimental work, whereas the proof written will represent 40%.		
	The people that wish to recover the experimental work in the second opportunity will deliver a new version of the poster, that will be again evaluated. Since all the students have had to present *oralmente the poster with the results of his work at the earliest opportunity, will not be necessary to repeat said oral presentation in the second opportunity. The date of delivery of this new version of the poster will be previous to the date of the examination and will be announced with sufficient *antelación. This delivery will be able to be conjoint by part of the group, presented by one of the members of the group or by a subset of members of the group. The recovery will complete with the answer to a series of questions on the content of the poster that will be answered in the own final examination. Only they will be able to answer to these questions the people that have presented a new version of the poster inside the term established.		
	To approve the subject will be necessary to reach an upper qualification to 5, considering the whole of the activities *evaluables. Incidentally, it will have to obtain an equal or upper qualification to 4 points on 10 in the conjoint qualification *ponderada of the section of seminars and experimental work.		
Essay questions exam	At the end of the course students will make a final examination that will represent the 40 % of the total qualification. To pass the subject it will be needed to reach a qualification of at least 5, considering the whole of the activities. Additionally, students should obtain a qualification equal or higher than 4 points in the qualification of the theoretical contents (joint weighted qualification of the final examination and the shot proofs.	40	A2 C10 D1 A3 C11 D2 A4 D5 A5
Objective questions exam	During the course, 3 proofs will be conducted on the concepts treated in the subject. These proofs will represent 10% of the final qualification. These short proofs will be done during the class. The date of realisation will be announced ahead.	10	A2 C10 D1 A3 C11 D2 A4 D5 A5

Other comments on the Evaluation

Global assessment option

The application for this evaluation option must be submitted in the time and manner determined by the Center, which will be published prior to the academic start. Given the experimental nature of the practices and seminars, attendance to these two activities is mandatory to be eligible for this evaluation option. **Failure to attend the practices, with no justified cause invalidates this possibility, as well as the opportunity for extraordinary evaluation (2nd opportunity).**

In the case of the global assessment option, an exam formed by two parts: theoretical and practical (seminars+experimental work) will be performed. Both parts will have the same relative weight on the total qualification. To pass the subject a value of 5 over 10 should be obtained. Additionally, a value equal or higher than 4 is required for each part of the exam

Second opportunity

The evaluation in the second opportunity will include an exam of theoretical contents and an exam of the contents of the seminars. Those students who did not obtain the minimum qualification to pass this section of the subject and wish to try a second opportunity should deliver a new version of the poster, that will be again evaluated. Since all the students have had to present the poster during the first opportunity, it will not be needed to present it again in the second opportunity. The date of delivery of this new version of the poster will be previous to the date of the exam and the date will be announced in advance. The students will additionally answer a series of questions on the content of the poster during the final

examination. Only students who presented a new version of the poster within the term established could answer to these questions.

Students coursing this matter are requested to demonstrate a responsible and honest behaviour. It is considered as inadmissible any form of fraud (copy or plagiarism). Fraudulent behaviors are not acceptable and will imply a negative qualification of this subject. Dates, hours and place where the evaluation proofs will be conducted will be published in the official web of the Faculty of Sciences of the Sea.

Sources of information

Basic Bibliography

Rodríguez, J, **Ecología**, Pirámide, 2016

Begon, M, **Ecology**, Blackwell, 2006

Krebs, C.J, **Ecology**, 6^a, International Rev. Collins, 2013

Complementary Bibliography

Recommendations

Subjects that continue the syllabus

Biological oceanography I/V10G061V01301

Biological oceanography II/V10G061V01306

IDENTIFYING DATA				
Coastal and marine sedimentary habitats				
Subject	Coastal and marine sedimentary habitats			
Code	V10G061V01207			
Study programme	Grado en Ciencias del Mar			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	2nd	2nd
Teaching language	#EnglishFriendly Spanish			
Department				
Coordinator	Nombela Castaño, Miguel Angel			
Lecturers	Diz Ferreiro, Paula García Gil, María Soledad Nombela Castaño, Miguel Angel			
E-mail	mnombela@uvigo.es			
Web	http://http://webs.uvigo.es/c10/webc10/ficha.php?id=4			
General description	This subject is directed to the acquisition of knowledge and competences on the marine sedimentary environments, from the coastal to the oceanic basins. It includes morphological features and classification of sedimentary environments and processes. It also considers aspects of environmental and economic management. It has a theoretical character-practical including two field trips for the observation and analysis of sedimentary environments.			
	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	
A2	Students can apply their knowledge and understanding in a manner that indicates a professional approach to their work or vocation, and have competences typically demonstrated through devising and sustaining arguments and solving problems within their field of study
A3	Students have the ability to gather and interpret relevant data (usually within their field of study) to inform judgments that include reflection on relevant social, scientific or ethical issues
A4	Students can communicate information, ideas, problems and solutions to both specialist and non-specialist audiences
B1	Know and use vocabulary, concepts, principles and theories related to oceanography and apply everything learned in a professional and/or research environment.
B2	Plan and execute surveys in the field and laboratory work, applying basic tools and techniques for sampling, data acquisition and analysis in the water column, sea bottom and marine substratum.
B4	Manage, process and interpret the data and information obtained both in the field and in the laboratory.
C12	Acquire knowledge about processes and products related to internal and external geological cycles.
C13	Acquire the basic sedimentological, geochemical and geophysical techniques and methodologies used in identification, use and sustainability of the natural resources of coastal and marine environments.
D1	Develop the search, analysis and synthesis of information skills oriented to the identification and resolution of problems.
D5	Sustainability and environmental commitment. Equitable, responsible and efficient use of resources.

Expected results from this subject				
Expected results from this subject	Training and Learning Results			
Elaborate and interpret stratigraphic sections and perform correlations	A3	B2 B4	C13	D1
Understand the pelagic sediments as the result of a global biogeochemical system.	A2 A3 A4	B2 B4	C12 C13	D1 D5
Identify the different types of coastal sedimentary environments in function of their sedimentary record.	A3	B1 B4	C13	D1 D5
Understand the coastal and marine environments space-temporal evolution	A2 A3 A4	B1 B4	C13	D1 D5

Contents	
Topic	

Subject 1. Introduction to the sedimentary environments	Introduction to the Stratigraphy and the sedimentary environments Evolution of the sedimentary environments in the context of the sequential Stratigraphy
Subject 2. Sedimentary processes in marine environments.	Control factors in marine sedimentary environments. Classification of coasts and main processes. Coastal landforms. Coastal evolution: changes in sea level
Subject 3. Beaches and barrier island-lagoon systems	Control factors of coastal morphology Coastal zones. Erosion, transport and sedimentation processes on beaches and barrier island-lagoon systems Beaches: types, sub-environments and dynamics. Coastal barriers: types and morphology Coastal dunes.
Subject 4. Deltas	Concept of delta. Deltaic processes: constructive and destructive Delta zones. Classification of deltas and sedimentary sub-environments. Architecture of deltas. Temporal and spatial variability of deltaic systems.
Subject 5. Estuaries and rias.	Definitions and related coastal forms. Origin and evolution of today estuaries and rias. Estuary classifications: According to their morphology. According to the internal circulation regime. According to the dominant processes and the resulting sediments (facies)
Subject 6. Muddy coasts.	Tidal plains. Marshes. Mangroves. Cheniers. Sedimentary processes in tidal plains. Sedimentary sub-environments in a tidal plain and sedimentary facies.
Subject 7. Continental shelves.	Definition, characteristics and types. Parts of the platform. Hydraulic processes in the platforms. Sedimentation: Controlling factors. Types of "marine" and platform sediments. Siliciclastic platforms: Classification according to hydraulic regime. Carbonate platforms: Characteristics and types.
Subject 8. Continental margins: the slope and the continental glacis.	Main sedimentary processes. Mass transport, dense flows and turbidity currents. Types of deposits, classifications and morphologies. Deep Sea Fans: Turbidity Systems. Types and Deposits.
Subject 9. Contourites and depositional contourite systems	Nomenclature and factors that define a contourite system. Deep oceanic circulation. Erosional and depositional contouritic features. . Economic interest of the contouritic deposits.
Subject 10. Deep sea sediments.	Deep and mid-oceanic ridge basins Pelagic sediments: Biogenic calcareous and siliceous muds (oozes). Abyssal clays. Autigenic sediments: phosphates (upper slope), manganese. Terrigenous and hemipelagic sediments: Turbidites in the abyssal plains and volcanogenic sediments. Lithothermal: deep sea reefs.
Subject 11. Deep and mid-oceanic ridge basins.	Deep-sea geomorphology: canyons, seamounts and oceanic plateaus. Distribution of pelagic and hemipelagic sediments on the ocean floor. Hydrothermal processes: fumaroles. Deep mineral deposits. Gas hydrates.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	25	62.5	87.5
Case studies	4	3.5	7.5
Studies excursion	16	16	32
Seminars	7	14	21
Objective questions exam	2	0	2

*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 50 minutes lessons. (40% of total mark). Up to 1 extra point for participation and discussion on classroom)
Case studies	It comprises the cartography, characterisation and evolution of sedimentary environments explored from the Google Earth. (Attendance and reports, 10% of the subject mark)
Studies excursion	It comprises two field-trips: 1. Arousa Island 2. Corrubedo (Attendance and reports, 20% of mark)
Seminars	Seminar 1. Beach Morphodynamics Seminar 2. Sedimentary structures. Seminar 3. Videos of marine sedimentary environments (Attendance and reports, 30% the mark)

Personalized assistance

Methodologies	Description
Lecturing	Individual or in group tutorial according to the teacher schedule: Monday, Wednesday and Friday: 12:00-14:00h , that will be able to be modified in function of the educational needs.
Studies excursion	Students that wish it will be able to attend to personalized tutorials to resolve doubts, mainly in the indicated schedules. To optimize time, it is necessary that the student to contact with the lecturer previously. The tutorials will be able to be individual or in group in accordance with the schedules of the lecturer: Prof. Soledad García Gil (Tuesday, Wednesday and Thursday: 12:00-14:00 h) that would be modified according to educational needs.
Case studies	Students that wish it will be able to attend to personalized tutorials to resolve doubts, mainly in the indicated schedules. To optimize time, it is necessary that the student to contact with the lecturer previously. The tutorials will be able to be individual or in group in accordance with the schedules of the lecturer: Prof. Soledad García Gil (Tuesday, Wednesday and Thursday: 12:00-14:00 h) that would be modified according to educational needs.
Seminars	Students that wish it will be able to attend to personalized tutorials to resolve doubts, mainly in the indicated schedules. To optimize time, it is necessary that the student to contact with the lecturer previously. The tutorials will be able to be individual or in group in accordance with the schedules of the lecturer: Prof. Soledad García Gil (Tuesday, Wednesday and Thursday: 12:00-14:00 h) that would be modified according to educational needs.

Assessment

Description		Qualification Training and Learning Results					
Case studies	Report (memory) of the results obtained in the classroom of computing.	10	A2	B4	C12	D1	C13 D5
Studies excursion	Reports of the exits of field. It will evaluate the assistance to the field.	20	A3	B2	C12	D1	A4 B4 C13 D5
Seminars	Preparation of a work of synthesis and results for each one of the seminars	30	A4	B4	C12	D1	C13 D5
Objective questions exam	Examination on the syllabus developed during the masterclasses, the appearances treated in the field trip, practical and in the seminars with questions of short answer, and/or questions of multiple options, and/or ask false/true type.	40	A3	B1	C12	D1	A4 D5

Other comments on the Evaluation

To surpass the subject, it will be necessary to:

1. Obligatory attendance at the practical (consisting of field trips and case studies in the classroom/laboratory) **and at the seminars**, as well as **the submission of the corresponding questionnaires**. Students who do not attend the seminars or the practicals will not be able to submit these questionnaires. Absences may be accepted for justified reasons. **To pass the course, it is essential to obtain an average of 5 or higher (both in the activities of the practical block and in the seminars)** so that the marks of these blocks are considered in the percentage of the final mark. In the case of obtaining a mark lower than 5 in any of the blocks, the student will have to take and pass an exam of that block in the final exam of the corresponding exam session. The approved activities (seminars and/or practicals) will be kept from one academic year to the next.

2. It is obligatory to obtain a mark of 5 or higher on the final exam of any session. **If the exam mark is lower than 5**, neither the percentages for practicals nor those for seminars will be added up and **the subject will appear to be a failure**.

The final exam in any of the exam sessions will include any theoretical or practical aspect that has been presented during the course, including field trips.

To pass the subject in the second convocation, students will have to take an exam on each of the parts of the subject that they have not successfully completed.

Global evaluation option: The application for this evaluation option must be submitted in the time and manner determined by the Centre, which will be published prior to the start of the academic year. Given the experimental nature of the practicals, seminars and field trips, attendance is compulsory in order to be eligible for this evaluation option. Non-attendance, without a justified cause, invalidates this possibility, as well as the opportunity for extraordinary assessment (2nd opportunity).

Date, time and place of exams will be published in the official web of Marine Sciences Faculty:
<http://mar.uvigo.es/alumnado/examenes/>

It is required a responsible and honest behavior from students. It is inadmissible any form of fraud (copy and/or plagiarism) directed to adulterate the level of knowledge or skill reached by the student in any type of proof, report or work designed with this purpose. The fraudulent behaviors will suppose to fail the matter during a complete course. An internal register of this behavior will be carried, in case of repetition, a request to the rector to open a disciplinary record will be submitted.

Sources of information

Basic Bibliography

Arche, A. (Ed), **Sedimentología. Del proceso físico a la cuenca sedimentaria**, 3rd, CSIC, Madrid, 2010

Davidson-Arnott, R., **Introduction to coastal processes and geomorphology**, 2nd, Cambridge, 2010

Davis, R.A. Jr. y Fitzgerald, D.M., **Beaches and Coasts**, 1st, Blackwell Publishing, 2004

Hüneke, H., Mulder, T. (Eds.), **Deep-Sea sediments. Developments in Sedimentology**, 63, 1st, Elsevier, 2011

Nichols, G., **Sedimentology and Stratigraphy**, 2nd, Wiley-Blackwell, 2009

Pickering, K.T.; Hiscott, R.N. y Hein, F.J., **Deep Marine Systems: Processes, Deposits, Environments, Tectonics and Sedimentation**, 1st, Unwin Hyman Ltd, 2016

Reading, H. G., **Sedimentary Environments**, 3rd, Blackwell Science, 1996

Stow, D.A.V., Pudsey, C.J., Howe, J.A., Faugères, J.C., Viana, A.R, **Deep-Water Contourite Systems: Modern Drifts and Ancient Series, Seismic and Sedimentary Characteristics**, 1st, Geological Society of London, Memoirs, 2002

Complementary Bibliography

Bird, E., **Coastal Geomorphology: An Introduction**, 2nd, Wiley, 2008

Scholle, P.A. y Ulmer-Scholle, D.S., **A color Guide to the Petrography of Carbonate Rocks: Grains, textures, porosity, diagenesis**, 1st, AAPG Memoir 77; AAPG, 2003

Recommendations

Subjects that continue the syllabus

Geological oceanography II/V10G061V01308

Geological oceanography I/V10G061V01303

Basin Analysis/V10G061V01406

Subjects that it is recommended to have taken before

Geology: Geology 2/V10G061V01108

IDENTIFYING DATA				
Principles of marine microbiology				
Subject	Principles of marine microbiology			
Code	V10G061V01208			
Study programme	Grado en Ciencias del Mar			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	2nd	2nd
Teaching language	#EnglishFriendly Spanish			
Department				
Coordinator	Bodelón González, Gustavo			
Lecturers	Bodelón González, Gustavo Rada Piñeiro, Xavier Manuel de			
E-mail	gbodelon@uvigo.gal			
Web	http://mar.uvigo.es			
General description	Basic introduction to marine microorganisms and their place in the living world. Estructure and function of bacterial cell. Methods for study of marine microbiology. Metabolic and genetic traits exclusives for procariotic microorganisms. Physiology and diversity of microbial communities. Microbial role in trophic chain and ocean processes. Interaction of microorganisms with living organisms and geobiochemical cycles. 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	
A2	Students can apply their knowledge and understanding in a manner that indicates a professional approach to their work or vocation, and have competences typically demonstrated through devising and sustaining arguments and solving problems within their field of study
A3	Students have the ability to gather and interpret relevant data (usually within their field of study) to inform judgments that include reflection on relevant social, scientific or ethical issues
A4	Students can communicate information, ideas, problems and solutions to both specialist and non-specialist audiences
B1	Know and use vocabulary, concepts, principles and theories related to oceanography and apply everything learned in a professional and/or research environment.
B4	Manage, process and interpret the data and information obtained both in the field and in the laboratory.
C9	Acquire basic knowledge about the structural and functional organization and the evolution of marine organisms.
C10	Know the biological diversity and functioning of marine ecosystems.
C11	Apply the knowledge and techniques acquired to the characterization and sustainable use of living resources and marine ecosystems.
D1	Develop the search, analysis and synthesis of information skills oriented to the identification and resolution of problems.
D2	Acquire the ability to learn autonomously, continuously and collaboratively, organizing and planning tasks over time.
D5	Sustainability and environmental commitment. Equitable, responsible and efficient use of resources.

Expected results from this subject

Expected results from this subject	Training and Learning Results			
Understand the concept of microorganism, its structural characteristics and its position on the biological scale	A4	B1 B4	C9	D1
Understand and know how to apply the different techniques of study of the marine microbiota	A2 A3	B4	C11	D1 D5
Know the diversity of the marine microbiota and know how to interpret its role in marine ecosystems in relation to the trophic chain and cycles of the elements	A4	B1	C10 C11	
Know and know how to interpret the characteristics of microbial growth in the marine environment, the influence of environmental factors and symbiotic processes with marine organisms	A2 A3 A4	B1	C11	D2

Contents

Topic	
Lesson 1. Microorganisms on the marine ambient	1.1. Purpose and field of study of marine microbiology 1.2. Microorganisms on the biological scale. 1.3. Role of microbiota in marine ecosystems. 1.4. Perspectives of marine microbiology

Lesson 2. Structure and function of prokaryotic microorganisms and acellular agents	2.1. Structure and function of prokaryotic microorganisms 2.2. Structure and function of acellular agents
Lesson 3. Microbial physiology	3.1. Microbial growth in the laboratory: mathematical expression 3.2. Microbial growth in the marine environment: effect of environmental factors 3.3. Cooperative and multicellular processes 3.4. Asexual reproduction in bacteria
Lesson 4.- Methods of study of marine microbiota: culture-dependent techniques	4.1. Concepts of asepsis and sterilisation 4.2. Sampling techniques. 4.3. Isolation, cultivation and conservation techniques .4.4. Techniques of cuantification. 4.5. Techniques for the characterisation of pure cultures.
Lesson 5.- Methods of study of marine microbiota: non-cultivation dependent techniques	5.1. U.V. light microscopy: unespecific fluorescence . 5.2. Flow Cytometry 5.3. In Situ Hybridization Techniques 5.4. Selective Amplification and sequencing: PCR; DGGE; NGS sequencing techniques 5.5. Principles of Metagenomic Analysis
Lessons 6. Diversity of marine microbiota.	6.1. Relevant species in the Bacteria, Archaea and Eucarya domains. Position in the phylogenetic tree. 6.2. Microorganisms in the trophic chain. 6.3. Microorganisms in the element cycles 6.4 Symbiotic associations with animals and plants 6.5. Diversity of Viruses and Bacteriophages Role in marine microbial ecosystems
LABORATORY PRACTICAL	1. Preparation of culture media 2. Sampling of environmental samples 3. Isolation and preservation of pure cultures 4. Cuantification of microorganisms 5. Tests of bacterial identification.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	30	68	98
Laboratory practical	18	28	46
Seminars	4	2	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	The teacher structures and/or explains the objectives and contents of each topic and responds to the questions raised by the students. At the end of each topic, students will have the presentations discussed in the classroom, demonstration videos, links to free access texts and self-assessment questionnaires on Moovi. During the semester the teacher will evaluate the students through four tests of a maximum of 25 minutes each, with objective and/or development questions.
Laboratory practical	The teacher explains the fundamentals and protocols of practices, supervises their execution and resolves the students' doubts. These will have the protocols and foundations of each practice in Moovi. The teacher will evaluate the students through a test of objective questions, exercises and development at the end of the practices.
Seminars	In one of the seminars, students, organized in groups, will complete a task on the computer that they must submit at the end of the seminar for evaluation. In the second seminar, students will learn microbial growth kinetics exercises and deliver exercises at the end of the session.

Personalized assistance

Methodologies	Description
Laboratory practical	The students will be able to solve doubts with the teacher, during the practices or once finished, making an appointment by e-mail within their tutorial schedule. To better optimize the procedure, the student is requested to contact the teacher in advance by email, with reasonable anticipation.
Seminars	The students will be able to solve doubts with the professor during the development of the seminar.
Lecturing	The students can solve doubts with the teacher, during the classes or out of them, making an appointment by e-mail within their tutorial schedule. To better optimize the procedure, the student is requested to contact the teacher in advance by email, with reasonable anticipation.

Assessment

Description	Qualification	Training and Learning Results
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Lecturing	Four partial tests, eliminatory along the semester of multiple choice, and/or development questions: Test 1: 14%. Test 2: 14%. Test 3: 14%. Test 4: 14%. Failed or not carried out tests can be recovered in the Second Call. - The dates of the different tests will appear in the schedule that the Dean's Office makes available to the student. The teacher structures and/or explains the objectives and contents of each topic and responds to the questions raised by the students. At the end of each class, students will have the presentations discussed in the classroom, demonstration videos, and links to free access texts on Moovi. During the semester the teacher will evaluate the students through 4 tests of a maximum of 25 minutes each that will consist of objective and/or development questions. Failed or not completed tests may be recovered in the Second Call through an exam that will consist of objective and/or development questions. Self-assessment questionnaires will be made available to students. Attendance at the master classes is recommended. The material explained in class may not be included in its entirety in the presentations that will be made available to students. On the other hand, attendance will be assessed by completing assignments and attention tests that will be delivered in the classroom at the end of the class and can provide up to 1 additional point to the final grade for the subject.	56	A2 B1 C9 D1 A3 B4 C10 D5 A4
Laboratory practical	Test of objective questions, development questions and exercises will take place at the end of the practices. The failed test will be recoverable in the Second Call. The assistance to practic classes is obligatory. A single lack of attendance is allowed due to force majeure and documented documentation.	34	A2 B4 C10 D1 A3 D5
Seminars	Seminar I (5%): individual test of objective questions and resolution of exercises. Seminar II (5%): delivery of a work done in group. Failed tests will not be recoverable in the final exam. Attendance at seminars is mandatory. A single lack of attendance is allowed due to force majeure and documented documentation.	10	A3 B4 C9 D1 A4 C10 D2

Other comments on the Evaluation

CONTINUOUS ASSESSMENT:

Students must pass, with at least 5 points out of 10, each of the five partial tests (4 for Theory and 1 for Practice). If the minimum grade is not achieved in any of the partial tests, the grade will be the average grade of the failed exams. The failed theoretical and practical tests may be recovered in the Second Call, preserving the qualifications of the tests passed during the semester. The qualification for two seminars is not recoverable in the Second Call.

OVERALL EVALUATION:

Exceptionally, students who choose not to take the continuous evaluation may request the global evaluation and take the complete exam of the subject (theoretical and practical contents) within the deadline established by the school. This evaluation will be carried out on the official dates of the first and second opportunity.

IN BOTH MODALITIES OF EVALUATION:

Students who, having failed the global test or one of the partial tests of the semester, do not appear for their retake in the Second Call, will appear in the Minutes as "Not Presented".

EVALUATION OF STUDENTS REGISTERED FOR THE SECOND OR SUCCESSIVE TIMES:

Continuous assessment:

Notes from the approved theoretical and practical part, as well as from the seminars, will be kept (for 2 years). If they consider it so, they may attend the practices voluntarily or not.

General evaluation:

Exceptionally, students who choose not to take advantage of the continuous evaluation may request the global evaluation and take the complete exam of the subject (theoretical and practical contents) within the deadline established by the school. This evaluation will be carried out on the official dates of the first and second opportunity.

Students are strongly requested to fulfil a honest and responsible behaviour. It is considered completely unacceptable any alteration or fraud (i.e., copy or plagiarism) contributing to modify the level of knowledge and abilities acquired in exams, evaluations, reports or any kind of teacher's proposed work. Fraudulent behaviour may cause failing the course for a whole academic year. An internal dossier of these activities will be built and, when reoffending, the university rectorate will be asked to open a disciplinary record.

OTHER COMMENTS:

Students may not have a mobile phone or other electronic device in class unless it is necessary to carry out an activity, which will be previously communicated by the teaching staff.

Final exam date: consult link mar.uvigo.es/alumnado/examenes/

Responsible and honest behavior is required of students taking this subject. Any form of fraud (copying or plagiarism) aimed at falsifying the level of knowledge and skills achieved in any type of test, report or work is considered inadmissible. Fraudulent conduct may result in failing the subject for an entire course. An internal record of these actions will be kept in order, in the event of recidivism, to request the opening of a disciplinary file to the rectorate.

Sources of information

Basic Bibliography

Josep M. Gasol J.M., David L. Kirchman, **Microbial Ecology of the Oceans**, 3th ed, Wiley Blackwell, 2.18

MUNN, C.B., **Marine Microbiology : Ecology and Applications**, 2nd ed., Garland science, 2011

Madigan, M.T. , K. S. Bender, D. H. Buckley, W.M. Sattley, D. A. Stahl., **Brock Biology of Microorganisms**, 16th ed., Pearson Education, 2022

Complementary Bibliography

Madigan, M. Martinko, J. M., Bender, K. y otros, **Brock Biology of Microorganisms**, 14th ed, Pearson Education, 2015

Willey, J.M., Sherwood, L. M. & otros, **Prescott Microbiology**, 10 th ed., McGraw-Hill Education, 2017

Johnson, T. R. & otros, **Laboratory Experiments in Microbiology**, 11th ed, Pearson, 2016

Rigel, N, Izquierdo, J., **Laboratory Exercises in Microbiology**, 12ª ed, McGraw-Hill, 2022

Recommendations

Subjects that continue the syllabus

Marine microbiology and parasitology/V10G061V01411

IDENTIFYING DATA				
Chemical oceanography II				
Subject	Chemical oceanography II			
Code	V10G061V01209			
Study programme	Grado en Ciencias del Mar			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	2nd	2nd
Teaching language	#EnglishFriendly Spanish Galician			
Department				
Coordinator	Nieto Palmeiro, Óscar			
Lecturers	Calle González, Inmaculada de la Nieto Palmeiro, Óscar			
E-mail	palmeiro@uvigo.es			
Web	http://http://depc07.webs.uvigo.es/			
General description	This subject presents the chemical methodology applied to the determination of the compounds of greatest interest in Chemical Oceanography, from sample taking to obtaining the final result.			
	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	
A2	Students can apply their knowledge and understanding in a manner that indicates a professional approach to their work or vocation, and have competences typically demonstrated through devising and sustaining arguments and solving problems within their field of study
A4	Students can communicate information, ideas, problems and solutions to both specialist and non-specialist audiences
B1	Know and use vocabulary, concepts, principles and theories related to oceanography and apply everything learned in a professional and/or research environment.
B2	Plan and execute surveys in the field and laboratory work, applying basic tools and techniques for sampling, data acquisition and analysis in the water column, sea bottom and marine substratum.
B3	Recognize and implement good practices in measurement and experimentation, and work responsibly and safely both in field surveys and in the laboratory.
B4	Manage, process and interpret the data and information obtained both in the field and in the laboratory.
C6	Acquire the fundamentals and terminology of chemical processes.
C7	Apply to the marine and coastal environment the principles and methods used in Chemistry.
D1	Develop the search, analysis and synthesis of information skills oriented to the identification and resolution of problems.
D2	Acquire the ability to learn autonomously, continuously and collaboratively, organizing and planning tasks over time.

Expected results from this subject

Expected results from this subject	Training and Learning Results			
Describe the foundations and the applications of the technicians of chemical analysis more usually used in the laboratory.	A2 A4	B1 B2 B3	C6 C7	D1
Know choose and use the material for the taking of sample of the water of mar.	A2 A4	B1 B2 B3	C6 C7	D1 D2
Apply the technicians of chemical analysis to the compounds of greater interest in the Chemical Oceanography.	A2 A4	B1 B2 B3 B4	C6 C7	D1 D2
Apply the experimental conditions more adapted for the determination of a chemical compound in function of the chemical reactivity.	A2 A4	B1 B2 B3 B4	C6 C7	D1 D2
Know realise all the necessary calculations to determine the final concentration of a compound in the water of sea in function of the analytical technician used.	A2 A4	B1 B2 B3 B4	C6 C7	D1 D2

Prepare the reagents and the necessary material to carry out an oceanographic campaign.	A2 A4	B1 B2 B3	C6 C7	D1 D2
Interpretation of results in chemical oceanography throughout deptc profiles.	A4	B1 B4	C7	

Contents

Topic	
Analytical methodology (I): previous operations	The analytical methodology of chemical measurement. Sampling. Preparation of the sample.
Analytical methodology (II): measurement techniques.	Gravimetric and volumetric methods. Instrumental techniques of analysis.
Analytical methodology (III): measure and chemical references-analytical.	Accuracy and precision. Limits of confidence. Linear regression adjustment by least squares.
Determination of salinity in seawater other major compounds	Determination of the salinity: chlorinity and chlorosity. Determination of major anions and cations.
Alkalinity of seawater	Measure of the temperature and pH in seawater. Determination of the alkalinity in seawater. Physicochemical parameters related with the salinity, temperature, pH and alkalinity in seawater. Concentration profile of carbon dioxide in the water column.
Oxygen dissolved	Determination of dissolved oxygen in seawater. Concentration profile of dissolved oxygen in the water column.
Nutrients: species of N, P, Si	Determination of phosphate and silicate in seawater. Determination of nitrates, nitrites and ammonium in seawater. Concentration profiles of nutrients in the water column.
Organic matter in the oceans	Fluorimetry: Determination of humic substances and other fluorescent substances. Chromatographic techniques: determination of photosynthetic pigments.
Metals traces	Atomic spectrometry. Determination of trace elements in seawater.

Planning

	Class hours	Hours outside the classroom	Total hours
Introductory activities	1	1	2
Lecturing	18	39	57
Problem solving	6	15	21
Laboratory practical	20	0	20
Seminars	7	7	14
Report of practices, practicum and external practices	0	20	20
Essay questions exam	0	12	12
Objective questions exam	2	0	2
Problem and/or exercise solving	2	0	2

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

Methodologies

	Description
Introductory activities	In this activity, the syllabus to develop during the semester will be presented to the students, as well as the aims, competences and evaluation criteria. Likewise it will explain them the way to develop the subject along the semester, will create the groups that will make the integrated methodologies.
Lecturing	During the teaching of each topic, students will have notes on the Moovi platform on the subject to be covered in the classroom session, which will be available days before the class session. The lecturer will present the topics in the classroom and a series of questions will be asked to promote critical thinking during the classroom session. The notes will no longer be available on the Moovi platform one week after the end of the course.
Problem solving	During the classroom sessions dedicated to "Problem solving", students will learn how to calculate concentrations of compounds of oceanographic interest in seawater from data usually obtained in the laboratory. The statements of these problems and their resolution will be available on the Moovi platform.

Laboratory practical	Students will carry out laboratory practicals on the determination of chemical parameters characteristic of seawater as well as chemical compounds of interest in chemical oceanography: - Chlorosity and chlorinity. - Total alkalinity. - Dissolved oxygen. - Phosphate in seawater. - Metals in seawater by atomic spectrometry. The practical reports must be submitted in the stipulated time, be original and will be evaluated by the teacher according to the evaluation criteria published on the Moovi platform. Unjustified absence from one of the practical sessions will result in the non-evaluation of this part of the course, which must be repeated in the following year. Students who took this part of the course during the academic year 2025-26 and obtained a grade equal to or higher than 5 points are not obliged to take this part of the course.
Seminars	In seminar session 1, students will carry out an original project related to a boat trip to carry out a chemical oceanography study. In session 2, students will carry out the necessary calculations for the preparation of reagents to be able to carry out the determinations programmed in the boat trip planned in session 1. In sessions 3 and 4, students will carry out the construction of depth profiles from data obtained in a laboratory. After the seminar sessions, students will have to answer questionnaires that will appear on the Moovi platform by the stipulated deadline. Unjustified absence from one of the practical sessions will result in the non-evaluation of this part of the course, which must be repeated in the following year. Students who took this part of the course during the academic year 2025-26 and obtained a grade equal to or higher than 5 points are not obliged to take this part of the course.

Personalized assistance

Methodologies	Description
Laboratory practical	The student who wishes to do so may have access to personalised tutoring arranged for him or her, and it is therefore necessary that the student contact the teacher well in advance. These tutorials can be done in person in the offices of the teachers or through the virtual offices that the teachers have in campusremotouvigo.gal . Likewise, any doubts that arise to the student can be formulated through the forums that are enabled for this on the Moovi platform.
Seminars	The student who wishes to do so may have access to personalised tutoring arranged for him or her, and it is therefore necessary that the student contact the teacher well in advance. These tutorials can be done in person in the offices of the teachers or through the virtual offices that the teachers have in campusremotouvigo.gal . Likewise, any doubts that arise to the student can be formulated through the forums that are enabled for this on the Moovi platform.
Introductory activities	The student who wishes to do so may have access to personalised tutoring arranged for him or her, and it is therefore necessary that the student contact the teacher well in advance. These tutorials can be done in person in the offices of the teachers or through the virtual offices that the teachers have in campusremotouvigo.gal . Likewise, any doubts that arise to the student can be formulated through the forums that are enabled for this on the Moovi platform.
Lecturing	The student who wishes to do so may have access to personalised tutoring arranged for him or her, and it is therefore necessary that the student contact the teacher well in advance. These tutorials can be done in person in the offices of the teachers or through the virtual offices that the teachers have in campusremotouvigo.gal . Likewise, any doubts that arise to the student can be formulated through the forums that are enabled for this on the Moovi platform.
Problem solving	The student who wishes to do so may have access to personalised tutoring arranged for him or her, and it is therefore necessary that the student contact the teacher well in advance. These tutorials can be done in person in the offices of the teachers or through the virtual offices that the teachers have in campusremotouvigo.gal . Likewise, any doubts that arise to the student can be formulated through the forums that are enabled for this on the Moovi platform.

Assessment

	Description	Qualification	Training and Learning Results
Lecturing	The students, during two sessions of classroom teaching, will make in each of them a questionnaire type test with 20 questions on the topics that have been taught to date. This questioned will be accessible from the Moovi platform, through the "safe exam browser" application, for all those students present in the classroom and will have a maximum time of 20 minutes to do so. Each well-answered question will have a value of 0.50 points and the poorly answered questions will subtract 0.25 points each. Unanswered questions will not add or subtract points. The final grade of these two tests shall be calculated with the geometric mean of the grades obtained.	5	A2 B1 C6 D1 A4 B2 C7 D2 B3

Problem solving	The students, during two classroom teaching sessions, will solve in each of them a problem on the calculation of the concentration of a compound of interest in oceanography, using a method of chemical analysis, from the data normally obtained in a laboratory work, and express the result with the correct significant units and figures. This problem will be accessible from the Moovi platform, through the "safe exam browser" application, for all students present in the classroom and will have a maximum time of 25 minutes to do it. The result obtained shall be evaluated. The final grade of these two tests shall be calculated with the geometric mean of the grades obtained.	5	A2 B1 C6 D1 A4 B2 C7 D2 B3 B4
Laboratory practical	The laboratory practicals are compulsory for all students and will be evaluated according to the work done during the laboratory sessions, according to quality criteria published on the Moovi platform.	3.75	A2 B1 C6 D1 A4 B2 C7 D2 B3 B4
Report of practices, practicum and external practices	The laboratory work and the practical report will be assessed by the teaching staff according to previously established criteria based on rubrics that will be published on the Moovi platform. In the event that the work is not original (it is a copy of another work or from the network), the teacher will not evaluate the work.	21.25	A2 B1 C6 D1 A4 B2 C7 D2 B3 B4
Essay questions exam	Seminar sessions are mandatory for all students, except those who have them validated from the 2025-26 course. At the end of each seminar session, students will have to answer a questionnaire accessible on the Moovi platform within the established deadline.	25	A2 B1 C6 D1 A4 B2 C7 D2 B3 B4
Objective questions exam	In the final exams, students will have to take a multiple-choice exam in which they will answer 40 questions on the aspects presented in the Master Class sessions. In each question, students will select a single answer that they consider correct. Each correctly answered question will be worth 0.250 points and incorrectly answered questions will subtract 0.125 points. Unanswered questions will neither add nor subtract points each.	20	A2 B1 C6 D1 A4 B2 C7 D2 B3
Problem and/or exercise solving	The problems will consist of calculating the concentration of a compound of interest in oceanography, using a method of chemical analysis, from data normally obtained in laboratory work, and expressing the result with the correct units and significant figures. The result obtained will be evaluated, as well as the clarity and reasoning used to arrive at it. The final examination will consist of the solution of three problems of this type and the mark for each problem will appear in the statement of the examination.	20	A2 B1 C6 D1 A4 B2 C7 D2 B3 B4

Other comments on the Evaluation

The date, time and place of the evaluation tests will be published on the official website of the Faculty of Marine Sciences:

<http://mar.uvigo.es/alumnado/examen/es/>

The subject consists of four main blocks and the score of each of them is weighted with 25% on the final grade:

To pass the subject you will need to pass with a minimum of 5 points out of 10 in each of these blocks. If the minimum mark is not exceeded in any of the blocks, the maximum mark which may be entered in the Minutes shall be 4,5 points.

1.-Part of theory.

This part is divided into "Objective Questions Exam", 20%, and the tests included in "Lecturing", 5%. To consider passed this part, the student/a will have to obtain a grade equal to or greater than 5 points in each of the tests.

If the grade obtained in the "Objective Questions Exam" is equal to or greater than 5 points and, in turn, higher than that achieved in the "Lecturing" tests, the final grade in Block 1 shall be that of "Objective Questions Exam".

2.-Part of problems.

This part is divided into "Problem and/or Exercise Solving", 20%, and tests included in "Problem Solving", 5%. To consider passed this part, the student/a will have to obtain a grade equal to or greater than 5 points in each of the tests.

If the grade obtained in the "Problem and/or Exercise Solving" is equal to or greater than 5 points and, in turn, higher than the one achieved in the "Problem Solving" tests, the total grade in Block 2 shall be that of "Problem and/or Exercise Solving".

In case of not reaching the minimum score in blocks 1.- and/or 2.-, the student, individually, will have to perform again in the 2nd chance exam part of the exam "Objective Questions Exam" and/or "Problem and/or Exercise Solving" not exceeded, respectively.

3.-Seminar work (Essay Questions Exam, 25%).

The final grade of the seminars will be calculated with the geometric mean obtained with the grades of each of the questionnaires performed. To be considered passed this test, the student will have to obtain a grade equal to or greater than 5 points.

In case of not reaching the minimum score in block 3.-, the student, individually, will have to carry out again the questionnaires of those sessions of seminars in which it has obtained a qualification inferior to 5 points in the term that the corresponding teacher will consider appropriate.

4.-Laboratory practices part.

The work carried out in the laboratory ("*Laboratory Practical*", 3.75%, 1.5 points out of 10) and the corresponding "*Report of practices, practicum and external practices*" (21.25%, 8.5 points out of 10) will be evaluated following criteria that will be published in the *Moovi* platform. The average grade of laboratory practice shall be calculated on the basis of the geometric mean of the grades obtained in each of the practices. To be considered passed this test, the student will have to obtain a grade equal to or greater than 5 points.

In case of not reaching the minimum score in block 4.-, the student, individually, will have to send again the reports of practices of those sessions in which he/she obtained a grade below 5 points with the relevant corrections, within the period deemed appropriate by the teacher concerned.

The performance by the students of any test of those shown in the table above, will be taken into account immediately for the final grade and will appear in the minutes as a student presented in the corresponding call.

The unjustified absence to one of the sessions of seminars and/or practices, blocks 3.- and 4.-, supposes the evaluation of the block that corresponds with a score of 0 points, being repeated in its entirety in the next course.

The ratings and each of the blocks will be published on the *Moovi* platform, indicating the date, time and place of the corresponding revisions.

Overall evaluation option. The application for this evaluation option will have to be submitted in the time and form determined by the Center, which will be published before the beginning of the academic year. Given the experimental nature of the practices and seminars, attendance is mandatory to qualify for this evaluation option. **Failure to attend the internship, without justified cause, invalidates this possibility, as well as the opportunity for extraordinary evaluation (2nd opportunity).**

Students are required to conduct this subject responsibly and honestly. Any form of fraud (e.g. copying and/or plagiarism) aimed at distorting the level of knowledge or skill achieved by students in any type of test, report or work designed for this purpose is considered inadmissible. Fraudulent conduct may involve suspension in the matter during a full course. An internal record shall be kept of these proceedings in order to request the Rectorate to open a disciplinary file in the event of a repeat offence.

If the subject does not pass, only the following tests will be validated for the following course, if they have passed:-
Laboratory Practical.- Report of practices, practicum and external practices.- Essay Questions Exam (seminars).

Sources of information

Basic Bibliography

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Beiras R., Pérez S. (Eds.), **Manual de métodos básicos en contaminación acuática**, Universidade de Vigo,

Gianguzza A., **Marine chemistry: an environmental analytical chemistry approach**, Springer,

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Chester R., **Marine Geochemistry**, 2, Blackwell Science,

Bearman G. (ed.), **Sewater: its composition, properties and behaviour**, 2, The Open University. Pergamon Press,

Horwitz W., Latimer G.W., **Official methods of analysis of AOAC International**, 18, AOAC International, cop.,

Miller J.N., Miller J.C., **Estadística y Quimiometría para Química Analítica**, Prentice-Hall,

Burriel F., Lucena F., Arribas S., Hernández J., **Química Analítica Cualitativa**, 14, Paraninfo,

Recommendations

Subjects that continue the syllabus

Chemistry applied to the marine environment II/V10G061V01309

Subjects that it is recommended to have taken before

Chemistry: Chemistry 2/V10G061V01110

Chemistry: Chemistry I/V10G061V01105

Chemical oceanography I/V10G061V01204

Other comments

It is assumed that students are familiar with the following chemistry concepts before starting the course:

- chemical formulation and nomenclature
- calculation of concentrations
- adjustments of basic chemical reactions and calculation of stoichiometric ratios.

It is also assumed that students are able to teach themselves how to use a scientific calculator, especially with regard to the calculation of basic statistical parameters (arithmetic mean and standard deviation), and the adjustment of a linear plot by least squares.

IDENTIFYING DATA				
Marine zoology				
Subject	Marine zoology			
Code	V10G061V01210			
Study programme	Grado en Ciencias del Mar			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	2nd	2nd
Teaching language	#EnglishFriendly Spanish English			
Department				
Coordinator	Vázquez Otero, María Elsa Paredes Rosendo, Estefanía Ramil Blanco, Francisco José			
Lecturers	Fernández Pujó, Wendy Paredes Rosendo, Estefanía Paz Sedano, Sofia Ramil Blanco, Francisco José Vázquez Otero, María Elsa			
E-mail	framil@uvigo.gal eotero@uvigo.es eparedes@uvigo.es			
Web	http://https://mar.uvigo.es/			
General description	With this subject intends to give to the student a basic knowledge in Marine Zoology, through the study of the different filos that integrate the marine fauna. It will study, in each case, the general plan of organisation, the external morphology, the internal anatomy, the reproduction and the embryonic development and the ranking. Likewise they will include notions envelope his vital activity, habitat and distribution. International students may request from the teachers: a) resources and bibliographic references in English, b) mentoring sessions in English, c) exams and assessments in English.			

Training and Learning Results	
Code	
A2	Students can apply their knowledge and understanding in a manner that indicates a professional approach to their work or vocation, and have competences typically demonstrated through devising and sustaining arguments and solving problems within their field of study
A3	Students have the ability to gather and interpret relevant data (usually within their field of study) to inform judgments that include reflection on relevant social, scientific or ethical issues
A4	Students can communicate information, ideas, problems and solutions to both specialist and non-specialist audiences
A5	Students have developed those learning skills that are necessary for them to continue to undertake further study with a high degree of autonomy
B1	Know and use vocabulary, concepts, principles and theories related to oceanography and apply everything learned in a professional and/or research environment.
B2	Plan and execute surveys in the field and laboratory work, applying basic tools and techniques for sampling, data acquisition and analysis in the water column, sea bottom and marine substratum.
B4	Manage, process and interpret the data and information obtained both in the field and in the laboratory.
C1	know at a general level the fundamental principles of sciences: Mathematics, Physics, Chemistry, Biology and Geology.
C9	Acquire basic knowledge about the structural and functional organization and the evolution of marine organisms.
C10	Know the biological diversity and functioning of marine ecosystems.
D1	Develop the search, analysis and synthesis of information skills oriented to the identification and resolution of problems.
D2	Acquire the ability to learn autonomously, continuously and collaboratively, organizing and planning tasks over time.

Expected results from this subject		
Expected results from this subject	Training and Learning Results	
Handle vocabulary, codes and inherent concepts to the marine zoology	A2	C1
Know and comprise the essential facts, concepts, principles and theories related with the marine zoology.	A2	
Know the basic techniques of sampling of the fauna in the column of water, and diverse types of fund	A2 A5	
Basic knowledge of the methodology of investigation in marine zoology	A2	B1 B2

Capacity to identify and understand the problems related with the marine zoology	A3	B1	C1 C9	D1
Know work in campaigns and in laboratory of responsible way and sure, promoting the tasks in team	A2	B2		D1 D2
Transmit information of form written, verbal and graphic for audiences of diverse types	A2 A4			
Capacity of analysis and synthesis	A2 A3	B4		D1
Capacity of organisation and planning		B2 B4		D1 D2
Oral communication and writing in the official tongues of the University	A4			
Capacity to work in one instrument	A5			D2
Capacity to learn of autonomous and continuous form	A5			D2
Capacity to apply the knowledges in practice	A2 A4	B4		D1
Skills of investigation	A2 A3 A4 A5	B1 B2 B4	C1 C9 C10	D1 D2

Contents

Topic	
LESSON 1: INTRODUCTION	Definition and objectives of the subject. General characteristics of the metazoa: definition and models of organisation
LESSON 2: PHYLUM PORIFERA. PHYLUM PLACOZOA.	PORIFERA: general characteristics, cell types and skeleton. Types of organisation. Reproduction and development. Systematic summary. PLACOZOA: Form and function.
LESSON 3: PHYLUM CNIDARIA	General characteristics. Polymorphism: The polyp and the medusa. Cell types. Reproduction. Systematic summary. Hydrozoa, Scyphozoa, Staurozoa, Cubozoa and Anthozoa: form and function.
LESSON 4: PHYLUM CTENOPHORA	General characteristics. (Cephalopod organisation) Form and function. Reproduction. Systematic summary
LESSON 5: THE BILATERIA: INTRODUCTION. PHYLA XENACOELOMORPHA, PLATYHELMINTHES, GASTROTRICHA AND "MESOZOA"	Introduction to Bilateria. Phylum Xenacoelomorpha: Form and function. Phylum Platyhelminthes: General characteristics and classification; Turbellaria: form and function. Phylum Gastrotricha: General characteristics and classification; Turbellaria: form and function. Phylum Mesozoa: General characteristics and classification.
LESSON 6. THE GNATHIFERA AND ANOTHER LOWER PROTOSTOMATES	Phyla Gnathostomulida, Rotifera, Cycliophora, and Entoprocta: form and function.
LESSON 7: The LOPHOPHORATES.	General characteristics. Phylum Bryozoa: Form and function; reproduction and development; systematic summary. Phylum Brachiopoda: Form and function; reproduction and development; systematic summary. Phylum Phoronida: Form and function; reproduction and development.
LESSON 8: PHYLUM MOLLUSCA (I)	General characteristics. (Cephalopod organisation) Form and function. Classification. Synopses of the lower class (Caudofoveata, Solenogastrea, Polyplacophora, Monoplacophora and Scaphopoda)
LESSON 9: PHYLUM MOLLUSCA (II)	Class Gastropoda: general characteristics; coiling; torsion; (corporate organisation) form and function; reproduction and development; systematic summary
LESSON 10: PHYLUM MOLLUSCA (III)	Class Bivalvia: general characteristics; (corporate organisation): form and function; reproduction and development; systematic summary
LESSON 11: PHYLUM MOLLUSCA (IV)	Class Cephalopoda: general characteristics; (corporate organisation): form and function; reproduction and development; systematic summary
LESSON 12: PHYLUM NEMERTEANS	Phylum Nemertea: General characteristics; (corporate organisation) form and function; reproduction and development; systematic summary.
LESSON 13: PHYLUM ANNELIDA	General characteristics; metamerism; classification. Class Polychaeta: general characteristics; (corporate organisation): form and function; reproduction and development. Specific features of Siboglinids, Echiurids and Sipunculids
LESSON 14: ECDISOZOA: INTRODUCTION and LOWER PHYLA	Definition and systematic summary . Phyla Nematoda, Kinorhyncha, Priapulida, Loricifera and Tardigrada: form and function.

LESSON 15: PHYLUM ARTHROPODA	General characteristics. (Corporal organisation) Form and function. Classification. Subphylum Cheliceriformes: General characteristics; Classification. Merostomata and Pycnogonida: form and function.
LESSON 16: PHYLUM ARTHROPODA: SUBPHYLUM CRUSTACEA (I)	General characteristics. Reproduction and development. Classification.
LESSON 17: PHYLUM ARTHROPODA: SUBPHYLUM CRUSTACEA (II)	Class Malacostraca: (corporal organisation) form and function, life forms and classification (Phyllocarida, Hoplocarida and Eumalacostraca).
LESSON 19: THE DEUTEROSTOMES. PHYLUM CHAETOGNATHA. PHYLUM ECHINODERMATA	Phylum Chaetognatha: General characteristics. Form and function. Reproduction and development. Phylum Echinodermata: General characteristics. (Corporal organisation) Form and function. Endoskeleton. Water vascular system.
LESSON 18: PHYLUM ARTHROPODA: SUBPHYLUM CRUSTACEA (III)	Class Remipedia, Cephalocarida, Branchiopoda, Mistacocarida, Copepoda, Ostracoda and Thecostraca: external anatomy and life forms; form and function.
LESSON 20: PHYLUM ECHINODERMATA (II)	Class Crinoidea, Asteroidea and Ophiuroidea: General characteristics; (corporal organisation:) form and function; reproduction and development. Systematic summary
LESSON 21: PHYLUM ECHINODERMATA (III)	Class Echinoidea and Holothuroidea: General characteristics; (corporal organisation:) form and function; reproduction and development. Systematic summary
LESSON 22: PHYLUM HEMICHORDATA	General characteristics and classification. Class Enteropneusta and Pterobranchia: general characteristics; form and function; reproduction and development.
LESSON 23: PHYLUM CHORDATA (I)	General characteristics and classification. Subphyla Tunicata and Cephalochordata: general characteristics; form and function; reproduction and development.
LESSON 24: PHYLUM CHORDATA (II)	The Agnatha: general characteristics and classification. Class Myxini and Cephalaspidomorphi: form and function. The Chondrichthyes: general characteristics; (corporal organisation:) form and function; reproduction and development; systematic summary.
LESSON 25: PHYLUM CHORDATA (III)	The Osteichthyes: general characteristics; habitat and distribution; form and function; functional adaptations; migrations; reproduction and development; systematic summary.
LESSON 26: PHYLUM CHORDATA (IV)	The Marine Tetrapoda: main groups; adaptations of the reptilia, birds and mammalian to the marine environment; systematic summary and general characteristics of the orders

PRACTICAL LESSONS

Lesson 1.- PORIFERA. The skeleton of Sponges: methods of extraction and preparation of spicules; microscopical study.

Lesson 2.- CNIDARIA. The polyp and the medusa: morphology. Observation of representatives of Hydrozoa, Scyphozoa and Anthozoa.

Lesson 3.- MOLLUSCA I. External morphology of the main groups: Polyplacophora, Scaphopoda, Bivalvia, Gastropoda and Cephalopoda; identification with keys of several species.

Lesson 4.- MOLLUSCA II. Internal anatomy: dissection of a Bivalvia: *Mytilus galloprovincialis*.

Lesson 5.- POLYCHAETA. External morphology: Errantia and Sedentaria polychaetes; identification with keys of some species.

Lesson 6.- ARTHROPODA I. Crustacea: External morphology; internal anatomy: and dissection of a Malacostraca: *Nephrops norvegicus*; observation and identification of brachiurans.

Lesson 7.- ARTHROPODA II. Crustacea: observation of Amphipoda, Isopoda, Cirripedia and Copepoda; identification with keys of some species. Pycnogonida And Xiphosura: observation of some exemplars.

Lesson 8.- ECHINODERMATA I. External morphology of the main groups. Identification with keys of several species.

Lesson 8.- ECHINODERMATA II. External morphology and internal anatomy: dissection of a Echinoidea: *Paracentrotus lividus*.

Lesson 10.- Chordata. Observation of Tunicata and Cephalochordata; external morphology, identification and dissection of a Osteichthyes.

Planning

	Class hours	Hours outside the classroom	Total hours
Laboratory practical	20	20	40
Seminars	2	2	4
Collaborative Learning	3	30	33
Lecturing	27	40.5	67.5
Problem and/or exercise solving	0.5	0	0.5
Laboratory practice	0.5	0	0.5
Essay	2	0	2
Objective questions exam	2.5	0	2.5

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

Methodologies

	Description
Laboratory practical	Attendance is compulsory; in order for the laboratory sessions to be evaluated, attendance to at least 80% of them is required. Attendance to at least 80% of the internship will be required in order for the internship to be evaluated. Study of the external and internal anatomy of the main groups using common microscopical techniques in Zoology
Seminars	During the first seminar there will be an exposition of a topic considered of relevance in the training in Marine Zoology and directly related to the practical work that must be done. Also, the methodology to do the collaborative work will be explained. Possible doubts will be solved. In the second seminar, the students will present the results achieved in the collaborative work. Attendance is compulsory

Collaborative Learning	Collaborative learning through a mainly practical work in small groups. The works will include the following phases: sampling through photographic transects, identification of the fauna in the photographs and their adaptations to their habitat, and writing the results. The other collaborative work is related to the labels of fish and shellfish in the markets and fish auctions. Students have to take pictures of fish and shellfish and to their labels. Then they have to compare the information of the labels with the required information by the regulations. Finally, students have to study the biology of these fish and shellfish and its relationship with the fishery.
Lecturing	This method refers to the explanation of the topics to the students. The teacher clarifies the syllabus content to the students. Although teachers are more active than students the teacher will ask questions to keep the students attentive.

Personalized assistance

Methodologies	Description
Lecturing	Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation
Laboratory practical	Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation
Seminars	Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation
Collaborative Learning	Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation

Assessment

	Description	Qualification	Training and Learning Results			
Laboratory practical	Attendance to the laboratory sessions is mandatory and attendance to at least 80% of the internships will be required in order for this methodology to be evaluated. The attendance and the work done by the students during the realization of the practices in the laboratory (1 point, 10%) A practical exam in the laboratory at the end of the course (1,5 points, 15%). To pass this methodology, students have to get a minimum mark of 4 out of 10 points in the practical exam.	25	A2 A5	B1 C9 C10	D1	
Seminars	Assistance and participation of the students in the two seminars and the presentation of the works done by students will be evaluated. Also their participation in the subsequent discussion will be evaluated.	5	A2 A3 A4 A5	B1 B2 B4	D1 D2	
Collaborative Learning	The ability to work together autonomously as well as the writing document of the results obtained (2 points, 20%). To pass this methodology, students have to get a minimum mark of 0,8 points in the assignments.	20	A2 A3 A4 A5	B1 B2 B4	D1 D2	
Lecturing	Continuous assessment: four mid term multiple choice tests (10 minutes) will be done during the semester. These tests will not get rid of themes. Each one will be score up to 0.5 points (2 points in total, 20%) Final exam: a major written exam will be done with short answer questions (3 points, 30%) Both results will be added. To pass this methodology, students have to get a minimum mark of 2 points.	50	A2 A5	B1 C9 C10		

Other comments on the Evaluation

The update official calendar of the final exams can be found at: <http://mar.uvigo.es/alumnado/examenes/>
The final qualification of the subject is the sum of the mark obtained in each of the proposed methodologies, provided that the rating of each one of them exceed 40% of the mark. This also applies to students that opt to the global assessment option.

Laboratory practical: in the case of unexcused absences higher than 20%, there will be no right to the recovery of this

learning methodology in the second opportunity. In the case of not reaching 40% of the grade of the laboratory exam, students will have the right to take another laboratory exam at the second opportunity.

Collaborative learning: in the case of not reaching 40% of the grade in the collaborative work, the student will be entitled to submit new work in the second opportunity.

Seminars: in the case of unexcused absences, students will not have the right to recover this methodology at the second opportunity.

Lectures: in the second opportunity the final exam will be worth 5 points (50%); follow-up tests (continuous evaluation) are carried out throughout the course will not be taken into account. The exam will consist of a multiple-choice part similar to the follow-up tests and another part of short answers.

In the second opportunity the student must present only failed methodologies.

NOT EVALUATED qualification will be applied to students who will not present or the final exam of theory or the practical exam.

The marks obtained in laboratory practical, seminars and tutorized works will be kept for the next course.

Global assessment option

The global assessment option will consist of a written exam of the theoretical contents (50% of the qualification) and of the seminars (European regulation of fish and shellfish labeling and zoning in the rocky intertidal in Galicia) (25%), followed by an exam in the laboratory in which the knowledge and skills of the students in the practical contents of the subject will be evaluated (25%).

The application for this evaluation option must be submitted in the time and manner determined by the Center, which will be published prior to the academic start. Given the experimental nature of the practices, attendance at them is mandatory to be eligible for this evaluation option. **Failure to attend the practices, with no justified cause invalidates this possibility, as well as the opportunity for extraordinary evaluation (2nd opportunity).**

Students are strongly requested to fulfill a honest and responsible behaviour. It is considered completely unacceptable any alteration or fraud (i.e., copy or plagiarism) contributing to modify the level of knowledge and abilities acquired in exams, evaluations, reports or any kind of teacher's proposed work. Fraudulent behaviour may cause failing the course for a whole academic year. An internal dossier of these activities will be built and, when reoffending, the university rectorate will be asked to open a disciplinary record.

Sources of information

Basic Bibliography

HICKMAN C. P.; KEEN S. L.; EISENHOUR D. J.; LARSON A.; JANSON H., **INTEGRATED PRINCIPLES OF ZOOLOGY**, 19th EDITION, MCGRAW HILL, 2024

HICKMAN, C. P.; KEEN, S. L.; EISENHOUR, D. J.; LARSON, A.; JANSON, H., **PRINCIPIOS INTEGRALES DE ZOOLOGIA**, 18ª EDICION, INTERAMERICANA, 2021

BRUSCA, R. C. Y BRUSCA, G. J., **INVERTEBRADOS.**, 2ª EDICIÓN, MCGRAW HILL-INTERAMERICANA, 2005

BRUSCA, R.C.; GIRIBET, G.; MOORE, W., **INVERTEBRATES**, 4ª EDITION, OXFORD UNIVERSITY PRESS, 2023

RUPPERT, E. E. Y BARNES, R. D., **ZOOLOGIA DE LOS INVERTEBRADOS.**, 6ª EDICION, INTERAMERICANA - MCGRAW HILL, 1996

BARNES, R.S.K.; CALOW, P.; OLIVE, P.J.W.; GOLDING, D.W.; SPICER, J.I., **THE INVERTEBRATES. A SYNTHESIS. 3rd EDITION. BLACKWELL SCIENCE**, 3ª EDITION, BLACKWELL SCIENCE, 2001

HELFMAN, G.S.; COLLETTE, B.B.; FACEY, D.E.; BOWEN, B.W., **THE DIVERSITY OF FISHES: BIOLOGY, EVOLUTION AND ECOLOGY**, 2ª EDICIÓN, WILEY-BLACKWELL, 2009

KARDONG, K. V., **VERTEBRADOS. ANATOMÍA COMPARADA, FUNCIÓN, EVOLUCIÓN.**, 3ª EDICION, MCGRAW HILL-INTERAMERICANA, 2007

KARDONG, K. V., **VERTEBRATES. COMPARATIVE ANATOMY, FUNCTION, EVOLUTION**, 8th EDITION, MCGRAW HILL-INTERAMERICANA, 2019

Complementary Bibliography

Recommendations

Subjects that continue the syllabus

Biological oceanography I/V10G061V01301

Biological oceanography II/V10G061V01306

Subjects that it is recommended to have taken before

Biology: Biology 2/V10G061V01106

IDENTIFYING DATA				
Biological oceanography I				
Subject	Biological oceanography I			
Code	V10G061V01301			
Study programme	Grado en Ciencias del Mar			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	3rd	1st
Teaching language	#EnglishFriendly Spanish			
Department				
Coordinator	Lastra Valdor, Mariano			
Lecturers	García-Boente Soto, Mariana Lastra Valdor, Mariano Moares Guedes, Jose Augusto Sobrino Garcia, Maria Cristina			
E-mail	mlastra@uvigo.gal			
Web	http://https://mar.uvigo.es/			
General description	This subject insight in the study of a number of coastal ecosystems, located in the sea-land interface, from a ecological approach. This includes beaches, rocky shore, saltmarshes, estuaries, seagrass, coastal lagoons, dunes, reefs and mangroves. The fundamental aim will be to understand the ecosystem functions, to analyze faunal assemblages and to describe the human impact that these environments face in an scenario of global change.			
	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 have the ability to gather and interpret relevant data (usually within their field of study) to inform judgments that include reflection on relevant social, scientific or ethical issues
A4	Students can communicate information, ideas, problems and solutions to both specialist and non-specialist audiences
A5	Students have developed those learning skills that are necessary for them to continue to undertake further study with a high degree of autonomy
B2	Plan and execute surveys in the field and laboratory work, applying basic tools and techniques for sampling, data acquisition and analysis in the water column, sea bottom and marine substratum.
B3	Recognize and implement good practices in measurement and experimentation, and work responsibly and safely both in field surveys and in the laboratory.
B4	Manage, process and interpret the data and information obtained both in the field and in the laboratory.
B5	Develop, implement and write basic or applied projects in oceanography from a multidisciplinary perspective.
C1	know at a general level the fundamental principles of sciences: Mathematics, Physics, Chemistry, Biology and Geology.
C9	Acquire basic knowledge about the structural and functional organization and the evolution of marine organisms.
C10	Know the biological diversity and functioning of marine ecosystems.
C11	Apply the knowledge and techniques acquired to the characterization and sustainable use of living resources and marine ecosystems.
D2	Acquire the ability to learn autonomously, continuously and collaboratively, organizing and planning tasks over time.
D3	Understanding the meaning and application of the gender perspective in different fields of knowledge and in professional practice with the aim of achieving a more just and equal society.
D5	Sustainability and environmental commitment. Equitable, responsible and efficient use of resources.

Expected results from this subject	
Expected results from this subject	Training and Learning Results
Through theoretical contents, practical, exits of field and the work of investigation, at the end of the course the student will have to have purchased the necessary knowledges that allow him interpret the operation of the coastal ecosystems (estuaries, beaches, coastal lagoons, etc), and his interaction with the anthropic activities in the open ocean.	A3 B2 C1 D2
	A4 B3 C9 D3
	A5 B4 C10 D5
	B5 C11

Contents
Topic

1. Estuaries	1.1. Introduction 1.2. Salinity and substrate 1.3. Vegetation and macrofauna 1.4. The communities of Petersen 1.5. The alimentary chain
3. Rocks	2.1. General appearances 2.2 Adaptations to the physical stress: temperature, waves, burial, .. 2.3. Coasts warmed up, exposed and moderately exposed. 2.4. Subtidal rocks 2.5. Control factors 2.6. The food chain
4. Beaches	3.1. Introduction 3.2. Types of Beaches 3.3. Zonation 3.4. Flora and fauna
5. Coastal lagoons	4.1. General characteristics 4.2. Lagoon organisms 4.3. Ecology of the coastal lagoons 4.4. Primary and secondary production
6. Dune systems	5.1. General characteristics 5.2. Characteristics of ecological importance 5.3. Dune vegetation 5.4. Fauna 5.5. Food chains
7. Mangroves	6.1. Distribution and physical conditions 6.2. Zonation 6.3. Ecological importance
8. Coral reefs	7.1. The paper of the zooxanthellae 7.2. Factors that limit the growth of the reefs 7.3. Geographic distribution and types of coral reefs 7.4. Productivity of the reef 7.5. Biological interactions and mutualism
9. Vertical structure in open ocean and coastal waters: biology of the superficial ocean.	8.1 Zonation of the oceanic region 8.2. Phytoplankton and zooplankton 8.3. Food webs

Planning

	Class hours	Hours outside the classroom	Total hours
Seminars	7	7	14
Laboratory practical	15	0	15
Studies excursion	0	10	10
Lecturing	25	37.5	62.5
Mentored work	0	34.5	34.5

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

Methodologies

	Description
Seminars	They will divide the groups in subgroups of 3-4 people. Each subgroup will prepare a work to choose between the subjects offered by the professor at the beginning of the course. Each student will have to involve clearly in all or some of the facets of the work. The works will be directed during the destined hours to the seminars. The oral exhibition will have a length of 20 minutes for the oral presentation and 5 minutes for the round of questions of the professor and of the rest of students. The presentation will come accompanied by an archive in computer support (PDF) that will send to the professor in dates fixed previously to the presentation.
Laboratory practical	With the samples taken during the exit to the sea, the students will learn to make separation, identification and headcounts of pertaining organisms to distinct groups of the *bentos. With the table of data obtained will work the statistical section from the univariant analysis, *bivariante and *multivariante. Although initially the academic calendar contemplates 5 days of practices of laboratory at a rate of 3 *h by day, by internal agreement between the *profesorado and the students, and after a better adaptation of the schedules to the design of the practices, will propose a calendar of 3 days at a rate of 5 hours by day. The agreement will reach by vote in one of the classes of theory to principle of course.

Studies excursion	They will conduct in the subject two field trips: 1) Sail along the the estuary of Vigo in the ship Mytilus, for the collecting benthic samples with quantitative dredges (Van-Veen). 2) Field trip to Aguiño (Ribeira, A Coruña) and Xuño beach and coastal lagoon.
Lecturing	They will present and they will argue theoretical contents that they will be evaluated in a final examination.
Mentored work	The works of investigation will be driving in group through the seminars. The students that belong to the same group will have to assist to same group of seminar.

Personalized assistance

Methodologies	Description
Lecturing	Theoretical classes on the subjects of the subject. Its content will be moved to the platform TEMA once that each subject have finalised. Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation. Tutoring schedules will be published on the Faculty's website.
Laboratory practical	3 groups of laboratory of 20 students roughly.
Seminars	3 groups of seminars, of roughly 15 students, and that will serve to give support to the works of investigation developed by the students.

Assessment

Description		Qualification	Training and Learning Results
Seminars	They will divide the students list in groups of 3-4 people. Each group will prepare a scientific work chosen from among the proposed by the own students or by the professor at the beginning of the course. The works will be supported during the destined hours to the seminars (small groups 2.5h). The exhibition of the works will take place in the date established in the calendar of the Faculty, and will have a length of 20 minutes for the oral presentation and 5 minutes for the round of questions of the professor and of the rest of students. The presentation will come accompanied by an archive in computer support (*powerpoint) as well as an archive in PDF in scientific format that will send to the professor in dates fixed in the calendar of *entregables of the Faculty.	40	A3 B2 C1 D2 A4 B3 C9 D3 A5 B4 C10 D5 B5 C11
Laboratory practical	The practical assistance of laboratory and to the field excursions will be mandatory. Will have to deliver a fascicle of practices (maximum 1500 words) in which they appear reflected the tasks, results and observations so much of the practices of laboratory as of the exits of field. It will evaluate the participation in the practices, the rigour in the work of sampling and laboratory, the aptitude for the work in team and the capacity to elaborate and interpret results.	20	A3 B2 C1 A4 B3 C9 A5 B4 C10 B5 C11
Lecturing	Examination written. They will make questions that show the level of understanding purchased by the students to the long of the matter, so much in the theoretical classes, as practical, seminars and field work.	40	A3 B2 C1 D2 A4 B3 C9 D3 A5 B4 C10 D5 B5 C11

Other comments on the Evaluation

To pass the subject it is necessary to pass each of the three tests (master sessions, research work and laboratory practices). Threshold score to pass each test: 5.

In the second call, there will be a written exam corresponding to the subject taught and the criteria established in the REGULATION ON ASSESSMENT, QUALIFICATION AND TEACHING QUALITY AND THE STUDENT LEARNING PROCESS of the University of Vigo will be followed.

The date, time and place of the evaluation tests, presentations and deliverables will be published on the official website of the Faculty of Marine Sciences: <http://mar.uvigo.es/alumnado/examenes/>

- **Global assessment option:** The application for this evaluation option must be submitted in the time and manner determined by the Center, which will be published prior to the academic start. Given the experimental nature of the practices, attendance at them is mandatory to be eligible for this evaluation option. **Failure to attend the practices and/or field trips, with no justified cause invalidates this possibility, as well as the opportunity for extraordinary evaluation (2nd opportunity).** Grades for practical work, research work, and field trips will be retained from one year

to the next, for one year only. Failure to attend practical work and/or field trips, or failure to complete research work, without justified cause, invalidates this option.

Students who take this subject are required to behave responsibly and honestly. Any form of fraud (copying or plagiarism) aimed at distorting the level of knowledge and skills achieved in any type of test, report or work is considered inadmissible. Fraudulent conduct may mean failing the subject for a full course. will keep an internal record of these actions so that, in case of recidivism, request the opening of a disciplinary file to the rector.

Sources of information

Basic Bibliography

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Little, C. & Kitching, J.A, **The Biology of rocky shores**, Second edition, Oxford University, 2009
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Barreiro F., Gómez M., López J., Lastra M. & la Huz R., **Coupling between macroalgal inputs and nutrients outcrop in exposed sandy beaches**, Hydrobiologia, 700: 73-84, 2013
Vila-Concejo A. & Kench P.S., **Storms in Coral Reefs: Processes and Impacts**, Coastal Storms, pp.127-149, 2017
Ansell, A.D, Gibson, R.N., Barnes, M., **Oceanography and Marine Biology, An annual review**, Aberdeen University Press, 1995
Shing Yip Lee et al., **Ecological role and services of tropical mangrove ecosystems: a reassessment**, Global Ecology and Biogeography 23 , 726-743, 2014

Recommendations

Subjects that continue the syllabus

Biological oceanography II/V10G061V01306

Subjects that are recommended to be taken simultaneously

Physiology of marine organisms/V10G061V01305

Geological oceanography I/V10G061V01303

Subjects that it is recommended to have taken before

Biology: Biology I/V10G061V01101

Biochemistry/V10G061V01201

Marine zoology/V10G061V01210

Biology: Biology 2/V10G061V01106

Marine botany/V10G061V01202

IDENTIFYING DATA				
Physical oceanography I				
Subject	Physical oceanography I			
Code	V10G061V01302			
Study programme	Grado en Ciencias del Mar			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	3rd	1st
Teaching language	#EnglishFriendly Galician			
Department				
Coordinator	Roson Porto, Gabriel			
Lecturers	Roson Porto, Gabriel Sánchez Carnero, Noela Belén			
E-mail	groson@uvigo.es			
Web	http://https://mar.uvigo.es/			
General description	Knowledge of the main physical processes in the ocean as well as their relevant climatological causes. 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	
A5	Students have developed those learning skills that are necessary for them to continue to undertake further study with a high degree of autonomy
B1	Know and use vocabulary, concepts, principles and theories related to oceanography and apply everything learned in a professional and/or research environment.
C3	Describe how works the global ocean circulation, its forcings and its climate implications.
C4	Know, analyze and interpret the physical properties of the ocean according to current theories, as well as to know the most relevant sampling tools and techniques.
C5	Formulate the mass, energy and moment conservation equations for geophysical fluids and solve them in basic oceanic processes.
D1	Develop the search, analysis and synthesis of information skills oriented to the identification and resolution of problems.

Expected results from this subject

Expected results from this subject	Training and Learning Results			
Basic knowledge of the climatological processes and the meteorological phenomena, with special attention to his influence on the oceanic processes.	A5	B1	C3 C5	D1
Descriptive knowledge of the main physical processes in the ocean			C3 C4	D1
Descriptive knowledge of the oceanic circulatory systems.		B1	C3 C4 C5	D1

Contents

Topic	
I. BASIC CLIMATOLOGY	I.1. Description of the atmosphere: composition, temperature and density with height. I.2. Electromagnetic radiation. Black body emission. Characteristics of solar and terrestrial radiation. I.3. Radiative budget. Albedo and absorption. The greenhouse effect. Energetic latitudinal disequilibrium of the Earth. General movements of air masses, planetary convective cells. I.2. Fundamentals of Meteorology: atmospheric pressure; vertical and horizontal structure. Surface maps: isobaric systems. Accelerations in isobaric systems; geostrophic equilibrium; horizontal and vertical circulation.

II. HYDROGRPHY AND WATER MASSES

II.1. TEMPERATURE

II.1.1. Surface distribution.

II.1.2. Temperature of the water column. Differences among three regions: Mixing layer, seasonal thermocline, main thermocline, deep waters.

II.1.3. Upwelling. Ekman spiral. Ekman Transport. Types of upwelling. Downwelling.

II.2. SALINITY

II.2.1. Conservative and no conservative components. Absolute and practical salinity.

II.2.2. Surface distribution and its relationship with balance precipitation + runoff - evaporation. Estuaries and estuarine circulation. Coupling estuarine circulation with upwelling and downwelling.

II.3. MASAS DE AGUA Y DIAGRAMAS TS

II.3.1. Water masses and water types. Abyssal circulation. Types of density variation in relation with water masses formation. The core method.

Identification of water masses circulation.

II.3.2. Equation of state of Seawater. Isopycnals. Density vertical profiles of by latitudes: The pycnocline. Density gradient and water masses stability.

II.3.3. TS diagrams. Mixing of water types; caballing. Stability of water masses using TS diagrams.

III. DYNAMICS OF OCEAN CURRENTS

III.1. Surface currents and wind systems. The westward intensification. Eulerian and lagrangian currents.

III.2. The subtropical and subpolar gyres. Equatorial currents. The Antarctic Circumpolar Current.

III.3. Dynamic topography and geostrophic currents. Barotropic and baroclinic regimes. Helland-Hansen equation.

III.4. Origin of the dynamic topography: cyclonic and anticyclonic winds. Convergences and divergences of the surface currents. Relationship with upwelling and downwelling. Ekman Pumping.

IV. REGIONAL OCEANOGRAPHY

IV.1. THE ANTARCTIC OCEAN.

IV.2. THE ATLANTIC OCEAN.

IV.3. THE MEDITERRANEAN SEA.

IV.4. THE PACIFIC OCEAN.

IV.5. THE INDIAN OCEAN.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	36	0	36
Seminars	16	8	24
Autonomous problem solving	0	46	46
Objective questions exam	1	3	4
Problem and/or exercise solving	0	20	20
Essay questions exam	4	16	20

*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 lessons
Seminars	Research work (obligatory attendance)
Autonomous problem solving	Exam

Personalized assistance

Methodologies	Description
Lecturing	Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation, only via institutional account @alumnado.uvigo.gal Monday-Tuesday-Wednesday 10-12 h.
Seminars	Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation, only via institutional account @alumnado.uvigo.gal Monday-Tuesday-Wednesday 10-12 h.

Autonomous problem solving Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation, only via institutional account @alumnado.uvigo.gal Monday-Tuesday-Wednesday 10-12 h.

Tests	Description
Objective questions exam	Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation, only via institutional account @alumnado.uvigo.gal. Monday-Tuesday-Wednesday 10-12 h.
Problem and/or exercise solving	Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation, only via institutional account @alumnado.uvigo.gal. Monday-Tuesday-Wednesday 10-12 h.
Essay questions exam	Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation, only via institutional account @alumnado.uvigo.gal. Monday-Tuesday-Wednesday 10-12 h.

Assessment					
	Description	Qualification	Training and Learning Results		
Objective questions exam	It is part of the official examination	20		C3	
Problem and/or exercise solving	Deliverable questions in seminars	40	B1	C4	
Essay questions exam	Official exam	40	A5	B1	C5 D1

Other comments on the Evaluation

Every report must be filed no later than 7 days after the seminar, and none will be evaluated if sent after that timeframe and the grade will be 0.

When a student files one report, his status in this subject will no be "nnot presented".

IMPORTANT REMARK: The treshold mark in the official test and seminars must be at least 5 (from 0 to 10).

The final grade of the subject (n) will be a weight of the final (official) test (eo), the intermediate test (iep), the seminars test (se), according to the formulas:

$$n = 0,4*eo + 0,4*se + 0,2*ep, \text{ if } eo \geq 5 \text{ y } se \geq 5$$

$$n = 0,2*eo + 0,2*se + 0,2*ep, \text{ if } eo < 5$$

Sources of information

Basic Bibliography

SENDIÑA, I y PÉREZ MUÑOZURI, V, **Fundamentos de meteorología**, Universidad de Santiago de Compostela, Servizo de Publicacións e Intercambio Científico,

ROSÓN G., **Problemas de Oceanografía Física: Ejercicios resueltos con y sin solución numérica**, 1ª EDICION, Servicio de Publicaciones, Universidade de Vigo, 2024

Varela, R.A. y G. Rosón., **Métodos en Oceanografía Física**, Editorial Anthias Biblioteca INNOVA,

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STEWART, R., **Introduction to Physical Oceanography**, Texas A&M University.,
<http://www.uv.es/hegigui/Kasper/por%20Robert%20H%2>,

TALLEY, LD, PICKARD, G., EMERY W & SWIFT, JH, **Descriptive Physical Oceanography**, 6ª edition.320 p., Elsevier ScienceDirect Books Complete, 2011

TOMCZAK, M. y J. STUART GODFREY, **Regional Oceanography: an introduction**, Pergamon. 422 p.,
<http://www.es.flinders.edu.au/~mattom/regoc/pdfver>,

Recommendations

Subjects that continue the syllabus

Physical oceanography II/V10G061V01307

Subjects that it is recommended to have taken before

Physics: Physics I/V10G061V01102
Mathematics: Mathematics I/V10G061V01104
Mathematics: Mathematics II/V10G061V01109
Physics: Physics II/V10G061V01203

IDENTIFYING DATA**Geological oceanography I**

Subject	Geological oceanography I			
Code	V10G061V01303			
Study programme	Grado en Ciencias del Mar			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	3rd	1st
Teaching language	#EnglishFriendly Spanish			
Department				
Coordinator	Rey García, Daniel			
Lecturers	Fontán Bouzas, Ángela Nombela Castaño, Miguel Angel Rey García, Daniel			
E-mail	danirey@uvigo.es			
Web	http://https://mar.uvigo.es/			
General description	Geological oceanography (also called marine geology) is one of the broadest fields in the Earth Sciences and contains many subdisciplines, including geophysics, and plate tectonics, petrology and geochemistry, sedimentation processes, and micropaleontology and stratigraphy. Geological Oceanography I will focus on the study of basic earth processes affecting sedimentation in litoral areas, since sediments are the main geological feature of these region. The subject will cover the fundamental techniques to study the topography, structure, sedimentation, and associated geological processes of these areas to discover how they were formed and how ongoing processes (coastal dynamics, climate change, human impact...) may change them in the future. The subject will deal with the peculiarity of combining terrestrial and marine data to study litoral and coastal processes. 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				
A1	Students have demonstrated knowledge and understanding in a field of study that builds upon their general secondary education, and is typically at a level that, whilst supported by advanced textbooks, includes some aspects that will be informed by knowledge of the forefront of their field of study			
A2	Students can apply their knowledge and understanding in a manner that indicates a professional approach to their work or vocation, and have competences typically demonstrated through devising and sustaining arguments and solving problems within their field of study			
A3	Students have the ability to gather and interpret relevant data (usually within their field of study) to inform judgments that include reflection on relevant social, scientific or ethical issues			
A5	Students have developed those learning skills that are necessary for them to continue to undertake further study with a high degree of autonomy			
B1	Know and use vocabulary, concepts, principles and theories related to oceanography and apply everything learned in a professional and/or research environment.			
B2	Plan and execute surveys in the field and laboratory work, applying basic tools and techniques for sampling, data acquisition and analysis in the water column, sea bottom and marine substratum.			
B5	Develop, implement and write basic or applied projects in oceanography from a multidisciplinary perspective.			
C12	Acquire knowledge about processes and products related to internal and external geological cycles.			
C13	Acquire the basic sedimentological, geochemical and geophysical techniques and methodologies used in identification, use and sustainability of the natural resources of coastal and marine environments.			
C14	Know basic concepts and events of global change obtained from geological records.			
D1	Develop the search, analysis and synthesis of information skills oriented to the identification and resolution of problems.			
D2	Acquire the ability to learn autonomously, continuously and collaboratively, organizing and planning tasks over time.			
D5	Sustainability and environmental commitment. Equitable, responsible and efficient use of resources.			

Expected results from this subject

Expected results from this subject	Training and Learning Results			
Ability to plan and execute field campaigns on the coast and coastline.	A5	B2	C13	D1 D5
Manage the techniques of observation, measurement, recognition and description of marine sedimentary elements and materials in these environments.	A1 A5	B1	C12 C13	D1
Manage sampling and prospecting techniques.	A2 A5	B2	C12 C14	D1

Handle sediment characterization and analysis techniques.	A1	B1	C12	D1
	A2	B2	C13	D2
	A5			
Geological mapping and representation capabilities	A2	B1	C12	D2
	A3		C13	
Ability to prepare and present reports	A3	B1	C14	D1
	A5	B5		

Contents

Topic	
T0 Presentation	0.1 Aims 0.2 Activities 0.3 Program 0.4 System of qualification
T1 Introduction	1.1 History and development of the Geological Oceanography 1.2 Importance of the Geological Oceanography
T2 General protocol for the geological investigation in coastal area	2.1. Nature of the research and of the projects in marine geology 2.2. General protocol for design and execution of a project 2.3. Approach and definition of methodological strategies 2.4. Evaluation, interpretation and publication of data
T3 Coastal morphodynamics	3.1 Basic concepts 3.2 Influence of the swell, the tide and the sedimentary characteristics 3.3 Morphodynamics evolution of the systems of beach
T4 Introduction to the positioning systems	4.1 Importance of the positioning in the acquisition of data 4.2 Basic concepts in geodesy: geoid, ellipsoid and datum 4.3 Global system of navigation by satellite (GNSS) 4.4 Sources of error in the measures of positioning 4.5 GPS: Methods of measure
T5 Methods of sampling and subsampling	5.1 Determination of sampling objectives, strategy and equipment selection 5.2 Sampling in subtidal area: techniques and strategy 5.3 Sampling in sea: Sediment of the bottom Sediment in the water column 5.4 Protocol for processing of samples in laboratory 5.5 Cataloging, archive and conservation
T6 Advanced methods of characterisation of the sediment SEMINAR 1: Physical properties of the sediment	- Density gamma and gamma natural - Resistivity and poropermeability - Susceptibility and other magnetic properties - Photos and colour - X-rays - Corescanners: *GEOTEK and 2G
T6 Advanced methods of characterisation of the sediment SEMINAR 2: Compositional analysis	- Elementary analysis: LECO, ICP, FRX - Mineralogical analysis: DRX - Corescanners: ITRAX and AVAATEC
T6 Advanced methods of characterisation of the sediment SEMINAR 3: Electronic microcopy	- Textural study - Compositional analysis
T7 Study of the intertidal and supra tidal zone	7.1 Duality earth-sea 7.2 Topography, teams of measured GPS Lidar 7.3 Study of the subsoil: GPR
T8 Study of the subtidal zone: Acoustic methods	8.1 Foundations of acoustic waves 8.2 Echo sounders 8.3 Side scan sonar 8.4 Processed of data
T9 Subsuperficial study of the subtidal zone: seismic Methods	9.1 Foundations of seismic waves 9.2 Seismic of reflection: Equipments Acquisition of data Processed of a seismic line Interpretation of data

PA1 Planning Campaign	Like designing a project, will make on a real example PA1.1 Definition of aims PA1.2 Selection of methodologies PA1.3 Definition of activities and scope PA1.4 Cronograms PA1.5 Economic calculations
PA2 Field trip	PA2.1 Requirements and basic norms of security in oceanographic boats PA2.2 Conhabitation PA2.3 Manoeuvres and technical of sediment sampling PA2.4 Manoeuvres and technical of geophysical exploration. PA2.5 Management and archive of data

Planning			
	Class hours	Hours outside the classroom	Total hours
Seminars	7	9	16
Field practice	5	5	10
Introductory activities	2	4	6
Case studies	15	32	47
Lecturing	23	48	71

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

Methodologies	
	Description
Seminars	2:20 h long seminars on complementary topics
Field practice	It includes ship minicruises oriented to experience oceanographic work in real conditions
Introductory activities	It comprises the activities carried out during the two first lectures, like subject presentation, time schedule, qualification procedures and other pertinent indications for the course well-being.
Case studies	Preparation of a project in real terms: analysis of the problematic, definition of aims, methodological planning, timing and economic estimate.
Lecturing	Lectures comprising the major topics of the course program

Personalized assistance	
Methodologies	Description
Lecturing	The tutorials will take place preferably on Monday and Thursday from 12:00 to 14:00 The tutoring sessions may be carried out by telematic means (email, videoconference, FAITIC forums, ...) under the modality of prior agreement. In the face-to-face modality, the tutorials will be held in office D42, block C, 3rd floor of the CC Experimental Building, as long as the teacher does not have to attend to other academic obligations. To optimize the time, it is necessary for the student to contact the teacher in advance
Seminars	The tutorials will take place preferably on Monday and Thursday from 12:00 to 14:00 The tutoring sessions may be carried out by telematic means (email, videoconference, FAITIC forums, ...) under the modality of prior agreement. In the face-to-face modality, the tutorials will be held in office D42, block C, 3rd floor of the CC Experimental Building, as long as the teacher does not have to attend to other academic obligations. To optimize the time, it is necessary for the student to contact the teacher in advance
Field practice	The tutorials will take place preferably on Monday and Thursday from 12:00 to 14:00 The tutoring sessions may be carried out by telematic means (email, videoconference, FAITIC forums, ...) under the modality of prior agreement. In the face-to-face modality, the tutorials will be held in office D42, block C, 3rd floor of the CC Experimental Building, as long as the teacher does not have to attend to other academic obligations. To optimize the time, it is necessary for the student to contact the teacher in advance
Introductory activities	The tutorials will take place preferably on Monday and Thursday from 12:00 to 14:00 The tutoring sessions may be carried out by telematic means (email, videoconference, FAITIC forums, ...) under the modality of prior agreement. In the face-to-face modality, the tutorials will be held in office D42, block C, 3rd floor of the CC Experimental Building, as long as the teacher does not have to attend to other academic obligations. To optimize the time, it is necessary for the student to contact the teacher in advance
Case studies	The tutorials will take place preferably on Monday and Thursday from 12:00 to 14:00 The tutoring sessions may be carried out by telematic means (email, videoconference, FAITIC forums, ...) under the modality of prior agreement. In the face-to-face modality, the tutorials will be held in office D42, block C, 3rd floor of the CC Experimental Building, as long as the teacher does not have to attend to other academic obligations. To optimize the time, it is necessary for the student to contact the teacher in advance

Assessment							
	Description	Qualification	Training and Learning Results				
Seminars	Individual written report on the activity made in seminars. It can include questionnaires.	15	A1 A2 A3 A5	B1 B5	C12	D1 D2	
	This activity is of compulsory assistance given his experimental character						
Field practice	Comprises a brief individual or group written summary, depending on the nature of the field trip. It must reflect the activity carried out in the field and its scope.	15	A2 A5	B1		D1 D5	
	This activity is of compulsory assistance given his experimental character						
Case studies	Group report that reflects the activities carried out during the practices, which will include objectives, methodology, results and conclusions.	30	A2 A3 A5	B1 B5	C13 C14	D1 D2	
	This activity is of compulsory assistance given his experimental character						
Lecturing	Written individual test of 2 to 4 hours, whose aim will be the global evaluation of the process of learning and the acquisition of skills and knowledge. It will comprise one or several of the following types of assessments: long questions to elaborate, short questions, tests, problem resolution, interpretation of images, maps and diagrams.	40	A1 A2 A3 A5	B1	C12 C13 C14	D1 D2	

Other comments on the Evaluation

Attendance at field trip, seminars and practices is an essential condition to be qualified. These activities are mandatory attendance given their experimental nature.

You must achieve at least 50% of the maximum partial score in each block (understanding as a block, each of the evaluation methodologies/tests described above, including the exam) to be able to compensate by averaging it with the grade obtained in the other blocks. If one of the parts is not qualified or does not reach that 50%, the final grade that will be assigned to the student will be the pure average divided by 2.

If the subject is not passed, the grade obtained in any of the blocks is not retained for the following course.

2nd chance

It will consist of an exam that will evaluate the theoretical and practical contents of the subject, provided that the students have attended the seminar classes, practices and field trips.

Global evaluation option

The request for this evaluation option must be submitted in the time and manner determined by the Center, which will be published prior to the academic start. Given the experimental nature of the practices, attendance is mandatory to qualify for this evaluation option. Failure to attend the practices without justified cause invalidates this possibility, as well as the opportunity for extraordinary evaluation (2nd opportunity).

Other considerations:

The official exam dates can be consulted at: <http://mar.uvigo.es/alumnado/examenes/>

Responsible and honest behavior is required of students taking this subject. Any form of fraud (copying or plagiarism) aimed at falsifying the level of knowledge and skills achieved in any type of test, report or work is considered inadmissible.

Fraudulent conduct may result in failing the subject for an entire course. An internal record of these actions will be kept so that, in the event of recidivism, the rector's office may be requested to open a disciplinary file.

Sources of information

Basic Bibliography

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Recommendations

Subjects that continue the syllabus

Geological oceanography II/V10G061V01308

Subjects that are recommended to be taken simultaneously

Biological oceanography I/V10G061V01301

Subjects that it is recommended to have taken before

Geology: Geology 2/V10G061V01108

Sedimentology/V10G061V01205

Geology: Geology 1/V10G061V01103

Coastal and marine sedimentary habitats/V10G061V01207

Other comments

DELIVERY OF ASSIGNMENTS

Unless it is stated otherwise, all the hand outs have to be delivered in electronic format and uploaded to the MooVI platform. No email, or paper submission will be accepted or acknowledged.

IMPORTANT

All deadlines expire at 24:00 of the marked day.

REGARDING THE AUTHORSHIP OF THE GROUP ASSIGNMENTS

Submission of the assignment is the responsibility of the coordinator, who must state the participants. All coauthors must upload their copy at MooVI to claim co-authorship.

Authorship cannot be modified after the deadline of the assignment.

Authors that appear in more than one assignment will cause the assignment to fail for all authors.

Plagiarism, partly or in whole, will cause course to fail and will be reported to the Dean for disciplinary action.

THE MooVI PLATFORM IS THE OFFICIAL COMMUNICATION CHANNEL OF THE COURSE

Any agreement has to be stated in the MooVI platform to be official.

IDENTIFYING DATA				
Chemistry applied to the marine environment I				
Subject	Chemistry applied to the marine environment I			
Code	V10G061V01304			
Study programme	Grado en Ciencias del Mar			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	3rd	1st
Teaching language	#EnglishFriendly Spanish			
Department				
Coordinator	Besada Pereira, Pedro			
Lecturers	Alonso Gómez, José Lorenzo Besada Pereira, Pedro Castro Fojo, Jesús Antonio Couce Fortúnez, María Delfina Salonen , Laura Teijeira Bautista, Marta			
E-mail	pbes@uvigo.es			
Web	http://https://mar.uvigo.es/			
General description	This subject includes the study of elements, inorganic substances and organic substances that can reach and alter the marine environment, acting as pollutants. Behaviour, influence and prevention of the effects produced by these elements, inorganic substances and organic substances in the environment will be studied. Moreover, the study of marine natural products (classification, function, pharmacological interest) will be addressed. 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				
A1	Students have demonstrated knowledge and understanding in a field of study that builds upon their general secondary education, and is typically at a level that, whilst supported by advanced textbooks, includes some aspects that will be informed by knowledge of the forefront of their field of study			
A2	Students can apply their knowledge and understanding in a manner that indicates a professional approach to their work or vocation, and have competences typically demonstrated through devising and sustaining arguments and solving problems within their field of study			
A3	Students have the ability to gather and interpret relevant data (usually within their field of study) to inform judgments that include reflection on relevant social, scientific or ethical issues			
A5	Students have developed those learning skills that are necessary for them to continue to undertake further study with a high degree of autonomy			
B1	Know and use vocabulary, concepts, principles and theories related to oceanography and apply everything learned in a professional and/or research environment.			
B2	Plan and execute surveys in the field and laboratory work, applying basic tools and techniques for sampling, data acquisition and analysis in the water column, sea bottom and marine substratum.			
B3	Recognize and implement good practices in measurement and experimentation, and work responsibly and safely both in field surveys and in the laboratory.			
B4	Manage, process and interpret the data and information obtained both in the field and in the laboratory.			
C6	Acquire the fundamentals and terminology of chemical processes.			
C7	Apply to the marine and coastal environment the principles and methods used in Chemistry.			
C8	Know the main pollutants, their causes and effects in the marine and coastal environment.			
D1	Develop the search, analysis and synthesis of information skills oriented to the identification and resolution of problems.			
D5	Sustainability and environmental commitment. Equitable, responsible and efficient use of resources.			

Expected results from this subject				
Expected results from this subject	Training and Learning Results			
To describe global cycles of the elements, including the input and output processes.	A1	B1	C6	D1
	A2			
	A3			
	A5			

To define and to explain concepts, principles and sources related to chemical pollution.	A1 A2 A3 A5	B1	C6 C8	D1 D5
To describe the chemical composition and speciation in seawater and to determine the mechanisms and factors that regulate it.	A1 A2 A3 A5	B1	C6	D1
To determine the processes that regulate chemical species complexation.	A1 A2 A3 A5	B1	C6	D1
To identify the toxicity mechanisms of metal ions, as well as the factors that determine and control the biomethylation processes.	A1 A2 A3 A5	B1	C6 C7 C8	D1 D5
To identify the toxicity mechanisms of the major organic pollutants.	A1 A2 A3 A5	B1	C6 C7 C8	D1 D5
To identify the most important natural products in the marine environment.	A1 A2 A3 A5	B1	C6	D1 D5
To identify the main interactions between marine organisms.	A1 A2 A3 A5	B1	C6 C7	D1
To describe the main applications of marine natural products.	A1 A2 A3 A5	B1	C6 C7	D1 D5
To analyze the results obtained in the laboratory using the theoretical concepts.	A1 A2 A3 A5	B1 B2 B3 B4	C6	D1
To develop the necessary skills for the resolution of the applications related with the subject.	A1 A2 A3 A5	B1 B2 B3 B4	C7	D1 D5

Contents

Topic	
1. Introduction to environment	Cycles of the elements in the environment
2. Pollution of marine environment	Generalities. Major sources of pollution
3. Metal speciation	Aerobic and anaerobic environments. Pourbaix diagrams
4. Metals and metallic species	General characteristics. Effects of metal complexation with natural ligands
5. Pollution by heavy metals	Biogeochemical cycles. Methylation processes. Mechanisms of toxicity associated. Applicable defense and detoxication procedures.
6. Reactivity of pollutants non-metallic chemical species	Introduction: carbonates, nitrates, phosphates, sulfates, perchlorates
7. Radioactive pollution in marine environment	Study, behavior and control of radioactive pollutants
8. Organic pollutants in the marine water	Classification. Functional and structural description. Origin of marine pollution
9. Chemical transformations of organic compounds	Solubility of organic compounds. Reactions of organic pollutants with nucleophilic species. Redox processes. Photochemical and biological transformations
10. Types of natural products	Terpenes, steroids and carotenoids. Oxygen compounds: Phenols, lignans, coumarins, macrolides and polyethers. Nitrogenous compounds: alkaloids, peptides
11. Marine natural products and their biologic function	Metabolite transfer in marine ecosystems. Biogenesis. Incorporation of halogens: Haloperoxidases
12. Marine chemical ecology	Chemical interactions between organisms. Organic compounds of marine origin and their ecological function
13. Marine natural products in drug discovery	Organic compounds of marine origin: isolation, characterization and biological activity

Planning			
	Class hours	Hours outside the classroom	Total hours
Seminars	16	24	40
Laboratory practical	12	2	14
Mentored work	0	17	17
Lecturing	24	48	72
Problem and/or exercise solving	1	0	1
Report of practices, practicum and external practices	0	4	4
Objective questions exam	1	0	1
Objective questions exam	1	0	1

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

Methodologies	
	Description
Seminars	Seminars will be used for further working on some of the theoretical contents, and also for problems resolution as a complement of the masterclass. Students may prepare a topic of interest related with the subject.
Laboratory practical	Application of laboratory techniques in practical problems related to the subject
Mentored work	Preparation and presentation of a tutored work on a topic related to the contents
Lecturing	Theoretical classes in which the professor and students will work the basic concepts of the matter

Personalized assistance	
Methodologies	Description
Lecturing	Tutoring, support and motivation in the learning process, in the classroom, personally in the professor's office as well as through e-mail or the virtual campus. Students willing so could attend personal tutorials to solve doubts and/or uncertainties. The professors of this subject will carry out the tutorials in the form of arranged face-to-face tutoring, to better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation.
Seminars	Tutoring, support and motivation in the learning process, in the classroom, personally in the professor's office as well as through e-mail or the virtual campus. Students willing so could attend personal tutorials to solve doubts and/or uncertainties. The professors of this subject will carry out the tutorials in the form of arranged face-to-face tutoring, to better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation.
Laboratory practical	Tutoring, support and motivation in the learning process, in the classroom, personally in the professor's office as well as through e-mail or the virtual campus. Students willing so could attend personal tutorials to solve doubts and/or uncertainties. The professors of this subject will carry out the tutorials in the form of arranged face-to-face tutoring, to better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation.
Mentored work	Tutoring, support and motivation in the learning process, in the classroom, personally in the professor's office as well as through e-mail or the virtual campus. Students willing so could attend personal tutorials to solve doubts and/or uncertainties. The professors of this subject will carry out the tutorials in the form of arranged face-to-face tutoring, to better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation.

Assessment			Qualification	Training and Learning Results			
	Description						
Mentored work	Students will carry out a brief tutored work, evaluating the report presented and its presentation	20	A1 A2 A3 A5	B1 C8	C6 D5	D1	
Problem and/or exercise solving	The student will have to resolve and deliver the questionnaires proposed in the classroom. It will value the participation and attitude of the student, his capacity to relate and apply the concepts purchased.	10	A1 A2 A3 A5	B1 C7 C8	C6	D1	
Report of practices, practicum and external practices	Students must present a report of the virtual practices carried out. Attendance at the laboratory sessions as well as preparation of the report is compulsory to get promoted. The attitude in the lab sessions, the skills and the understanding of the experimental techniques used will be evaluated.	10	A1 A2 A3 A5	B1 B2 B3 B4	C6 C7	D1 D5	

Objective questions exam	Exam in which the theoretical contents of the subject worked in the master sessions and in the seminars, corresponding to the subjects 1-7, will be evaluated.	30	A1 A2 A3 A5	B1 	C6 C7 C8	D1
	To get promoted the student must obtain a minimum of a 3.5 out of 10 in the exam.					
	The exam will be held during the semester or on the official date of the final exam.					
Objective questions exam	Exam in which the theoretical contents of the subject worked in the master sessions and in the seminars, corresponding to the subjects 8-13, will be evaluated.	30	A1 A2 A3 A5	B1 	C6 C7 C8	D1
	To get promoted the student must obtain a minimum of a 3.5 out of 10 in the exam.					
	The exam will be held during the semester or on the official date of the final exam.					

Other comments on the Evaluation

The official exam schedule can be checked at the following link:

<http://mar.uvigo.es/alumnado/examenes/>

The final qualification will be the sum of all sections whenever the required minimum is reached. If the required minimum is not reached the final qualification will be the weighted grade of the exams.

The participation of the student in the laboratory sessions, in the tutored work or in any exam will involve the condition of presented and the assignment of a score.

In case of doubt about the acquisition of learning results by the students, additional oral evaluation tests may be carried out.

Second assesment call (July): Students will only need to retake the exams they failed (grade below 5 out of 10). Grades obtained in the sections, excluding the exams, will be maintained for this call and are not recoverable. The final grade will be the sum of the grades from all sections, provided the minimum requirements are met. If the student does not pass the subject, the grade on the official record will be the weighted average of the exam grades.

Global assessment option: The application for this evaluation option must be submitted in the time and manner determined by the Center, which will be published prior to the academic start. Given the experimental nature of the practices, attendance at them is mandatory to be eligible for this evaluation option. Failure to attend the practices, with no justified cause invalidates this possibility, as well as the opportunity for extraordinary evaluation (2nd opportunity).

Students are strongly requested to fulfil a honest and responsible behaviour. It is consider inadmissible any kind of fraud (copy or plagiarism) aimed to falsify the level of knowledge and skills achieved in exams, evaluations, reports or any kind of teacher's proposed work. Fraudulent behaviour may involve failing the subject during a whole academic year. An internal record of these actions will be kept to request, in case of reincidence, the opening of a disciplinary file.

Sources of information

Basic Bibliography

I. Bodek, W.J. Lyman, W.F. Reehl y D.H. Rosenblatt, **Environmental Inorganic Chemistry**, Pergamon Press, 1988

R.P. Schwarzenbach, P.M. Gschwend, D.M. Imboden, **Environmental Organic Chemistry**, 2, John Wiley & Sons Inc, 2003

R. Chang, **Química**, 11, Mc Graw Hill, 2013

P. Yurkanis Bruice, **Química Orgánica**, 5, Prentice Hall México, 2007

Complementary Bibliography

S. E. Manahan, **Environmental chemistry**, 9, CRC Press, 2009

H. G. Seiler, H. Sigel, A. Sigel, **Handbook on toxicity of inorganic compounds**, Marcel Dekker, 1988

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Paul M. Dewick, **Medicinal natural products: A biosynthetic approach**, 3, John Wiley & Sons Inc, 2009

J. B. McClintock, B.J. Baker, **Marine chemical ecology**, CRC Press, 2001

M.A. Martínez Grau, A.G. Csáky, **Técnicas experimentales en síntesis orgánica**, 2, Síntesis, 2012

Journal of Natural Products,

Natural Products Reports,

Marine Chemistry,

Recommendations

Subjects that continue the syllabus

Marine Pollution/V10G061V01401

Subjects that it is recommended to have taken before

Chemistry: Chemistry I/V10G061V01105

Chemical oceanography I/V10G061V01204

IDENTIFYING DATA				
Physiology of marine organisms				
Subject	Physiology of marine organisms			
Code	V10G061V01305			
Study programme	Grado en Ciencias del Mar			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	3rd	1st
Teaching language	#EnglishFriendly Spanish Galician			
Department				
Coordinator	Blanco Imperiali, Ayelén Melisa Pedrol Bonjoch, María Nuria			
Lecturers	Blanco Imperiali, Ayelén Melisa Lopez Patiño, Marcos Antonio Pedrol Bonjoch, María Nuria Velasco Rubial, Cristina			
E-mail	pedrol@uvigo.es amblanco@uvigo.es			
Web	http://https://mar.uvigo.es/			
General description	Study of the operation of the marine organisms (animal and vegetal) and of the mechanisms that make possible his adaptation to the half. It will loan special attention the those physiological **appearances mothers related with the integration of the pertinent information of the half marine and the generation of specific answers.			
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	
A2	Students can apply their knowledge and understanding in a manner that indicates a professional approach to their work or vocation, and have competences typically demonstrated through devising and sustaining arguments and solving problems within their field of study
A3	Students have the ability to gather and interpret relevant data (usually within their field of study) to inform judgments that include reflection on relevant social, scientific or ethical issues
A5	Students have developed those learning skills that are necessary for them to continue to undertake further study with a high degree of autonomy
B1	Know and use vocabulary, concepts, principles and theories related to oceanography and apply everything learned in a professional and/or research environment.
C9	Acquire basic knowledge about the structural and functional organization and the evolution of marine organisms.
C10	Know the biological diversity and functioning of marine ecosystems.
C11	Apply the knowledge and techniques acquired to the characterization and sustainable use of living resources and marine ecosystems.
D1	Develop the search, analysis and synthesis of information skills oriented to the identification and resolution of problems.
D4	Ability to communicate orally and in writing in Galician language.
D5	Sustainability and environmental commitment. Equitable, responsible and efficient use of resources.

Expected results from this subject	
Expected results from this subject	Training and Learning Results
5. To gain capacity of analysis and approaching to hypothesis in plant physiology.	A2 A3
6. To know the relationships among the photosynthetic marine organisms and the abiotic and biotic marine environments, by means of the study of their adaptations and the physiological processes of acclimation (functional types, osmoregulation, fotoprotection, biomass partitioning).	A2 B1 C10 D4 A5 D5
ANIMAL PHYSIOLOGY:	A2 B1
7. To know the mechanisms of acquisition and integration of the sensory information in marine animals	A3 A5
8. To know the physiological bases of muscular activity and its implication in aquatic locomotion	A3 B1
9. To know in marine animals the mechanisms trough which synthesis, release, transport and the action of hormones synthesised by endocrine glands and the nervous system of marine animals occur.	A2 B1 A3

10. Knowing the corporal fluids and the functioning of cardiovascular systems.	A3	B1	C9	
11. To know the mechanisms of gas exchange between the animals and the water where they live.	A3	B1		
12. To know the mechanisms for wastes elimination and of osmotic regulation in distinct groups of marine animals.	A3	B1		
13. To know how animals obtain energy through food consumption, and how to use such energy as well.	A3 A5	B1		D5
15. To know the general and basic terminology in Animal Physiology.	A3	B1		
17. To understand the general functioning of the animal as a whole, emphasizing in the role played by the integratory and coordinatory systems.	A2 A3	B1	C9 C10	D5
18. To understand basic aphysiology-related aspects, such as aquaculture.	A2 A3 A5	B1	C11	D1 D5

Contents

Topic

PLANT PHYSIOLOGY:	1. Plant Physiology in the ocean. 2. Cell and tissue basic characteristics photosynthetic marine organisms 3. Water relations in photosynthetic marine organisms. Osmoregulation and osmoprotection. 4. Mineral nutrition in marine environments. 5. Photosynthesis: definition and physiological, ecological and evolutionary relevance. 6. The photosynthetic organelles. 7. Light and photosynthetic pigments. 8. The photochemical phase of photosynthesis. 9. The biochemical phase of photosynthesis. 10. Mechanisms of carbon gain and concentration in photosynthetic marine organisms.
ANIMAL PHYSIOLOGY:	1. Physiological bases of excitability 2. The nervous system and the neural communication 3. Physiology of the systems effectors in marine animals: muscular activity and locomotion, cromatophora and bioluminescence 4. Sensory physiology in marine animals: mecanoreception, electroreception, magnetoreception, quimioreception, fotoreception and vision. 5. Physiology of the neuroendocrine and endocrine systems in marine animals 6. Circulatory fluids and operation of the cardiovascular systems in marine animals 7. Operation of the respiratory systems in marine animals 8. Physiology of excretion and osmorregulation in marine animals 9. Physiology of the digestive systems in marine animals

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	28	70	98
Laboratory practical	10	4	14
Mentored work	0	12	12
Discussion Forum	0	2	2
Seminars	5	15	20
Objective questions exam	0.7	0	0.7
Essay questions exam	1	0	1
Problem and/or exercise solving	0.3	0	0.3
Debate	0	2	2

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

Methodologies

	Description
Lecturing	2-4 weekly hours until the planning is completed. To be developed in the corresponding classroom, with all the enrolled students. PowerPoint presentations will support theory sessions. The educational materials will be at the students' disposal on the Moovi platform. Student participation will be promoted through collaborative methodology in the classroom.
Laboratory practical	The students will assist 4 sessions of practice in the laboratory: two sessions of 2.5 h each in Animal Physiology, and two sessions of 2.5 h in Plant Physiology. Attendance is compulsory.

Mentored work	PLANT PHYSIOLOGY: short Activities of cooperative learning in the classroom, in spontaneous or random groups. Immediate delivery. They are a complement to the evaluation, not compulsory. Each activity delivered can add up to 0.1 points to the final mark of PLANT PHYSIOLOGY, although they do not penalize if they are not delivered.
Discussion Forum	Through the platform Moovi: -Virtual forum of innovation and state of the art: Scientific Articles and websites of physiological /ecophysiological subjects of ANIMAL and PHOTOSYNTHETIC marine organisms -Virtual forum of review: scientific Articles and websites of cytology and histology of photosynthetic marine organisms Each QUALITY contribution to the forums adds one-tenth to the final grade of the corresponding ANIMAL Ph. or PLANT Ph. exam, up to a maximum of 1 point in each part. It does not penalize you if you do not participate.
Seminars	In the module of ANIMAL PHYSIOLOGY seminars will be devoted to the planning and exhibition of subjects elaborated by the distinct groups of students In the module of PLANT PHYSIOLOGY seminars will be devoted to the resolution of problems

Personalized assistance

Methodologies	Description
Seminars	Resolution of doubts and difficulties to the groups or personnel if necessary. During the seminar and in tutorials, by prior arrangement with the teachers via e-mail
Lecturing	Resolution of doubts and difficulties to the group or personnel if necessary. During the session and in tutorials, by prior arrangement with the teachers via e-mail. Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place by prior arrangement with the teachers via e-mail. To better optimize the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation.
Laboratory practical	Resolution of doubts and difficulties to the groups or personal if necessary. During the practices and in tutorials, by prior arrangement with the teachers via e-mail.
Mentored work	Resolution of doubts and difficulties to the groups the groups or personal if necessary. In the classroom and in tutorials, by prior arrangement with the teachers via e-mail
Discussion Forum	Feedback through the platform Moovi
Tests	Description
Debate	Feedback through the platform Moovi and during the sessions.

Assessment

	Description	Qualification	Training and Learning Results			
Lecturing	Attendance will be evaluated	0	A2 A3 A5	B1	C9 C10 C11	D1 D5
	There will be final evaluation tests for both modules. The relative weighting of each will be 50%. A minimum of a 4 in each module is required to pass the exam.					
	The final exam will consist of objective tests, developmental questions and problem solving.					
Laboratory practical	In the module of Plant Physiology (5% of the qualification) the evaluation will be by attendance and questions in the final exam.	10	A2 A3 A5	B1	C9 C10 C11	D1 D5
	In the module of Animal Physiology (5% of the qualification) the evaluation will be by attendance.					
Mentored work	Volunteer for the module of Plant Physiology.	0	A2 A3 A5	B1	C9 C10	D1 D4 D5
	(Short collaborative learning activities in the classroom, in spontaneous or random groups. Immediate delivery. They are complementary to the evaluation, not mandatory. Each classroom activity delivered raises one tenth of the final grade of PLANT PHYSIOLOGY, although they do not penalize if they are not delivered).					

Discussion Forum	Voluntary for both modules	0	A2 A3 A5	C10 C11	D1 D4 D5
	(Each QUALITY contribution to the forums adds one-tenth to the final grade of the corresponding ANIMAL Ph. or PLANT Ph. exam, up to a maximum of 1 point in each part. It does not penalize you if you do not participate.).				
Seminars	Attendance is mandatory for the continuous evaluation, given its experimental and practical nature.	20	A2 A3 A5	B1 C9 C10 C11	D1 D4 D5
	In the Plant Physiology module, the mark will be based on attendance and performance (5%), and the problems will be subject of the exam.				
	In the Animal Physiology module, students in groups of 2-3 will elaborate a work to be presented in the classroom, and the mark will be based on attendance and performance (15%).				
Objective questions exam	Mandatory	25	A2 A3 A5	B1 C9 C10 C11	D4
Essay questions exam	Mandatory	35	A2 A3 A5	B1 C9 C10	D4
Problem and/or exercise solving	Mandatory	10	A3	C10	D1 D4

Other comments on the Evaluation

To pass the subject, it is required that the overall qualification of each of the modules (exams, seminars and practices) separately is not less than 4 points.

Partial and final exams: The partial evaluation of the Animal Physiology module will be held in classroom hours at the end of the module (date to be confirmed, will be communicated through the Moovi platform with due notice). The evaluation of the Plant Physiology module will take place on the official date of the first opportunity determined by the Xunta de Facultade and published in the exam calendar of the Faculty's website (mar.uvigo.gal). On this official date, students may sit the exam of both modules of the subject, as long as they have not sat the partial exam of the Animal Science module. The second chance exam will be held on the official date determined by the Xunta de Facultad and published in the exam calendar of the Faculty's website (mar.uvigo.gal). In this second chance exam, students will be able to sit only the module they have pending (with qualification < 4).

Itinerary of global evaluation: There is a second alternative itinerary to the continuous evaluation with the possibility of passing the subject in a single final test, which will include the contents of theory and the seminars of problems of Plant Physiology. The application for this evaluation option must be submitted in the time and manner determined by the Center, which will be published prior to the academic start. However, it must be communicated to the teachers of the subject at the beginning of the semester and must be justified. For students who opt for the global evaluation, the delivery of the report of problems of Plant Physiology and the work of Animal Physiology is voluntary and can raise the final grade up to two points.

Students taking this course are required to behave responsibly and honestly. Any form of fraud (**copying or plagiarism**) aimed at falsifying the level of knowledge and skills achieved in any type of test, report or work is considered unacceptable. Fraudulent behaviour may lead to suspension from the course for a full academic year. will keep an internal record of these actions so that, in the event of a repeat offence, a disciplinary case can be submitted to the rector's office for disciplinary action.

Any **use of AI** in academic work must be disclosed, specifying the tool used, the function it performed, the scope of its involvement, and which part of the work was authored by a human. If there are reasonable grounds to suspect misuse of AI, faculty members may reject the work, request additional evidence, or refer the case to the appropriate administrative disciplinary procedure.

Sources of information

Basic Bibliography

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Taiz L et al., **Plant Physiology and Development, Sixth Edition**, Sinauer Associates, Inc.,
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Randall,D. et al., **Fisiología animal.**,
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Kirk JTO, **Light and photosynthesis in aquatic ecosystems**, 3rd ed. Cambridge, UK: Cambridge University Press,
Larkum AWD, Robert JO, Duarte CM, **Seagrasses: biology, ecology, and conservation**, Dordrecht (The Netherlands): Springer,
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Recommendations

Subjects that are recommended to be taken simultaneously

Aquaculture/V10G061V01310
Biological oceanography I/V10G061V01301
Biological oceanography II/V10G061V01306

Subjects that it is recommended to have taken before

Biology: Biology I/V10G061V01101
Marine zoology/V10G061V01210
Biology: Biology 2/V10G061V01106
Marine botany/V10G061V01202

Other comments

Students are strongly requested to fulfil a honest and responsible behaviour. It is considered completely unacceptable any alteration or fraud (i.e., copy or plagiarism) contributing to modify the level of knowledge and abilities acquired in exams, evaluations, reports or any kind of teacher's proposed work. Fraudulent behaviour may cause failing the course for a whole academic year. An internal dossier of these activities will be built and, when reoffending, the university rectorate will be asked to open a disciplinary record.

IDENTIFYING DATA				
Biological oceanography II				
Subject	Biological oceanography II			
Code	V10G061V01306			
Study programme	Grado en Ciencias del Mar			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	3rd	2nd
Teaching language	#EnglishFriendly Spanish Galician			
Department				
Coordinator	Marañón Sainz, Emilio Mouriño Carballido, Beatriz			
Lecturers	Aranguren Gassis, María Blanca Sújar, Rocío Marañón Sainz, Emilio Mouriño Carballido, Beatriz Teira Gonzalez, Eva Maria			
E-mail	bmourino@uvigo.es em@uvigo.es			
Web	http://https://mar.uvigo.es/			
General description	This course addresses the study of the interaction between the composition and dynamics of biological communities and the production and fate of organic matter in the ocean. The diversity and metabolic activity of microbial plankton receive special attention, due to their key role in the regulation of marine biogeochemical cycles. Multiple levels of organization are considered, including cells, populations, communities and the ecosystem. The ultimate aim is to understand the role of ocean's biology in the functioning of the Earth system.			
English Friendly subject: International students may request from the teachers: a) materials and bibliographic references in English, b) tutoring sessions in English, c) exams and assessments in English.				

Training and Learning Results				
Code				
A1	Students have demonstrated knowledge and understanding in a field of study that builds upon their general secondary education, and is typically at a level that, whilst supported by advanced textbooks, includes some aspects that will be informed by knowledge of the forefront of their field of study			
B1	Know and use vocabulary, concepts, principles and theories related to oceanography and apply everything learned in a professional and/or research environment.			
B4	Manage, process and interpret the data and information obtained both in the field and in the laboratory.			
C10	Know the biological diversity and functioning of marine ecosystems.			
C11	Apply the knowledge and techniques acquired to the characterization and sustainable use of living resources and marine ecosystems.			
D1	Develop the search, analysis and synthesis of information skills oriented to the identification and resolution of problems.			
D2	Acquire the ability to learn autonomously, continuously and collaboratively, organizing and planning tasks over time.			

Expected results from this subject				
Expected results from this subject	Training and Learning Results			
Know and understand how organisms and communities drive the cycling of matter in the ocean, linking the physiological and ecological traits of key functional groups with their biogeochemical role.	A1	B1	C10	
Ability to connect the different physical, chemical and biological processes that determine the role of the ocean within the Earth system.	A1	B1	C10	D1
Know and understand the natural and anthropogenic variability in pelagic ecosystems and marine biogeochemical cycles, as well as their response to processes of global environmental change.	A1		C10 C11	D1
Ability to interpret biological oceanography data.		B4	C10 C11	D1
Ability to use computing applications to run mathematical models of biogeochemical processes.		B4	C11	D2
Ability to use specialised bibliography				D1 D2

Contents

Topic

Unit 1. Introduction	Main physical processes in the ocean: ocean circulation, mixing and stratification, mesoscale turbulence. Distribution and abundance of chemical elements in the sea. Metabolic pathways and key plankton functional groups. Properties of element cycles.
Unit 2. Production of organic matter.	Variability and control of primary production. Stoichiometry of phytoplankton production. Dynamics of dissolved organic matter. New and regenerated production. Trophic organization and biogeochemical functioning of the ecosystem.
Unit 3. Remineralization.	Distributions of nutrients and oxygen. Oxygen utilization rates. Stoichiometric relations. Heterotrophic processes: quantification and variability. Photosynthesis respiration balance. Balance between N ₂ fixation and denitrification. Global nitrogen cycle.
Unit 4. Export.	The biological pump. Methodological issues. Spatio-temporal variability in export. Attenuation of vertical fluxes: controlling factors. Shallow and deep sedimentation. Coast-ocean gradients.
Unit 5. Biogeochemical processes in the sediments.	Physical structure of the sediment. Coast-ocean gradients. Reactions of organic matter oxidation. Redox potential. Spatio-temporal variability in benthic fluxes. Global carbon budget in the sediments.
Unit 6. The global carbon cycle.	Chemistry of dissolved inorganic carbon (DIC). Distribution and abundance of main DIC forms. CO ₂ fluxes between ocean and atmosphere. The biological pump and the solubility pump. Global C cycle: current unbalances.
Unit 7. The calcium carbonate cycle.	CaCO ₃ oceanic budget. Carbonate saturation. Production, export and redissolution of CaCO ₃ . Distribution of carbonates in the sediments. Pelagic calcification: coccolithophore blooms and biogeochemical impacts.
Unit 8. Global change and the biology of the ocean.	Multiple environmental stressors. Warming. Acidification. Deoxygenation. Eutrophication. Impacts on species, communities, ecosystems and biogeochemical cycles. Global feedback processes.
Seminar program.	Critical reading and discussion of scientific papers in a journal club format.
Practical session program.	Graphical representation of spatio-temporal distributions and vertical integration of biogeochemical variables. Analysis of data on phytoplankton cell size, abundance, and metabolism. Light-mixing contrast and phytoplankton growth. Nitrogen budgets and N ₂ fixation in coastal and open-ocean systems. Global-scale calcium carbonate cycle. Modelling of the global carbon cycle. Resolution of practical cases using real data.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	22	46	68
Seminars	10	15	25
Problem solving	10	25	35
Practices through ICT	10	10	20
Objective questions exam	1	0	1
Problem and/or exercise solving	1	0	1

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

Methodologies

	Description
Lecturing	Presentation of fundamental contents of the course, supported by graphic material.
Seminars	Formulation and testing of hypotheses in biological oceanography. Critical synthesis of scientific papers. Oral presentation and discussion.
Problem solving	Practical cases are solved using real data presented numerically and graphically.
Practices through ICT	Análisis de datos de abundancia, tamaño celular y metabolismo del fitoplancton. Representación gráfica de distribuciones xyz. Integración vertical. Análisis de flujos de nitrógeno en océano abierto. Ciclo del carbonato cálcico. Modelado del ciclo global del carbono.

Personalized assistance

Methodologies	Description
Lecturing	Students can ask for assistance on any aspect of the course both on line and during personal interviews. Schedule for personal attention is Mon, Tue from 12:00 to 14:00. This schedule may be modified due to other teacher's commitments. Students are encouraged to contact the teacher via email to schedule interviews at a mutually convenient time.

Seminars	Students can ask for assistance on any aspect of the course both on line and during personal interviews. Schedule for personal attention is Mon, Tue from 12:00 to 14:00. This schedule may be modified due to other teacher's commitments. Students are encouraged to contact the teacher via email to schedule interviews at a mutually convenient time.
Problem solving	Students can ask for assistance on any aspect of the course both on line and during personal interviews. Schedule for personal attention is Mon, Tue from 12:00 to 14:00. This schedule may be modified due to other teacher's commitments. Students are encouraged to contact the teacher via email to schedule interviews at a mutually convenient time.

Assessment

	Description	Qualification	Training and Learning Results
Seminars	Performance will be assessed continuously throughout the seminars: the critical reading and synthesis of the papers, participation across the different roles, and oral presentation and discussion. Both the quality of the presentations and attendance at all seminars and performance during them will be valued. The mark obtained in the ordinary session (June) is retained for the second-opportunity session (July). It is possible, after consultation with the coordinator, to retake this assessment for the July session.	20	B1 C10 D1 D2
Problem solving	Written submission of practical cases solved during the practical sessions, analogous to those addressed in them. The mark for this assessment is retained for the July session. It is possible, after consultation with the coordinator, to resubmit this work for the July session.	20	B1 C10 D1 B4 C11 D2
Objective questions exam	Objective-question tests (multiple choice and true/false) assessing knowledge of the material covered. These may be carried out periodically throughout the course or as a mid-term test, depending on the group.	20	A1 B1 C10 B4
Problem and/or exercise solving	Written final exam, comprising an objective test (multiple choice and/or true/false), short questions, and practical cases, designed to comprehensively assess the acquisition of the knowledge and skills developed in the theory classes, seminars, and practical sessions.	40	A1 B1 C10 B4 C11

Other comments on the Evaluation

The date, time, and venue of the assessment tests will be published on the official website of the Faculty of Marine Sciences: <http://mar.uvigo.es/alumnado/examenes/>

Global assessment option: The application for this assessment option must be submitted within the timeframe and in the manner determined by the Centre, which will be published before the start of the academic term.

In the second-opportunity session, the marks obtained in the seminars and in the submission of solved practical cases are retained, but not the mark of the intermediate objective-question exam or that of the final exam. All those who sit the second-opportunity session must retake the exam, whose mark will represent 60% of the overall grade. It is possible, after consultation with the coordinator, to repeat the seminars and the submission of practical cases for this second session. All enrolled students must complete both components (seminars and practical cases), as marks from previous courses are not retained.

Students taking this subject are required to behave responsibly and honestly. Any form of fraud (copying or plagiarism) aimed at misrepresenting the level of knowledge and skills demonstrated in tests, reports, or assignments is unacceptable. Fraudulent conduct may result in failing the subject for a full academic year. An internal record of such actions will be kept so that, in the event of repeat offences, the Rectorate may be requested to open disciplinary proceedings.

Sources of information

Basic Bibliography

Sarmiento, J., L., Gruber, N, **Ocean biogeochemical dynamics**, Princeton University Press, 2006

Libes, S., **An introduction to marine biogeochemistry**, Wiley, 2009

Williams RG, Follows MJ, **Ocean dynamics and the carbon cycle : principles and mechanisms**, Cambridge University Press, 2011

Complementary Bibliography

Miller, C. B., **Biological Oceanography**, Blackwell, 2012

Steele JH, Turekian KK, Thorpe SA, **Encyclopedia of Ocean Sciences**, 2a, Elsevier, 2008

Middelburg, Jack J., **Marine Carbon Biogeochemistry A Primer for Earth System Scientists**, Springer, 2019

Schlesinger, W.H., **Biogeoquímica: un análisis del cambio global.**, Ariel, 2000

Falkowski PG, **Life's Engines: How Microbes Made Earth Habitable**, Princeton University Press, 2015

Recommendations

Subjects that it is recommended to have taken before

Marine Ecology/V10G061V01206

Biological oceanography I/V10G061V01301

IDENTIFYING DATA				
Physical oceanography II				
Subject	Physical oceanography II			
Code	V10G061V01307			
Study programme	Grado en Ciencias del Mar			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	3rd	2nd
Teaching language	#EnglishFriendly Spanish			
Department				
Coordinator	Varela Benvenuto, Ramiro Alberto			
Lecturers	Varela Benvenuto, Ramiro Alberto			
E-mail	rvarela@uvigo.es			
Web	http://www.gofuvi.org			
General description	This course, mostly a practical one, brings to the student knowledges of the fundamental methodologies used in physical oceanography.			
	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				
A2	Students can apply their knowledge and understanding in a manner that indicates a professional approach to their work or vocation, and have competences typically demonstrated through devising and sustaining arguments and solving problems within their field of study			
A3	Students have the ability to gather and interpret relevant data (usually within their field of study) to inform judgments that include reflection on relevant social, scientific or ethical issues			
A4	Students can communicate information, ideas, problems and solutions to both specialist and non-specialist audiences			
B1	Know and use vocabulary, concepts, principles and theories related to oceanography and apply everything learned in a professional and/or research environment.			
C3	Describe how works the global ocean circulation, its forcings and its climate implications.			
C4	Know, analyze and interpret the physical properties of the ocean according to current theories, as well as to know the most relevant sampling tools and techniques.			
D1	Develop the search, analysis and synthesis of information skills oriented to the identification and resolution of problems.			
D2	Acquire the ability to learn autonomously, continuously and collaboratively, organizing and planning tasks over time.			
D5	Sustainability and environmental commitment. Equitable, responsible and efficient use of resources.			

Expected results from this subject				
Expected results from this subject	Training and Learning Results			
The student has to know how to calculate variables derived from the basic parameters such as speed of the sound, dynamic height, density, frequency of Brunt-Vaisala, stability and interpret them properly.	A2	C3	D1	
	A3	C4	D2	
	A4			
The student has to understand the principles and main uses of several advanced oceanographic instruments and its implications in current physical oceanography (i.e., current meters, CTD, High Frequency radars, Argo profilers, mooring lines)	A2	B1	C4	D1
	A3			D2
	A4			
The student should understand and distinguish the advantages and disadvantages of the several wind, wave and tide related energy systems available	A2	C3	D1	
	A3	C4	D2	
			D5	
The student has to be able to understand the complete process of treatment of pertinent data of oceanographic probes (CTD), and to use at an intermediate user level programs of generation of charts and analysis of the oceanographic information such as Ocean Data View and the Seabird proprietary Seabird system.	A3	C4	D1	
	A4		D2	

Contents	
Topic	
Sea Temperature	Horizontal and vertical distribution of temperature. Temperature measurement at the sea. Termistors. Temperature sensors
Sea Salinity	Horizontal and vertical distribution of the salinity. Measurement of sea salinity. Salinity sensors.

Sea surface circulation	Methods of measurement of the sea surface circulation. Geostrophic approximation. Current meters
Light radiation and thermal balance	How to measure light irradiance at the sea. Computing light attenuation in the water column. Method to determine light absorbance by the water, and dissolved or particulate matter I. Computation of a simple thermal balance.
Wind Waves	Sea wave velocity, height and period. Diagrams of waves. Approximation of a train of waves to the coast. Influence of the bathymetry.
Tides	Mechanisms of measurement of the level of the sea. Newton Equilibrium tide theory. Dynamic tides. Dynamic models. How to compute FPM in a particular point on the earth surface
Sound and speed of sound in the sea	Sea sound velocity estimation. Influence of diverse parameters (temperature, salinity, pressure). Vertical sound profiles. Sound reflection and refraction. Sound channels.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	18	45	63
Seminars	14	28	42
Studies excursion	4.75	2	6.75
Practices through ICT	16	10.75	26.75
Objective questions exam	3	0	3
Essay questions exam	2.25	0	2.25
Problem and/or exercise solving	2.25	0	2.25
Report of practices, practicum and external practices	0	4	4

*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 lecturer will give an insight of the main subjects treated during the course.
Seminars	Student work on subjects and exercises brought by the teachers. Data come from the real world and the discussion can either individual or in small groups. A questionnaire must be solved at the end of each session
Studies excursion	Cruise to practise the different instruments (CTD, light, Lagrangian buoys, ADCP, etc) used in the physical oceanography. This cruise has compulsory character in the modality of continuous evaluation as well as in the modality of global evaluation
Practices through ICT	Practices aiming to solve actual oceanographic problems using instruments and software such as Seabird data processing and Ocean Data View. These practical are compulsory in the modality of continuous evaluation as well as in the modality of global evaluation

Personalized assistance

Methodologies	Description
Lecturing	Master class. Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation. Tutorial sessions will be also available by electronic means, videoconference or FAITIC forums if previously agreed
Seminars	At the beginning of every seminar, the teacher will describe the objectives and purpose of the seminar. The students will have a guide on the TEMA platform describing all the exercises and questions required. The exercises can be solved individually or in small groups, but a personalised report is required. At the end of this seminar a 15 minute multiple option quest will be fulfilled.
Studies excursion	The teacher will describe the tasks to do, explain the different instruments and technique, and monitors the students' use of such instruments
Tests	Description
Objective questions exam	A multiple option test to calibrate the students' knowledge, always closely related to what was done during seminars, classroom practical work, etc.
Essay questions exam	An examen to validate the general knowledge of the student.

Assessment

Description		Qualification	Training and Learning Results
Seminars	During the seminars the student will be asked to solve several theoretical and practical subjects taken from real cruises/data. At the end of the seminar a questionnaire must be solved in class and using Moovi (this is the evaluation)	20	A2 C3 D5 A3 C4 A4
Studies excursion	After the cruise a report is required and evaluated	5	A3 C4 D1
Objective questions exam	Three questionnaires of objective questions of individual resolution are requested during the course. All must be done in Moovi. The first proof consists in questions that are presented along the development of the theoretical lessons (10% of the total note) and can be completed anytime along the course before the final exam. The second questionnaire tests the knowledge obtained in the practices sessions (except the cruise which has his own report); it opens in Moovi at the end of the practices and remains opened until the examination of questions of development (15% of the total note). The last test values the global knowledges of the OFII subject and has to be done anytime after the end of the masterclasses but before the final examination (10% of the total qualification)	35	C4
Essay questions exam	Questions and exercises to value the understanding, capacity of analysis, synthesis and knowledges purchased. This exam must be approved with a minimum of 5 points out of 10	40	A2 C4 A3

Other comments on the Evaluation

It is necessary to obtain a minimal qualification of 5 in the final examination and in the questionnaires derived of the seminars to approve the subject. The questionnaires derived from the seminars can be repeated once if the student want to, and the final qualification will be the average of the two instances. The cruise report, the questionnaires associated to the practices and the small questions presented in the theoretical lessons do not require a minimal qualification

Qualifications obtained in the objective questions tests are kept for the current course and the next. Happened this term, the student will have to redo the objective questionnaires.

Global assessment option: The application for this evaluation option must be submitted in the time and manner determined by the Center, which will be published prior to the academic start. Given the experimental nature of the practices, attendance at them is mandatory to be eligible for this evaluation option. **Failure to attend the practices, with no justified cause invalidates this possibility, as well as the opportunity for extraordinary evaluation (2nd opportunity).**

The official exam dates can be obtained at: <http://mar.uvigo.es/alumnado/examenes/>

Students are strongly requested to fulfil a honest and responsible behaviour. It is considered completely unacceptable any alteration or fraud (i.e., copy or plagiarism) contributing to modify the level of knowledge and abilities acquired in exams, evaluations, reports or any kind of teacher's proposed work. Fraudulent behaviour may cause failing the course for a whole academic year. An internal dossier of these activities will be built and, when reoffending, the university rectorate will be asked to open a disciplinary record

Sources of information

Basic Bibliography

Kirk, J.T.O, **Ligth and photosynthesis in aquatic ecosystems**, Cambridge Press, 2011
Varios autores, **Ocean circulation**, Open University Course Team, 1999
Varios autores, **Waves, tides and shallow-water processes**, 2, Open University Course Team, 1999
Pond, S y Pickard, GL, **Introductory Dynamical oceanography**, 3, Pergamon Press, 1991
Pickard, GL y Emery, W, **Descriptive Physical oceanography**, 6, Pergamon Press, 2011
Sverdrup, HU; Johnson, MW y Fleming, RH, **The Oceans. Their physics, chemistry and general biology**, 2, Prentice-Hall, 1946
Varela, R y Rosón, G, **Métodos en oceanografía Física**, 1, Anthia., 2008

Complementary Bibliography

Beer, T, **Environmental Oceanography. An introduction to the behavior of coastal waters**, Pergamon Press, 1983
Newman, G y Pierson, Jr, WJ, **Principles of Physical Oceanography**, Prentice-Hall, 1966
Kennish, MJ, **Practical handbook of Marine Science**, 3, CRC Press, 2001

Recommendations

Subjects that are recommended to be taken simultaneously

Geological oceanography II/V10G061V01308

Subjects that it is recommended to have taken before

Physical oceanography I/V10G061V01302

IDENTIFYING DATA**Geological oceanography II**

Subject	Geological oceanography II			
Code	V10G061V01308			
Study programme	Grado en Ciencias del Mar			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	3rd	2nd
Teaching language	#EnglishFriendly Spanish			
Department				
Coordinator	Alejo Flores, Irene			
Lecturers	Alejo Flores, Irene Copete Hernández, María Fernanda Diz Ferreiro, Paula Nombela Castaño, Miguel Angel			
E-mail	ialejo@uvigo.es			
Web	http://https://mar.uvigo.es/			
General description	The subject Geological Oceanography II, intends to train the student in the direct and indirect techniques for the characterization of the submarine bottoms, as well as the geological record in marine environments of continental shelf and deep environments (continental slope, continental abyssal plains, dorsal flanks, Ridges and ocean trenches). Therefore this subject has a different approach to the one of the Geological Oceanography I dedicated to the coastal and coastal areas. It is intended therefore that the student acquire the knowledge in the use and application of the latest generation techniques in sea surveys, as well as the ability to plan and develop oceanographic geological field works and prepare and submit reports. Students are required to take this course in responsible and honest behavior. Any form of fraud (i.e. copy and/or plagiarism) intended to falsify the level of knowledge or skill attained by a student in any type of test, report, or work designed for this purpose is considered inadmissible. This fraudulent conduct will be sanctioned with the firmness and rigor that establishes the current regulation. 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	
A2	Students can apply their knowledge and understanding in a manner that indicates a professional approach to their work or vocation, and have competences typically demonstrated through devising and sustaining arguments and solving problems within their field of study
A3	Students have the ability to gather and interpret relevant data (usually within their field of study) to inform judgments that include reflection on relevant social, scientific or ethical issues
A4	Students can communicate information, ideas, problems and solutions to both specialist and non-specialist audiences
B2	Plan and execute surveys in the field and laboratory work, applying basic tools and techniques for sampling, data acquisition and analysis in the water column, sea bottom and marine substratum.
B4	Manage, process and interpret the data and information obtained both in the field and in the laboratory.
B5	Develop, implement and write basic or applied projects in oceanography from a multidisciplinary perspective.
C13	Acquire the basic sedimentological, geochemical and geophysical techniques and methodologies used in identification, use and sustainability of the natural resources of coastal and marine environments.
C14	Know basic concepts and events of global change obtained from geological records.
D1	Develop the search, analysis and synthesis of information skills oriented to the identification and resolution of problems.
D5	Sustainability and environmental commitment. Equitable, responsible and efficient use of resources.

Expected results from this subject

Expected results from this subject	Training and Learning Results			
1. Get skills to plan and carry out geological oceanographic surveys	A3	B2	C13	D5
2. Get familiar with oceanographic databases in public repositories	A3	B4	C14	D1
3. To know the basic methods of geophysical exploration	A3	B2	C13	D5
		B4	C14	
4. To know the basic techniques of compositional analysis and physical properties of sedimentary cores	A2	B2	C13	D5
	A3	B4	C14	
5. To know and apply the techniques of geochemical characterization in sediments.	A2	B2	C13	D1
		B4	C14	D5

6. Get familiar with geophysical and geochemical data processing methods	A3 A4	B4 B5	C13	D1
7. Get skills to write and submit reports	A2 A3 A4	B4 B5	C14	D1
8. Security during the execution of an oceanographic survey	A2	B2	C13	D5

Contents

Topic	
THEMATIC UNITY I-: INTRODUCTION TO THE MARINE GEOLOGICAL RESEARCH IN THE SEA	THEME 1.- Introduction to the subject Geological Oceanography II. Introduction to the geological oceanography technologies applied to the study of shelf and deep sea environments. Presentation of public data repositories.
THEMATIC UNITY -II: POSITION SYSTEMS IN THE SEA	THEME 2.- Topic to select a position system. Global position systems and integration with acoustic position systems.
THEMATIC UNITY III-: ACOUSTIC SYSTEMS IN DEEP SEA	THEME 3.- Acoustic underwater and sonar systems. THEME 4.- Sidescan Sonar
THEMATIC UNIT IV-: MARINE SEISMIC SURVEYING	THEME 5.- Marine Seismic surveying: conceptual aspects. THEME 6.- Description of the diferents equipment and collected records
THEMATIC UNIT V-: MARINE GRAVIMETRY SURVEYING	THEME 7.- Gravimetry surveying and its application to marine research.
THEMATIC UNIT -VI-: MARINE MAGNETIC SURVEYING	THEME 8.- Magnetic surveying and its application to marine research.
THEMATIC UNIT-VII-: MARINE GEOTHERMAL FLOW	THEME 9.- Geothermal flow and its application to marine research.
THEMATIC UNIT -VIII: ELECTROMAGNETIC AND RADIOMETRIC SURVEYING IN MARINE ENVIRONMENTS	THEME 10.- Electromagnetic and radiometric surveying and its application to marine research.
THEMATIC UNIT IX-: SAMPLING SEDIMENTS AND ROCKS METHODS IN SHELF AND DEEP SEA ENVIRONMENTS.	THEME 11.- Sampler methods for Particulate Suspended Matter and bottom sediment samples at deep environments.
GEOTHECNICS TECHNIQS	THEME 12.- Deep sea coring technics. methods. Ocean Drilling Projects. THEME 13.- Geophysical observation into the corers.
THEMATIC UNIT X-: OCEANOGRAPHY INFRASTRUCTURES	THEME 14.: Sampler platforms in geological oceanography. THEME 15: New technology in submarine observatories.
THEMATIC UNIT -XI: PLANNING OCEANOGRAPHIC SURVEYS	THEME 16.: Project and planification of oceanographic surveys.

Planning

	Class hours	Hours outside the classroom	Total hours
Introductory activities	1	0	1
Lecturing	24	48	72
Laboratory practical	15	16	31
Mentored work	2	13	15
Seminars	5	12	17
Field practice	5	6	11
Objective questions exam	1	0	1
Objective questions exam	2	0	2

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

Methodologies

	Description
Introductory activities	Detailed introduction about the content of the subject and the methodology followed aswell as the form of evaluation, field trips, practical classes and seminars. The materials necessary to follow lecturesrs ans practical sessions and references will be presented.
Lecturing	This include the theoretical contents about all methods used in Oceanography Geology surveys, including selected aplicated examples. The student will be evaluated about this content in a final exam.
Laboratory practical	Laboratory practices consist of three thematic blocks divided into 5 sessions: 1- Corer description and interpretation. 2- Introduction to the interpretation of seismic records: reflection and refraction systems. 3- Data processing, with an specific software, for the elaboration of bathymetric maps (the computer classroom will be used). Attendance and deliverables are MANDATORY.

Mentored work	In groups of 3-4 students, the students will choose a applied scientific study on the subject for an oral presentations. The student will show there ability to work as a team and his ability to make an oral presentation on a scientific topic. In the ensuing discussion, the capacity for synthesis and understanding of the proposed topic will be evaluated. The activity and deliverables are MANDATORY.
Seminars	The seminars that students will have to hold and deliver, consists of three sessions: 1- Handling of nautical charts, navigation parameters, point positioning and sampling path. Key tools for the preparation and conduct of oceanographic surveys. 2- Interpretation of Side Scan Sonar records. 3- Exhibition of examples of studies applied in Geological Oceanography, focusing into the specific methodology used for each specific work. Debate and analysis of the topic presented. These activities and deliverables are MANDATORY.
Field practice	There will be a session onboard the B/O Mytilus along the Ria de Vigo were the student will participate in a oceanographyc survey. The objetive is to be able to familiarize themselves with the systems of acquisition of submarine acoustic data and of marine sediment samples (sediment cores, dredgers, etc.). It is also intended that they become familiar with the organization and procedure of an oceanographic survey, for which smaller groups of work will be created to carry out the activity on board the oceanographic vessel. At the end of the activity, each group will have to produce a "cruise report". Some of the collected data will be worked out in practical sessions. The activity and deliverables are MANDATORY.

Personalized assistance

Methodologies	Description
Introductory activities	This first part corresponds to the presentation of the subject: activities that will be developed along the course, material that will be needed, and to specify the deliverables that the students will have to present along the course. The evaluation system to be followed will also be presented. The active participation of the students will be encouraged, basically aimed at clarifying all the doubts related to the approach and development of the subject. Students are invited to contact the teacher to clarify doubts at all times, preferably in person, individually, or in a group. It is necessary to contact the teacher sufficiently in advance by email or using the virtual secretary.
Lecturing	The active participation of the students in the classes will be encouraged, encouraging the discussion and approach of small questions to be solved in class. The student can contact at all times with the teacher to clarify doubts, in person, individually, or in a group. If the doubts require greater personal attention to solve problems they can ask for personalized tutorials. It is necessary to contact the teacher sufficiently in advance by email or using the virtual secretary.
Laboratory practical	The exercises presented in the three Practical blocks will be solved in the same classroom in order to resolve the doubts gradually as they arise as the work progresses in the complexity of the exercises. The active participation of students will be encouraged. Each practice will have a deliverable for evaluation. Once completed, the student can contact at all times with the teacher to clarify doubts, preferably in person, individually, or in a group. If the doubts require greater personal attention will be agreed a tutorial to solve problems. It is necessary to contact the teacher sufficiently in advance by email or using the virtual secretary.
Field practice	An oceanography Survey will be carried out in the B/O Mytilus, in groups of 5-6 students, where they will put into practice the methodology involved in Geological Oceanography cruises. Some of the data collected on board will be worked out in practical sessions. After the activity, each group of students must produce a survey report to be evaluated. This will include: a description of the methodology achieved and collected data. Students who wish may attend personalized tutorials to resolve doubts. Contacting the teacher sufficiently in advance by email or using the virtual secretary is necessary.
Mentored work	In groups of two or three persons, students will choose a current publication that shows an applied practical work of any of the equipment and methodologies that are included in the assignment. They will have to give their colleagues an oral exposition of the work and present a written paper in an article format. Students who wish may attend personalized tutorials to resolve doubts. Contacting the teacher sufficiently in advance by email or using the virtual secretary is necessary.
Seminars	The practical exercises presented in the different seminars sessions will be solved in the same classroom in order to resolve the doubts gradually as they arise as the work progresses in the complexity of the exercises. The active participation of students will be encouraged. Once completed, the student can contact at all times with the teacher to clarify doubts, preferably in person, individually, or in a group. If the doubts require greater personal attention, a tutorial to solve problems will be agreed upon. Contacting the teacher sufficiently in advance by email or using the virtual secretary is necessary.

Assessment

Description		Qualification	Training and Learning Results			
Laboratory practical	Attendance at the laboratory practices and deliverables are MANDATORY. The correct implementation of the exercises proposed in these practices will be evaluated.	15	A2 A3	B2 B4	C13 C14	D1
Mentored work	The assignment of individual or paired work will be evaluated, assessing both the preparation of the topic, the presentation of a summary document of the subject as well as the presentation of the same. This activity is MANDATORY	15	A2 A3 A4	B5	C13 C14	D1
Seminars	Seminar attendance and deliverables are MANDATORY. The correct implementation of the exercises proposed in these seminars will be evaluated.	10	A2 A3	B2 B4	C13 C14	D1
Field practice	Attendance at the sea survey and deliverables are MANDATORY. The correct implementation of the exercises proposed in these practices will be evaluated.	15	A2 A3	B2 B4 B5	C13	D5
Objective questions exam	Questions and exercises to assess understanding, analytical capacity and synthesis of acquired knowledge, mainly in relation to the content of the first thematic blocks of the master classes. It will be done throughout the course.	5	A2 A3 A4	B2 B4	C13 C14	D1 D5
Objective questions exam	Questions and exercises to assess understanding, analytical capacity and synthesis of acquired knowledge, mainly in relation to ALL the content of the theoretical classes. This exam will coincide with the 1st chance official date.	40	A2 A3 A4	B2 B4	C13 C14	D1 D5

Other comments on the Evaluation

Continuous assesment option

It will be **necessary to obtain a minimum of 5 points (out of 10)** in all the Methodologies/Tests to carry out the weighting and pass the subject, except in the follow-up tests of the Theory block.

Given the experimental nature of the practices, seminars and Field practice, attendance at them is MANDATORY to be eligible for this evaluation option. **Failure to attend any of this activities, without justified cause, invalidate this option as well as the opportunity for extraordinary assesment (2nd opportunity).**

Global assessment option

The application for this evaluation option must be submitted in the time and manner determined by the Center, which will be published prior to the academic start.

Given the experimental nature of the practices, seminars and field trip, it is MANDATORY to have completed these activities to be eligible for this assesment option. **Failure to attend any of this activities without justified cause invalidate this option.**

Second opportunity assesment

Exams of each of the Items NOT passed in the 1st opportunity evaluation, as long as these activities have been carried out, given their mandatory nature.

Date, time and place of exams will be published in the official web of Marine Sciences
Faculty: <http://mar.uvigo.es/index.php/en/alumnado-actual-2/examenes-3>

Grades for completed assignments (except for objective question exams) **are retained for one year**, as long as they are the same as those actually taken. However, students may retake them if they wish to improve their grade.

Others considerations

Students are strongly requested to fulfil a honest and responsible behaviour. It is considered completely unacceptable any alteration or fraud (i.e., copy or plagiarism) contributing to modify the level of knowledge and abilities acquired in exams, evaluations, reports or any kind of teacher's proposed work. Fraudulent behaviour may cause failing the course for a whole academic year. An internal dossier of these activities will be built and, when reoffending, the university rectorate will be asked to open a disciplinary record

Sources of information

Basic Bibliography

Danovaro, R., **Methods for the Study of Deep-Sea Sediments, Their Functioning and Biodiversity**, CRC Press. 458 pp,

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Hüneke, H., Mulder, T., **Deep-Sea Sediments (Developments in Sedimentology).**, Elsevier Science, 750 pp.,

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Musset, A.E., Aftab, M., **Looking into the earth. An Introduction to Geological Geophysics.**, Cambridge University Press. 470 pp.,

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McQuilling, R., Bacon, M., Barclay, W., **An Introduction to seismic interpretation**, Graham & Trotman, 287 pp.,

Complementary Bibliography

Flor, Germán, **Geología Marina**, Librería Servitec,

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Lozano, L., **Introducción a la Geofísica.**, Ed. Paraninfo, Madrid.,

McQuilling, R., Ardu, D.A., **Exploring the Geology of Shelf Seas.**, Graham & trotman limited. Gulf Publishing Company, 234 pp.,

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Sheriff, R., **Encyclopedic Dictionary of Exploration Geophysics. Second Edition.**, Society of Exploration Geophysicists, 323 pp,

Sheriff, R.E., **Geophysical Methods**, Prentice Hall. Englewood Cliffs, New York,

Telford, W.M.; Geldart, L.P., Sheriff, R.E., **Applied Geophysics, 2nd Edition.**, Cambridge University Press, 770 pp.,

Trabant, P.K., **Applied High-Resolution Geophysical Methods Offshore Geoengineering Hazards.**, D. reidel Publishing Company. International Human Resources Development Corporation. Boston., 265 p.,

Udias, A., Mézcua, J., **Fundamentos de Geofísica**, Ed. Alhambra. 419 pp,

Wille, P. C., **Sound images of the Ocean in Research and Monitoring.**, Springer-Verlag, 471,

OpenCourseWare, <http://ocw.mit.edu/index.htm>,

Recommendations

Subjects that continue the syllabus

Applied marine geology/V10G061V01403

Basin Analysis/V10G061V01406

Subjects that are recommended to be taken simultaneously

Physical oceanography II/V10G061V01307

Subjects that it is recommended to have taken before

Geology: Geology 2/V10G061V01108

Sedimentology/V10G061V01205

Geological oceanography I/V10G061V01303

Geology: Geology 1/V10G061V01103

Coastal and marine sedimentary habitats/V10G061V01207

IDENTIFYING DATA**Chemistry applied to the marine environment II**

Subject	Chemistry applied to the marine environment II			
Code	V10G061V01309			
Study programme	Grado en Ciencias del Mar			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	3rd	2nd
Teaching language	#EnglishFriendly Spanish Galician			
Department				
Coordinator	Nieto Palmeiro, Óscar Moldes Moreira, Diego			
Lecturers	Costas Rodríguez, Marta Moldes Moreira, Diego Nieto Palmeiro, Óscar			
E-mail	diegomoldes@gmail.com palmeiro@uvigo.es			
Web	http://mar.uvigo.es			
General description	The student will acquire competences and skills on several topics of chemistry in the marine environment. In the first part of the subject, students will tackle important applications such as wastewater treatment, desalination and marine biotechnology. In the second part, students will acquire theoretical and practical competences regarding the analysis of chemical contaminants as well as other compounds of interest in the marine environment. In this case they will learn to use simple techniques for sample preparation prior to the measurement step and their applications in the compartments of the marine environment. The students will get knowledge about the relevance of chemistry regarding the marine environment.			
English Friendly subject: International students may request from the teachers: a) materials and bibliographic references in English, b) tutoring sessions in English, c) exams and assessments in English.				

Training and Learning Results

Code				
A3	Students have the ability to gather and interpret relevant data (usually within their field of study) to inform judgments that include reflection on relevant social, scientific or ethical issues			
A4	Students can communicate information, ideas, problems and solutions to both specialist and non-specialist audiences			
A5	Students have developed those learning skills that are necessary for them to continue to undertake further study with a high degree of autonomy			
B1	Know and use vocabulary, concepts, principles and theories related to oceanography and apply everything learned in a professional and/or research environment.			
B4	Manage, process and interpret the data and information obtained both in the field and in the laboratory.			
C6	Acquire the fundamentals and terminology of chemical processes.			
C7	Apply to the marine and coastal environment the principles and methods used in Chemistry.			
C8	Know the main pollutants, their causes and effects in the marine and coastal environment.			
D1	Develop the search, analysis and synthesis of information skills oriented to the identification and resolution of problems.			
D2	Acquire the ability to learn autonomously, continuously and collaboratively, organizing and planning tasks over time.			
D5	Sustainability and environmental commitment. Equitable, responsible and efficient use of resources.			

Expected results from this subject

Expected results from this subject	Training and Learning Results			
Recognise the main characteristics of the wastewater. Classify the wastewater depending on their origin.	A3		C6 C8	
Knowing the main technologies used for wastewater treatment and choosing the suitable one depending on the wastewater properties.	A3	B1	C6 C7	
Elaborate scientific documents with own data obtained by means of a simulation software	A3 A4 A5	B1 B4	C6 C7 C8	D1 D2
Recognise the main methodologies of sea water desalination	A3 A4	B1	C6 C7 C8	D5

Knowing the potential of the marine environment as a source of marketable products by means of biotechnological processes	A3 A4 A5		C6	
Enumerate the most important points regarding the setup of a control plan about marine pollution.	A4 A5	B1 B4	C6 C8	D2 D5
Choose and use the suitable material for sediments sampling. Choose the most important sentinel organisms for studying marine pollution.	A3 A4 A5		C6 C7 C8	
Apply the suitable chemical analytical techniques for the most interesting compounds in Environmental Chemistry. Knowing the suitable experimental conditions for the determination of a chemical compound depending on the selected technique.	A3 A4 A5	B1 B4	C6 C7 C8	D1
Being able to determine the concentration of a chemical compound in the marine environment depending on the analytical technique employed.	A3 A4 A5	B4	C6 C7 C8	D1 D2
Apply the fundamental concepts of quality control in an analytical laboratory.	A3 A5	B4	C7	D1

Contents

Topic	
Wastewater treatment	Sources and classification of wastewaters. Physical, chemical and biological properties of wastewater. General operation of a wastewater treatment plant (WWTP). Pretreatment and primary treatment. Secondary treatment: aerobic and anaerobic systems, suspended and fixed biomass systems. Tertiary or advanced treatment.
Desalination of seawater	Technologies of desalination: thermal processes and processes with membranes. Environmental effects.
Marine biotechnology	Definition and importance of biotechnology. General diagram of biotechnological production. Procedures to obtain biotechnological products from marine organisms (biofuels, pharmaceutical products, biorremediation of pollutants)
Chemical analysis of contaminants I: introduction.	The need for chemical analysis. Levels of security.
Chemical analysis of contaminants II: atmosphere.	Sampling methods for dissolved and particulate matter in the atmosphere. Sampling methods for the atmosphere-ocean interface.
Chemical analysis of contaminants III: seawater.	Methods for sampling preparation and determination of contaminants in the water column.
Chemical analysis of contaminants IV: sediments and marine organisms.	Methods of sampling, extraction, purification and determination of contaminants in sediments and marine organisms.
Analysis of marine biotoxins.	Chemical structure of marine biotoxins. Toxicity of marine biotoxins. Sample preparation. Methods of separation and detection.
Control and guarantee of quality in the measures.	Systems of guarantee of quality. Validation of analytical methods. Intercomparison assays.

Planning

	Class hours	Hours outside the classroom	Total hours
Introductory activities	1	2	3
Lecturing	20	30	50
Problem solving	2	10	12
Mentored work	7	21	28
Laboratory practical	10	10	20
Practices through ICT	5	1	6
Studies excursion	5	1	6
Presentation	0.5	1.5	2
Objective questions exam	2	4	6
Essay	0	12	12
Report of practices, practicum and external practices	0	2	2
Problem and/or exercise solving	1	2	3

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

Methodologies

Description

Introductory activities	The syllabus will be presented to the students (mainly aims, competences and evaluation criteria). Moreover the activities of the semester will be presented..
Lecturing	The professor will make an exhibition of the contents of the syllabus to develop, where the professor can pose some question to the students for his resolution in class. Likewise, the students can ask to the professor the questions that go arising along the exhibition. The material of the presentation will be available for the students before the session and will have to assist to her with said material. At the end of each subject, or of each group of subjects, will have to make a questionnaire that will resolve individually.
Problem solving	During the problem solving sessions, the teacher will explain the calculations to be made on a series of problems to calculate the concentration of a chemical contaminant in samples of biota and/or marine sediments.
Mentored work	During the session of computing practice, the students will obtain data related with the wastewater treatment. With these data the students will write a report with the same format of a scientific article. On the other hand, the students will study a practical case based in the analysis of a contaminant based on a bibliographic research.
Laboratory practical	The students, in groups of 4 people, will make 3 of the following practical of laboratory: - Determination of ions in freshwater by ionic chromatography. - Determination of PAHs in mussels by gas chromatography or by HPLC. - Determination of domoic acid in mussels. - Determination of Pb in seawater by cathodic stripping voltammetry. - Determination of Zn or Cu in marine sediments by atomic spectrometry. When finalising the practices, each group will present the corresponding report in the term that the professors indicate in the Moovi platform.
Practices through ICT	The students will make some practices of computer on the treatment of residual waters. They will consist in the utilisation of a simulator in which it will study the effect of diverse parameters in the process of treatment of the residual waters. The students will have to take data of the different parameters studied, which will be employed for the preparation of the Supervised Works.
Studies excursion	A visit to a wastewater treatment facility will be carried out. After the visit the students will answer to a brief questionnaire. Considering the economic possibilities of the centre, schedules and availability of companies of interest, the students could visit other company of interest related with the subject. The attendance to this visit wouldn't be mandatory.
Presentation	The students will do a brief presentation in public related with the analytical work made in the Supervised Works. The mates and the professor will be able to make questions on the presentation made.

Personalized assistance

Methodologies	Description
Introductory activities	Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation.
Mentored work	Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation.
Presentation	Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation.
Laboratory practical	Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation.
Practices through ICT	Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation.
Studies excursion	Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation.
Lecturing	Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation
Problem solving	Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation.

Assessment						
	Description	Qualification	Training and Learning Results			
Laboratory practical	The accurate work of the student, the attitude to learn and the correct employment of the lab material will be assessed.	2.5	A5	B4	D2	
Studies excursion	The students will visit a wastewater treatment facility. After that, a brief questionnaire must be answer.	5	A3 A4		C6	
Presentation	The students will do a brief public presentation related to the guided work derived from the seminar sessions.	2.5	A3 A4	B1		D2
Objective questions exam	Diverse quizzes of theoretical content and practical/theoretical content derived from the masterclasses will be made. These exams may contain type test questions, problems resolutions and/or questions with open answers	37.5	A3 A4 A5	B1 B4	C6 C7 C8	D1 D5
Essay	A scientific article must be written by the students. The data will be obtained by means of a wastewater simulation software. This counts for 20% of final evaluations. Moreover, a guided work must be carried out during/after the seminar sessions. This counts for 10% of final evaluation.	30	A3 A4 A5	B1 B4	C6 C7 C8	D1
Report of practices, practicum and external practices	The students will present an original report of the results obtained in the lab practices	10	A3 A4 A5		C6 C7 C8	D1 D2
Problem and/or exercise solving	The problems will consist in calculating the concentration of a chemical contaminant, from the data normally obtained in a laboratory work, and expressing the result with the correct significant units and figures. The result obtained shall be evaluated, as well as the clarity and reasoning used to arrive at it. The final examination will consist in solving two such problems.	12.5	A4 A5	B1 B4	C7	D1

Other comments on the Evaluation

Date, time and place of exams will be published in the official web of Marien Sciences Faculty:

<http://mar.uvigo.es/alumnado/examenes/>

To pass the subject, students have to achieve a minimum of 5 points up to 10 in each one of the qualified activities.

The activities with a lower qualification than 5 points will be repeated in the final exam.

The reports of practices, works and projects that do not reach the minimum qualification, will have to send with the timely corrections in the term that will estimate the lecturers in each case.

The students may present their work regarding simulation of wastewater treatment to a students congress to be hosted at the Engineering College. The presentation may be as an "oral presentation" or "poster". The participation to this congress will improve the qualification of the scientific article. Moreover, the students will receive a certificate of their participation and presentation.

The realisation by part of the student of any proof of which show previously will be taken into account immediately for the final qualification and will be recorded in the record like student presented in the corresponding announcement.

An absence to one of the sessions of seminars or practical supposes the no evaluation of that qualified activity and will be repeated on next year.

Sources of information

Basic Bibliography

Metcalf & Eddy, **Wastewater Engineering. Treatment and Resource Recovery**, 5, McGrawHill, 2014

Aminot A., Kérouel R., **Hydrologie des écosystèmes marins: paramètres et analyses**, Editions Quae, 2004

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Beiras R., Pérez S., **Manual de métodos básicos en Contaminación Acuática**, Universidade de Vigo, 2013

K. Grasshoff, K. Kremling, M. Ehrhardt, **Methods of Seawater Analysis**, 3, Wiley-VCH, 1999

Fifield F.W., Haines P.J., **Environmental Analytical Chemistry**, Blackie Academic, 1995

Harris D.C., **Análisis Químico Cuantitativo**, Reverté, 2007

Recommendations

Subjects that it is recommended to have taken before

Chemistry: Chemistry 2/V10G061V01110

Chemistry applied to the marine environment I/V10G061V01304

Chemistry: Chemistry I/V10G061V01105

Chemical oceanography I/V10G061V01204

Chemical oceanography II/V10G061V01209

IDENTIFYING DATA				
Aquaculture				
Subject	Aquaculture			
Code	V10G061V01310			
Study programme	Grado en Ciencias del Mar			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	3rd	2nd
Teaching language	Spanish			
Department				
Coordinator	Rocha Valdes, Francisco Javier			
Lecturers	Paredes Rosendo, Estefanía Rocha Valdes, Francisco Javier			
E-mail	frocha@uvigo.es			
Web	http://https://mar.uvigo.es/			
General description	This course aims to provide to the students with the knowledge, skills and abilities that enable their to conceive, design and carry out research projects in the field of aquaculture. At the same time, this matter allows the student to design, manage and control aquaculture farming facilities on land and sea. 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	
A2	Students can apply their knowledge and understanding in a manner that indicates a professional approach to their work or vocation, and have competences typically demonstrated through devising and sustaining arguments and solving problems within their field of study
A3	Students have the ability to gather and interpret relevant data (usually within their field of study) to inform judgments that include reflection on relevant social, scientific or ethical issues
B3	Recognize and implement good practices in measurement and experimentation, and work responsibly and safely both in field surveys and in the laboratory.
B4	Manage, process and interpret the data and information obtained both in the field and in the laboratory.
C8	Know the main pollutants, their causes and effects in the marine and coastal environment.
C11	Apply the knowledge and techniques acquired to the characterization and sustainable use of living resources and marine ecosystems.
D1	Develop the search, analysis and synthesis of information skills oriented to the identification and resolution of problems.
D5	Sustainability and environmental commitment. Equitable, responsible and efficient use of resources.

Expected results from this subject				
Expected results from this subject		Training and Learning Results		
Knowing the potentially cultivable marine species in the world		A3	B3 B4	C11 D1 D5
Know the aquaculture installations in land and sea		A2	B3 B4	D5
Dominate the aquaculture auxiliary techniques (phytoplankton and zooplankton) and the culture technics of the main species that are cultivate now in Europe		A2	B3 B4	
Know the treatments for the water in the culture systems		A3	B3	C11 D1 D5
Known the operational details of marine companies, recognise specific problems and propose solutions		A3		C8 D5
Design, control and manage culture production plants		A2		D1 D5
Aquariology		A2	B4	D1

Contents	
Topic	
INTRODUCTION	Objectives of aquaculture. History, current situation and perspectives in the world and in Spain. Types of cultivation: according to species and its stages, according to its characteristics. New farming systems.
SPECIES SELECTION CRITERIA	Introduction. Biological criteria (reproductive, productive and health characteristics). Commercial criteria (consumption and market). Cultured freshwater species. Farmed marine species. Potentially cultivable species.

FACILITIES	Types of Facilities. Water intake. Storage and settling tanks. Culture tank design. Pond designs for culture. Floating cages, rafts, long-line. Auxiliary equipment.
WATER QUALITY AND ITS CONTROL	Sea water as culture medium. Changes suffered by the water in the crop. Biological filtration. mechanical filtration. physical absorption. Disinfection. Decantation. Aeration. Water quality criteria for aquaculture.
FOOD AND NUTRITION	Introduction. Feeding modes (larval, juvenile and adult stages). Nutrient requirements (molluscs, crustaceans, fish). Types of feed used in aquaculture. Formulation of diets.
PHYTOPLANKTON CULTURE	Introduction. Optimal properties for the choice of a cultivable species of phytoplankton. physical requirements. Nutrient requirements. Culture media. Characteristics of growth in culture. Phytoplankton culture methods.
ZOOPLANKTON CULTURE	Introduction. Artemia culture: general characteristics, life cycle, culture methodology, use in aquaculture. Rotifera culture: general characteristics, life cycle, culture methodology, use in aquaculture. Other planktonic crustaceans used in aquaculture: Copepods, Cladocera.
MOLLUSKS FARMING	Clam culture: obtaining and transporting broodstock, conditioning and obtaining gametes, embryo culture, larval culture, natural seed capture, post-larvae culture, pre-growing, fattening. Differences in the cultivation of other species. Octopus culture: obtaining and transporting broodstock, conditioning and obtaining eggs, embryo culture, larval culture, post-larvae culture, fattening and production.
ECHINODERMS FARMING	Introduction. Hedgehog Cultivation: Conditioning of reproducers and obtaining spawns; embryonic and larval culture, culture of postlarvae, pre-fattening, fattening. Other echinoderms farmed in Aquaculture.
CRUSTACEAN FARMING	Shrimp culture: obtaining and transporting broodstock, conditioning and obtaining gametes, embryo culture, larval culture, post-larvae culture, pre-fattening, fattening. Ceteraria and their characteristics.
FISH FARMING	Turbot culture: obtaining and transporting reproducers, conditioning and obtaining gametes, embryo culture, larval culture, weaning, pre-fattening, fattening. Bream culture: obtaining and transporting broodstock, conditioning and obtaining gametes, embryo culture, larval culture, weaning pre-fattening, fattening. Seabass farming: obtaining and transporting broodstock, conditioning and obtaining gametes, embryo culture, larval culture, weaning pre-fattening, fattening. Salmon farming: obtaining and transporting broodstock, conditioning and obtaining gametes, embryo culture, larval culture, weaning pre-fattening, fattening.
MACROALGAE FARMING	Introduction on the cultivation of macroalgae, advantages and characteristics. cultivated species. Culture systems and methodology.
DISEASES OF CULTIVATED SPECIES	Mortality. Prevention: vaccinations, disinfection and isolation of specimens. Treatments: medications, environmental manipulation, isolation and disposal. Animal examination. Viral diseases. Bacterial diseases. Fungal infections. Protozoan diseases. Metazoan diseases.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	30	45	75
Seminars	7	14	21
Laboratory practical	15	15	30
Seminars	2	0	2
Studies excursion	7	0	7
Essay questions exam	3	7.5	10.5
Objective questions exam	1	1.5	2.5
Report of practices, practicum and external practices	0	2	2

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

Methodologies

	Description
Lecturing	Program contents will be explained through classes. During the sessions the students will encourage the realization of comments and questions for clarification of questions during class. For the classes preparation by the students, notes on each of the topics will be available on the platform Tem@ before classes begin.

Seminars	Each group will prepare a seminar topic related to aquaculture, which will be presented and discussed in groups. Similarly, each group should prepare a brief abstract on the subject matter to be placed on the platform Tem@. This abstract will be distributed among all students and will be evaluated in the test.
Laboratory practical	This is obligatory because it is an essential complement to the theoretical sessions. Laboratory practices will be used to explain the techniques of cultivation and laboratory culture. To take full advantage of these practices, the student will write a resume for each practice. Text will include all possible information about this activity, including the theoretical foundation, the purpose of practice and job description to be held.
Seminars	During the tutorials it will be discussed questions concerning any aspect of the subject. Moreover, as this matter is attended in the last year of the degree, this tutoring time may also be used by students to see career or incorporation into different graduate curricula related to aquaculture.
Studies excursion	It is planned to conduct two studio outputs, aimed at students to observe the practical application of knowledge taught in class. The outputs shall be performed: 1. Visit the farmed salmon in Cotobade (Pontevedra). 2. Site visit of the Galician Institute for Aquaculture Training of the Galician Government in the Island of Arousa.

Personalized assistance

Methodologies	Description
Seminars	These activities will be developed in small groups. Students can obtain help and guidance to guide them in the seminar preparation and learning process. These activities will be developed in person (by direct consultations in the classroom or during tutorials and consultation sessions in the teacher's office) or via email.
Seminars	These activities will be developed individually or in small groups. Its purpose will be to meet the needs and queries of students related to the study, topics related to the subject and correction of exams, providing guidance, support and motivation in the learning process. These activities will be developed in person or via email. The tutorials, both individual and group, will be held from Monday to Thursday from 11:30 to 12:30 a.m. Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation

Tests	Description
Essay questions exam	For the preparation of the tests, students may consult questions or clarify aspects of the subject that are evaluated in the exam. The assistance will be developed in person (by direct consultations in the classroom or during tutorials and consultation sessions by the teacher in his office) or via email. Similarly, once the test has been completed, the students will have a consultation schedule and review of exams to solve doubts and make inquiries about the exam itself.
Objective questions exam	The tests will be developed weekly with the objective that the students prepare each week the subject that will be discussed during the sessions. For the preparation of the tests, students may consult questions or clarify aspects of the subject that will be evaluated in the exam. The assistance will be developed in person (by direct consultations in the classroom or during tutorials and consultation sessions by the teacher in his office) or via email.

Assessment

	Description	Qualification	Training and Learning Results		
Seminars	Following the completion of the seminars, each student group must submit a summary report of the subject matter, which will be evaluated. A minimum of 5 will be required to approve.	10	A2 A3	B4	D1 D5
Laboratory practical	Laboratory practices are considered an essential part of the subject. Practices will be evaluated by the attendance and assistance of students to them. Laboratory practices are an obligatory activity.	5		B3 B4	C8
Essay questions exam	There will be a long written test on the official date will be assessed on the knowledge gained throughout the course. This test will assess all the knowledge acquired in the course of the subject. The minimum grade to pass the exam will be 5	40	A2 A3	B4	C11 D5
Objective questions exam	There will be several quizzes, multiple choice, during the course of lectures. Since the objective of these tests is that students prepare in advance the subjects to be discussed, questions of each test will cover the topics that are being treated that week (including topics to be covered in that class or the next if they are part of issue). The minimum grade to pass the test will be 5.	15	A2 A3	B3 B4	D1

Report of practices, practicum and external practices	For the evaluation of practices is obligatory that each student prepare a written report on the implementation and results of laboratory practices, which will be evaluated. The minimum grade to approve the report will be 5.	30	A2 B3 A3 B4	D1 D5
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Other comments on the Evaluation

In order to pass the subject, each student **must approve** the evaluation of teaching (long answer test) and laboratory practices (attendance and practice report) **separately** (with a mark higher than 5).

In the case of laboratory practices, which are mandatory, failure to attend these practices that is not duly justified will mean the elimination of the option to take the second chance test. Obviously, if the student has attended the practices, but has not passed them, they will have the right to recover them through a job and attend the second chance test if necessary.

The application for this evaluation option must be submitted in the time and manner determined by the Center, which will be published prior to the academic start.

In the case that the student takes the **second chance evaluation** (July test), the weekly test scores, laboratory practices and seminars will be saved for the estimation of the final qualification in the case that the student exceeds (with note on 5) the exam. If the student passes the second chance exam, the grade will account for 40% of the final grade.

The official calendar of the evaluation will be published in:

<http://mar.uvigo.es/alumnado/examenes/>

If the student fails the course but completes the Seminar and Practical activities, the qualification of these activities may be saved for the student to retake the course, provided the student requests it. Qualifications will be saved for a maximum of two academic years, after which the student must complete the entire course.

Students are strongly requested to fulfil a honest and responsible behaviour. It is considered completely unacceptable any alteration or fraud (i.e., copy or plagiarism) contributing to modify the level of knowledge and abilities acquired in exams, evaluations, reports or any kind of teacher's proposed work. Fraudulent behaviour may cause failing the course for a whole academic year. An internal dossier of these activities will be built and, when reoffending, the university rectorate will be asked to open a disciplinary record.

Sources of information

Basic Bibliography

Barnabe, G., **Bases biológicas y ecológicas de la acuicultura**, 1996,

Abalde, J. et al., **Microalgas: cultivo y aplicaciones**, 1995,

Fingerman, M. y R. Nagabhushanam, **Aquaculture**, 2000,

FAO, **Fichas de la FAO sobre acuicultura**, 2012,

Stickney, R., **Aquicultura. Texto introductorio**, 2016, ACRIBIA S.A., 2016

Complementary Bibliography

Costa-Pierce, B. A., **Ecological Aquaculture: the Evolution of the Blue Revolution**, 2003,

Xunta de Galicia - VV.AA., **Unidades didácticas de acuicultura**, 1991,

Beveridge, M., **Cage Aquaculture**, 2004,

Fernández Souto, B. y X.L. Rodríguez Villanueva, **Guía da piscicultura europea**, 2002,

Huguenin, J. E. y J. Colt, **Design and Operating Guide for Aquaculture Seawater Systems**, 2002,

Lee, D. O. y J. F. Wickings, **Cultivo de crustáceos**, 1996,

Southgate, P. et al., **Aquaculture: farming aquatic animals and plants**, 2012,

Stead, S. M. y L. Laird, **Handbook of Salmon farming**, 2001,

Wedmeyer, G. A., **Physiology of fish in intensive culture systems**, 1996,

Wedemeyer, G. A., **Fish Hatchery Management**, 2001,

Recommendations

Subjects that it is recommended to have taken before

Marine zoology/V10G061V01210

IDENTIFYING DATA				
Marine Pollution				
Subject	Marine Pollution			
Code	V10G061V01401			
Study programme	Grado en Ciencias del Mar			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	4th	1st
Teaching language	#EnglishFriendly Galician English			
Department				
Coordinator	Beiras García-Sabell, Ricardo			
Lecturers	Beiras García-Sabell, Ricardo Fernández Suárez, Emilio Manuel García-Boente Soto, Mariana Hernando Morales, Víctor Montalvo Rodríguez, Javier Teira Gonzalez, Eva Maria			
E-mail	rbeiras@uvigo.gal			
Web	http://www.ecotox.es			
General description	Main pollutants, sources, environmental distribution, toxic effects. Marine environmental legislation. 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	
A2	Students can apply their knowledge and understanding in a manner that indicates a professional approach to their work or vocation, and have competences typically demonstrated through devising and sustaining arguments and solving problems within their field of study
A3	Students have the ability to gather and interpret relevant data (usually within their field of study) to inform judgments that include reflection on relevant social, scientific or ethical issues
A4	Students can communicate information, ideas, problems and solutions to both specialist and non-specialist audiences
A5	Students have developed those learning skills that are necessary for them to continue to undertake further study with a high degree of autonomy
B2	Plan and execute surveys in the field and laboratory work, applying basic tools and techniques for sampling, data acquisition and analysis in the water column, sea bottom and marine substratum.
B3	Recognize and implement good practices in measurement and experimentation, and work responsibly and safely both in field surveys and in the laboratory.
B4	Manage, process and interpret the data and information obtained both in the field and in the laboratory.
C8	Know the main pollutants, their causes and effects in the marine and coastal environment.
C11	Apply the knowledge and techniques acquired to the characterization and sustainable use of living resources and marine ecosystems.
D1	Develop the search, analysis and synthesis of information skills oriented to the identification and resolution of problems.
D2	Acquire the ability to learn autonomously, continuously and collaboratively, organizing and planning tasks over time.
D5	Sustainability and environmental commitment. Equitable, responsible and efficient use of resources.

Expected results from this subject

Expected results from this subject	Training and Learning Results			
4. Know how to design an integrated study of evaluation of pollution in a coastal ecosystem, including the variables to measure and the samples to collect.	A2	B2	C8	D1
	A3	B3	C11	D2
	A4	B4		D5
	A5			
5. To get familiar with the study and the management of the waste water effluents in regard to the uses of the surface water bodies, with particular attention to estuaries and marine waters.	A2	B2	C8	D1
	A3	B3	C11	D2
	A4	B4		D5
	A5			
6. To get familiar with the instruments of management and control of the human actions with impact on the coastline, and basic notions of the legislation involved in pollution control, within the autonomic, state and international administrations	A2	B2	C8	D1
	A3	B3	C11	D2
	A4	B4		D5
	A5			

Contents	
Topic	
Basic concepts	1. Introduction. Pollution, anthropogenic process. Pollution: deleterious effects. Environmental Quality Criteria and Standards. PBT substances. Sources, distribution and fate of pollutants in the marine compartments.
Urban and agriculture pollutants	2. Organic pollution. Sources: liquid wastes. Estimating the organic load in wastewaters and receiving waters: BOD, COD, TOC. Excess of organic matter: hypoxia and anoxia. 3. Pollution by excess of inorganic nutrients. Nitrogen and phosphorus in the marine environment; anthropogenic sources. Eutrophication and hypereutrophication. Detergents. 4. Microbial pollution. Pathogenic microorganisms present in marine waters. Microbiological analysis of water and shellfish. Self-depuration of natural waters. Disinfection of wastewaters.
Industrial pollutants	5. Hydrocarbons. Oil. Polycyclic Aromatic Hydrocarbons. Sources and weathering of oil in the sea. Effects on marine organisms. Oil spills, lessons learnt. 6. Organohalogenated pollutants. Organochlorine pesticides: sources and levels in the marine compartments; bioaccumulation and biomagnification. Toxicity. Polychlorinated biphenyls (PCBs). Polybrominated compounds (PBDEs); sources and levels in the marine compartments; toxicity. Dioxins and dibenzofurans. 7. Trace metals I. Background levels and enrichment factors. Distribution in the oceans. Mercury: Sources, distribution, bioaccumulation and biomagnification. Toxicity. Methylmercury. 8. Trace metals II. Copper, lead, cadmium. Sources, concentrations in marine compartments, toxicity. Tributyltin (TBT).
Ecotoxicology	9. Distribution of pollutants in the environment. Fugacity models. Environmental persistence and half-life. Biodegradation. Chemical speciation and bioavailability of metals. 10. Bioaccumulation. Toxicokinetics. Uptake, accumulation and biotransformation of pollutants in the organisms. Bioconcentration factor (BCF). First order kinetic bioaccumulation models. Thermodynamic bioaccumulation models, Kow. 11. Molecular and cellular responses to pollutants: biomarkers. Biotransformation and elimination of toxic chemicals. Lysosomal alterations. Metallothioneins and stress proteins. Cytochrome P450. Enzymatic alterations. 12. Lethal and sublethal toxicity. Basic principles of toxicology. Dose:response curves. LC50/EC50 and toxicity threshold. Time and other factors affecting toxicity. Effects on reproduction and development. Effects on the bioenergetics and growth. 13. Effects of pollution at population and community levels. Changes in the presence and abundance of populations. Bioindicators by presence and absence. Biological indices in communities.
Managing and assessing marine environmental quality	14. Integrative assessment of marine pollution. Coastal pollution monitoring programs. Integration of chemical and biological methods. Use of wild organisms as bioindicators and laboratory bioassays. The mussel watch approach 15. Ecotoxicological bioassays. requirements and methodological aspects. Liquid phase: copepod survival, Seaurchin Embryo Test (SET). Solid phase: amphipod survival, bivalve burrowing. In situ bioassays. 16. Protection of the marine environment. I. Control at the point source discharges. Identification of priority pollutants. Evaluation of the ecological risk. Regulation of new chemical products. REACH. Regulation of complex effluents. 17. Protection of the marine environment. II. Control of the levels of pollutants in receiving waters. Sediment and Water Quality Criteria and standards. International legislation. Water Framework Directive. Marine Strategy Framework Directive.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	20	40	60
Seminars	12	28	40
Studies excursion	4	0	4

Laboratory practical	15	30	45
Objective questions exam	1	0	1

*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 contents that will be evaluated in two calls, one exam along the course and another at the end.
Seminars	The basic scheme of the seminars consists in the following: 1. preparation by the student of a questionnaire and a practical case available through TEMA. 2. handing over the questionnaire to the teacher at the beginning of the seminar. 3. resolution and discussion of the case in common with the teacher. Attendance is mandatory.
Studies excursion	Field trip to a supposedly polluted zone with basic sampling material for sediments, water and biota. Collection of representative samples with support of the professor for further analysis in laboratory. Attendance is mandatory.
Laboratory practical	The practices consist in a field trip to an impacted site in the Port of Vigo, and the collection of environmental matrices (water sub-superficial with oceanographic bottle, sediment with *draga Vain *Veen dredge) and native mussels, with object to realize a series of observations, chemical analyses and biological essays in the laboratory, including the solids in suspension, phosphates, BOD5 and faecal microorganisms in water, organic matter, presence of indicator species and ecotoxicological bioassays with the sediments. After the days of laboratory the data obtained are shared in the TEMA platform, and individual memories must be elaborated and handed over to the teacher by the date of the final exam. Attendance is mandatory.

Personalized assistance	
Methodologies	Description
Lecturing	Power point presentations in the classroom; personal assistance in my office at tutorial times. To better optimize the procedure, the student is requested to contact the teacher in advance by email, with reasonable anticipation.
Laboratory practical	Practical work in the laboratory. Students who wish may attend personal tutorials to resolve doubts and/or uncertainties, mainly at the times indicated on the faculty website and/or on the MOOVI platform. To better optimize the procedure, the student is requested to contact the teacher in advance by email, with reasonable anticipation.
Seminars	Questionnaire elaboration and discussion. Students who wish may attend personal tutorials to resolve doubts and/or uncertainties, mainly at the times indicated on the faculty website and/or on the MOOVI platform. To better optimize the procedure, the student is requested to contact the teacher in advance by email, with reasonable anticipation.

Assessment						
	Description	Qualification	Training and Learning Results			
Lecturing	Multiple choice questions and short answers exams. Two tests will be designed: one with 30% throughout the course and a final one with the 40% coinciding with the 1st opportunity call.	70	A2	B2	C8	D1
			A3	B3	C11	D2
			A4	B4		D5
			A5			
Seminars	Mandatory presence in the seminars. Delivery of the corresponding individual questionnaires	15	A2	B2	C8	D1
			A3	B3	C11	D2
			A4	B4		D5
			A5			
Laboratory practical	Mandatory presence in the practices and an individual report	15	A2	B2	C8	D1
			A3	B3	C11	D2
			A4	B4		D5
			A5			

Other comments on the Evaluation

Global assessment option: The application for this evaluation option must be submitted in the time and manner determined by the Center, which will be published prior to the academic start. Given the experimental nature of the practices and seminars, attendance at them is mandatory to be eligible for this evaluation option. **Failure to attend the practices, with no justified cause invalidates this possibility, as well as the opportunity for extraordinary evaluation (2nd opportunity).**

2nd opportunity assesment: All tests performed in continuous evaluation may be recovered at the 2nd opportunity, mantaining the corresponding percentage indicated above.

Date, time and place of exams will be published in the official web of Marine Sciences Faculty:

<http://mar.uvigo.es/index.php/en/alumnado-actual-2/examenes-3>

Students are strongly advised to fulfil an honest and responsible behaviour. It is considered completely unacceptable any alteration or fraud (i.e., copy or plagiarism) contributing to modify the level of knowledge and abilities acquired in exams, evaluations, reports or any kind of teacher's proposed work. Fraudulent behaviour may cause failing the course for a whole academic year. An internal dossier of these activities will be built and, when reoffending, the university rectorate will be asked to open a disciplinary record

Sources of information

Basic Bibliography

Beiras, R., **Marine Pollution**, 1, Elsevier, 2018

Campbell, P.G.C., **Ecotoxicology**, 1, Cambridge, 2022

Walker C.H. et al., **Principles of ecotoxicology**, 4th ed., Taylor & Francis, 2012

E. Law, **Aquatic pollution**, 4a, Wiley, 2017

Beiras, R. e Pérez, S, **Manual de métodos básicos en contaminación acuática**, ECIMAT, 2013

Complementary Bibliography

Kennish, M.J., **Estuarine and marine pollution**, CRC Press, 1997

Recommendations

Subjects that it is recommended to have taken before

Chemistry applied to the marine environment I/V10G061V01304

Chemistry applied to the marine environment II/V10G061V01309

IDENTIFYING DATA				
Ocean Dynamics				
Subject	Ocean Dynamics			
Code	V10G061V01402			
Study programme	Grado en Ciencias del Mar			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	4th	1st
Teaching language	#EnglishFriendly Spanish English			
Department				
Coordinator	Roson Porto, Gabriel			
Lecturers	Roson Porto, Gabriel Souto Torres, Carlos Alberto Varela Benvenuto, Ramiro Alberto			
E-mail	groson@uvigo.es			
Web	http://https://mar.uvigo.es/			
General description	Equations of the ocean and its solutions. The student will learn about the seven ocean equations and their main solutions, from the ocean waves scale to the planetary scale, like Rossby waves and Sverdrup and Stommel models.			
	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	
A4	Students can communicate information, ideas, problems and solutions to both specialist and non-specialist audiences
A5	Students have developed those learning skills that are necessary for them to continue to undertake further study with a high degree of autonomy
B3	Recognize and implement good practices in measurement and experimentation, and work responsibly and safely both in field surveys and in the laboratory.
C4	Know, analyze and interpret the physical properties of the ocean according to current theories, as well as to know the most relevant sampling tools and techniques.
D1	Develop the search, analysis and synthesis of information skills oriented to the identification and resolution of problems.
D2	Acquire the ability to learn autonomously, continuously and collaboratively, organizing and planning tasks over time.

Expected results from this subject				
Expected results from this subject			Training and Learning Results	
Basic understanding of the role of the ocean in the global climate dynamics.			A4 A5	B3 C4 D1 D2

Contents	
Topic	
Development of the ocean equations.	1.1 f plane approximation. 1.2 Beta plane approximation. Problems. 1.3 Continuity equation, deduction and interpretation. 1.4 Gauss theorem. 1.5 Momentum equation. Pressure forces. Viscous forces. Coriolis acceleration. Application and simplifications. 1.6 Energy conservation equation and salt conservation equation. 1.7 Equation of state. Approximations. 1.8 Recapitulation. 1.9 Problems.

Wavelike solutions of the equations

Wave kinematics. Dispersion relation.

2.1 Wavelike solutions I: Wave's dynamics. Short waves (deep water waves) and long waves (shallow water waves) approximations. Pressure and particles movement. Stokes drift. Problems.
2.2 Inertial movement and forced inertial movement.
2.3 Wavelike solutions II: Planetary waves. Kelvin waves. Rossby waves. Poincaré Waves.

2.4 Wavelike solutions III. Internal waves. Dynamics of internal waves with and without rotation. Stratified Internal waves.

Non wavelike solutions of the equations.

3.1 Geostrophic currents. Thermal wind equations. Sverdrup relation.
3.2 Barotropic currents.
Problems
3.3 Ekman's surface and bottom layer and Ekman theory. Ekman's transport. Problems
3.4 Barotropic wind forced oceanic circulation. Ekman's pumping. Vertically integrated equations. Sverdrup and Stommel model's. Vertical structure.
Problems
3.5 Baroclinic currents. Theory and applications. Problems.
3.6 Stratification in the ocean. Static stability and friction. Problems.
3.7 Eighth equation: Vorticity conservation. Applications.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	36	0	36
Seminars	16	8	24
Problem solving	0	46	46
Problem and/or exercise solving	3	20	23
Objective questions exam	1	20	21

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

Methodologies

	Description
Lecturing	Lectures developing the theory for 36 hours.
Seminars	Guided problem solving during 8 clases of 2 hours.
Problem solving	During this activity related problems or exercises are proposed. Student have to developpe their adequate or correct solutions through rutine exercising, application of formulas, algorithms or procedures of transformation of available information, as well as give result interpretation. It is often used as a complement of master lessons.

Personalized assistance

Methodologies	Description
Lecturing	PERSONAL ATTENTION WILL BE MADE. TUTORIAL TIME: TU-WE-TH 11-13 . Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation and ONLY via institutional email @alumnado.uvigo.gal.
Seminars	PERSONAL ATTENTION WILL BE MADE. TUTORIAL TIME: TU-WE-TH 11-13 . Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation and ONLY via institutional email @alumnado.uvigo.gal.
Problem solving	PERSONAL ATTENTION WILL BE MADE. TUTORIAL TIME: TU-WE-TH 11-13 . Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation and ONLY via institutional email @alumnado.uvigo.gal.

Tests	Description
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Objective questions exam	PERSONAL ATTENTION WILL BE MADE. TUTORIAL TIME: TU-WE-TH 11-13 . Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation and ONLY via institutional email @alumnado.uvigo.gal.
Problem and/or exercise solving	PERSONAL ATTENTION WILL BE MADE. TUTORIAL TIME: TU-WE-TH 11-13 . Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation and ONLY via institutional email @alumnado.uvigo.gal.

Assessment						
	Description	Qualification	Training and Learning Results			
Lecturing	Final test.	40	A4 A5	B3	C4	
Seminars	Seminars test.	40	A4 A5	B3	C4	D1 D2
Problem and/or exercise solving	Intermediate exam	10	A4	B3	C4	D1
Objective questions exam	Intermediate exam	10	A5			D2

Other comments on the Evaluation

Every report must be filed no later than 7 days after the seminar, and none will be evaluated if sent after that timeframe and the grade will be 0.

When a student files his/her report his status in this subject will change to presented.

The final grade of the subject will be the sum of 40% of the final (official) test (ot), 20% of an intermediate test (ie), and a 40% from the seminars test (st), according to the formula:

$$N=0.4*ot+0.2*ie+0.4*st$$

IMPORTANT REMARK: The threshold mark in the official test and seminars must be at least 5 (from 0 to 10).

The threshold to overcome the subject is $n=5$.

CONTINUOUS EVALUATION of the education in the classroom:

Intermediate test half course (1 hour, 40% divided between 20% problems and 20% objective questions). The test will take place during the theoretical classes, and be part of the faculty's test's schedule.

SEMINARS CONTINUOUS EVALUATION.

Seminars individual report's (20%). If don't pass the subject, students must do both intermediate and official tests, as well as to attend the seminars, do and present the reports again next year.

The seminars and partial test qualification's will be saved for the second opportunity.

Final official test (3 hours, 40%).

If a student does not pass the matter in the first opportunity, seminar and intermediate exam marks are kept to the second opportunity. If a student does not pass the matter in the second opportunity, seminar and intermediate exam marks are not kept to the next year. Repeat students have to return to doing both exams as well as attend and deliver the seminars test.

GLOBAL EVALUATION PROCEDURE: For the students choosing this modality, there will be a global oral evaluation test, in the language chosen by the student, the same day of the official test according to the faculty's schedule. This test will be public and the audio and video will be recorded. The application for this evaluation option must be submitted in the time and manner determined by the Center, which will be published prior to the academic start.

Students are strongly requested to fulfil a honest and responsible behaviour. It is considered completely unacceptable any alteration or fraud (i.e., copy or plagiarism) contributing to modify the level of knowledge and abilities acquired in exams, evaluations, reports or any kind of teacher's proposed work. Fraudulent behaviour may cause failing the course for a whole academic year. An internal dossier of these activities will be built and, when reoffending, the university rectorate will be asked to open a disciplinary record.

The tests' classroom, date and time will be published at the Marine Sciences' website:

Sources of information**Basic Bibliography**

Rosón, Gabriel, **Las Ecuaciones del océano: Teoría y problemas resueltos.**, Universidade de Vigo, Servicio de Publicaciones, 2020

CUSHMAN-ROISIN, B., **Introduction to Geophysical Fluid Dynamics. Physical and Numerical Aspects**, Ray Henderson & Deirde Cavanaugh. U.S.A., ACADEMIC PRESS, 2009

POND, S., G.L.PICKARD, **Introductory Dynamical Oceanography**, Pergamon Press. Oxford, Butterworth-Heinemann, 1983

Periáñez, Raúl, **Fundamentos de oceanografía dinámica**, Secretariado de Publicaciones de la Universidad de Sevilla, UNIVERSIDAD DE SEVILLA, 2010

Complementary Bibliography

Recommendations**Subjects that continue the syllabus**

Modelling/V10G061V01410

Subjects that it is recommended to have taken before

Physical oceanography I/V10G061V01302

Physical oceanography II/V10G061V01307

IDENTIFYING DATA**Applied marine geology**

Subject	Applied marine geology			
Code	V10G061V01403			
Study programme	Grado en Ciencias del Mar			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	4th	1st
Teaching language	#EnglishFriendly Spanish Galician			
Department				
Coordinator	Marino , Gianluca			
Lecturers	García Gil, María Soledad Gil Lozano, Carolina Marino , Gianluca			
E-mail	gianluca.marino@uvigo.es			
Web	http://webc10.webs.uvigo.es/gl/			
General description	This course analyzes the implications of marine geology in evaluating geological risks, environmental impact, coastal conservation, and mineralogical and geochemical aspects associated with the extraction of mineral resources.			
	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	
A1	Students have demonstrated knowledge and understanding in a field of study that builds upon their general secondary education, and is typically at a level that, whilst supported by advanced textbooks, includes some aspects that will be informed by knowledge of the forefront of their field of study
A2	Students can apply their knowledge and understanding in a manner that indicates a professional approach to their work or vocation, and have competences typically demonstrated through devising and sustaining arguments and solving problems within their field of study
A3	Students have the ability to gather and interpret relevant data (usually within their field of study) to inform judgments that include reflection on relevant social, scientific or ethical issues
A5	Students have developed those learning skills that are necessary for them to continue to undertake further study with a high degree of autonomy
B1	Know and use vocabulary, concepts, principles and theories related to oceanography and apply everything learned in a professional and/or research environment.
B4	Manage, process and interpret the data and information obtained both in the field and in the laboratory.
B5	Develop, implement and write basic or applied projects in oceanography from a multidisciplinary perspective.
C12	Acquire knowledge about processes and products related to internal and external geological cycles.
C13	Acquire the basic sedimentological, geochemical and geophysical techniques and methodologies used in identification, use and sustainability of the natural resources of coastal and marine environments.
C14	Know basic concepts and events of global change obtained from geological records.
D1	Develop the search, analysis and synthesis of information skills oriented to the identification and resolution of problems.

Expected results from this subject

Expected results from this subject	Training and Learning Results			
1. Know the main applications of the Marine Geology regarding natural resources, risks, environmental problems and associated to the Global Change.	A1 A2 A3 A5	B1	C13 C14	D1
2. Know the main coastal and submarine geological risks and his consequences. Purchase the capacities for the design of measures of adaptation in prevention of risks.	A1 A2 A3 A5	B5	C13	D1
3. Know and modeling the antropic impacts on coastal and marine environments and the methodology of regeneration, restoration and protection.	A1 A2 A3 A5	B5	C12 C14	D1

4. Know the main geological resources of the half marine and his training, as well as the basic strategies of exploration and exploitation. Other applications: methods on CO2 capture.	A1 A2 A3	B1 B5	C12 C13	D1
5. Realisation of technical reports	A3	B1 B4 B5	C14	D1

Contents

Topic	
Topic 0. Course introduction (1 hour)	0.1. Objectives. 0.2. Lectures and course contents. 0.3. Seminars and laboratory practical sessions. 0.4. Fieldwork. 0.5. Assessment and exam. 0.6. Tutorials. 0.7. Evaluation criteria 0.8. Course rules and regulations.
Topic 1. Ocean- and marine sediment-based carbon dioxide (CO2) removal (4 hours).	1.1. The (long- and short-term) carbon cycle. 1.2. Weathering versus volcanism: Earth's thermostat. 1.3. The ocean as a CO2 regulator: fundamentals and timescales. 1.4. The carbonate system in seawater. 1.5. Ocean alkalinity enhancement. 1.6. Other approaches: blue carbon enhancement, accelerated limestone weathering, and accelerated silicate weathering.
Topic 2. Seawater as a resource (3 hours)	2.1. Physicochemical properties and composition of seawater. 2.2. Salt recovery processes: sequential evaporation of seawater, desalination plants, and brine recovery. 2.3. Recovery of metals and critical elements from seawater: opportunities and challenges. 2.4. Extraction of lithium, magnesium, or rare earth elements from seawater.
Topic 3. Genesis, exploration and exploitation of marine geological resources: fossil hydrocarbons (5 hours)	3.1. Production and preservation of organic matter in marine environments. 3.2. Types of fossil hydrocarbons: oil, natural gas, and gas hydrates. 3.3. Physical and chemical properties of oil. 3.4. Processes of oil generation and migration. 3.5. Formation and exploitation of petroleum reservoirs. 3.6. Geological traps and seals. 3.7. Concept of petroleum system. 3.8. Unconventional hydrocarbons: formation conditions and potential of gas hydrates.
Topic 4. Genesis, exploration and exploitation of marine geological resources: mineral resources (5 hours)	4.1. Introduction to marine mineral resources. 4.2. Unconsolidated sedimentary deposits: sands and heavy mineral placers. 4.3. Chemical deposits: phosphorites, polymetallic nodules, and cobalt-rich crusts. 4.4. Hydrothermal deposits: massive sulfides rich in copper, zinc, lead, iron, gold, and silver. 4.5. Deep-sea mining: challenges and opportunities. 4.6. Environmental impacts of marine mining.
Seminars (14 hours)	Seminar I. Geochemical modelling between sediments and seawater: evaporite formation and geological capture of atmospheric CO2 (7 h). Seminar II. Stratigraphic control in petroleum exploration wells (7 h).
Laboratory Practice (4 hours)	Experimental crystallization of mineral phases applied to the formation of marine minerals.
Field Trips (16 hours)	Two field trips in which practical aspects of the theoretical syllabus and seminars are analysed through visits to different locations along the Galician coast.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	18	45	63
Seminars	14	37	51
Laboratory practical	4	4	8
Studies excursion	16	0	16
Objective questions exam	2	0	2

Problem and/or exercise solving	0	2	2
Report of practices, practicum and external practices	0	4	4
Report of practices, practicum and external practices	0	4	4

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

Methodologies	
	Description
Lecturing	Presentation of the theoretical contents about the subject under study, theoretical bases and/or guidelines of a work, an exercise that the student body has to develop.
Seminars	Activity focused on work on specific topics, complementary to the theoretical classes, which may involve solving exercises on practical cases.
Laboratory practical	Realization of experiments on crystallization the laboratory. They are used as a laboratory analogues to understand the precipitation of minerals in the marine environment. They are clinical/experimental practices of compulsory attendance.
Studies excursion	Coastal flood risks and data collection. Human action on coasts. Analysis of the geological context. These are activities considered clinical/experimental and, therefore, attendance is mandatory.

Personalized assistance

Methodologies	Description
Seminars	Personalized attention will be provided through tutoring carried out in person or through the use of the virtual campus. Tutoring will be arranged at the request of the student, and will be focused on resolving doubts about the contents of the seminars.
Laboratory practical	Conducting crystallization experiments applied to the formation of marine minerals. The student can go to personalized tutoring. These will be arranged at the request of the student and will be focused on resolving doubts about the work done in the laboratory
Studies excursion	The student who wishes may go to tutorials. These will be arranged at the student's request and focused on resolving doubts about the fieldwork.
Tests	Description
Objective questions exam	Attention of doubts
Problem and/or exercise solving	Attention of doubts
Report of practices, practicum and external practices	Attention of doubts
Report of practices, practicum and external practices	Attention of doubts

Assessment

	Description	Qualification	Training and Learning Results			
Seminars	The activity of the seminars is focused on the development of specific topics, complementary to the theoretical classes, which may involve solving exercises on practical cases. Attendance at the seminars is mandatory in order to access the continuous assessment.	0	A2 A3 A5		D1	
Laboratory practical	Crystallization processes and their application to the formation of marine mineral resources are analyzed using experimental techniques. Attendance is mandatory and active participation is evaluated.	0	A3	C13	D1	
Studies excursion	Some of the most relevant aspects described in the theoretical program are analyzed through the geological trips through different points of the Galician coast. It is a clinical/experimental activity and, therefore, mandatory attendance is required.	0	A3	C13 C14	D1	
Objective questions exam	Part of the theoretical proof-practical.	40	A1 A3 A5	B1 C14	C12	
Problem and/or exercise solving	Reports of the seminars	30	A2 A3	B1 B4	C12	D1
Report of practices, practicum and external practices	Report of the practices	10	A2 A3	B1 B4	C12 C13 C14	D1

Report of practices, practicum and external practices	Reports of the fieldwork	20	A2 A3 A5	B1 B4 B5	C12	D1
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Other comments on the Evaluation

-Attendance at practices, seminars and field trips is mandatory.

-Students who have not attended in their entirety - except for justified reasons - laboratory practices or field trips, given their clinical/experimental nature, will not be able to opt for the evaluation of these activities. (art. 14 Reg. aval. 2023).

-Global evaluation option, the final exam -in any of the calls- may include any theoretical and/or practical aspects that have been explained during the course, both in theoretical classes and in seminars. Practices of a clinical/experimental nature (laboratory practices and field trips) may not be the subject of global evaluation. (art. 14 Reg. aval. 2023). The application for this evaluation option must be submitted in the time and manner determined by the Center, which will be published prior to the academic start.

-Continuous evaluation at the first opportunity

To pass the subject by continuous assessment, it will be necessary to reach 40% of the maximum score in seminars, practices and field trips, as a necessary condition to take the objective question exam, which will contribute 40% of the remaining grade (as long as 40% of your score is reached).

- Second chance evaluation

The exam will have the same characteristics and fulfill the same requirements as **the continuous assessment of the first opportunity**

Exam dates and classes can be consulted on the website of the Faculty of Marine Sciences.

Grades for completed activities (except for objective question exams) are retained for one year, as long as they are the same as those actually taken. However, students may retake them if they wish to improve their grade.

Individualized tutoring

Tutoring schedules of subject teachers can be consulted on the MOOVI platform.

"Responsible and honest behavior is required of the students taking this subject. If any form of fraud (copying or plagiarism) aimed at falsifying the level of knowledge and skills achieved in any type of test is considered inadmissible, report the work. Fraudulent behavior may result in suspension of the subject for an entire course. An internal record of these actions will be kept so that, in case of recidivism, the rector can request the opening of a disciplinary file"

Sources of information

Basic Bibliography

Burns, R. (Ed.), **Marine Minerals**, Mineralogical Society of America, 380 pp., 1979

Chester, R., Jickells, T.D., **Marine Geochemistry**, 3rd ed., Wiley-Blackwell, 411 pp., 2012

Craig, J.R., Vaughan, D.J., Skinner, B.J., **Recursos de la Tierra y el Medio Ambiente**, 4º ed., Pearson Education, 598 pp., 2012

Earney, F.C.F., **Marine Mineral Resources**, Routledge, 387 pp., 2016

Hsu, C.S., Robinson, P.R., **Handbook of Petroleum Technology**, 2ª ed., Springer International Publishing, 1238 pp., 2017

Oelkers, E.; Gislason, S., **Carbon Capturage and Storage: From Global Cycles to Global Solutions**, Geochemical Perspectives, 12, 2023

Zeebe, R.E., Wolf-Gladrow, D.A., **CO2 in Seawater: Equilibrium, Kinetics, Isotopes**, Amsterdam: Elsevier Oceanography Series, 2001

Complementary Bibliography

Couper, A.D., **The Times atlas and encyclopaedia of the sea**, Times Book, 272 pp., 1989

Cronan, D.S., **Handbook of Marine Mineral Deposits**, CRC Press, 406 pp., 2000

Parkhurst, D., Appelo, T., **User's guide to PHREEQC version 3 - a computer program for speciation, batch-reaction, one-dimensional transport, and inverse geochemical calculations**, ETS research report series, 2001

Seibold, E.; Berger, W.H., **The sea floor: An Introduction to Marine Geology**, 4th ed., Springer, 268 pp., 2017

Recommendations

Subjects that continue the syllabus

Geographic analysis methods/V10G061V01409

Basin Analysis/V10G061V01406

Subjects that are recommended to be taken simultaneously

Marine and coastal management/V10G061V01404

Subjects that it is recommended to have taken before

Geological oceanography II/V10G061V01308

Sedimentology/V10G061V01205

Geological oceanography I/V10G061V01303

Coastal and marine sedimentary habitats/V10G061V01207

IDENTIFYING DATA				
Marine and coastal management				
Subject	Marine and coastal management			
Code	V10G061V01404			
Study programme	Grado en Ciencias del Mar			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	4th	1st
Teaching language	Galician			
Department				
Coordinator	Méndez Martínez, Gonzalo Benito			
Lecturers	Méndez Martínez, Gonzalo Benito			
E-mail	mendez@uvigo.es			
Web	http://https://mar.uvigo.es/			
General description	In this matter presents a multidisciplinary vision of the coastal and marine zone, identifying the conflicts and risks associated to these areas. They enter the main tools for the management of these two environments as well as the administrative context-legislative in that it is framed the coastal and marine management.			

Training and Learning Results	
Code	
A2	Students can apply their knowledge and understanding in a manner that indicates a professional approach to their work or vocation, and have competences typically demonstrated through devising and sustaining arguments and solving problems within their field of study
A3	Students have the ability to gather and interpret relevant data (usually within their field of study) to inform judgments that include reflection on relevant social, scientific or ethical issues
A4	Students can communicate information, ideas, problems and solutions to both specialist and non-specialist audiences
B1	Know and use vocabulary, concepts, principles and theories related to oceanography and apply everything learned in a professional and/or research environment.
B4	Manage, process and interpret the data and information obtained both in the field and in the laboratory.
B5	Develop, implement and write basic or applied projects in oceanography from a multidisciplinary perspective.
C13	Acquire the basic sedimentological, geochemical and geophysical techniques and methodologies used in identification, use and sustainability of the natural resources of coastal and marine environments.
C14	Know basic concepts and events of global change obtained from geological records.
D1	Develop the search, analysis and synthesis of information skills oriented to the identification and resolution of problems.
D3	Understanding the meaning and application of the gender perspective in different fields of knowledge and in professional practice with the aim of achieving a more just and equal society.
D5	Sustainability and environmental commitment. Equitable, responsible and efficient use of resources.

Expected results from this subject				
Expected results from this subject		Training and Learning Results		
Knowledge and critical assessment of the sources of information for coastal and sea planning and management	A2	B1		D1
	A3	B4		D3
Elaborate land use/cover maps	A4	B4	C13	
		B5	C14	
Capacity to understand the application of the corresponding sectorial legislations	A3	B1		D3
	A4	B4		D5
		B5		
To know and evaluate the legal uses of the coastal and marine areas	A4	B5		D1
				D5
To understand the sustainable use of the resources	A3	B5		D5
To evaluate the environmental impacts in the coastal and marine zones				D1
				D3
				D5

Contents	
Topic	
1. Processes and state of the coastal environments	1.1. Processes and state of the coastal environments 1.1.1. Global change problems.
2. Management of the coastal space	2.1. Criteria of management 2.2. Experiences

3. Tools and Technics for the planning and management of the sea	3.1. Methodologies 3.2. Technics
4. Intervention instruments in the coast and marine areas	4.1. The Law of the Coast 4.2. Urbanistic Legislation applicable to the protection of the seaboard 4.3. Protection of natural areas, elements and species of interest 4.4. Use and conservation of the coastal spaces for turistic uses. 4.5. Management of port spaces 4.6. The management of the installations and spaces for the aquaculture
5. Evaluations of impact	5.1. Basic concepts 5.2. Evaluation of projects 5.3. Evaluation of plans and programs
6. Jurisdictional Waters and territorial sea	6.1. Basic concepts and international norms 6.2. Methodologies 6.3. The Spanish rule 6.4. Examples of application

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	23	46	69
Seminars	14	30	44
Studies excursion	8	11	19
Practices through ICT	7	9	16
Problem and/or exercise solving	2	0	2

*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 contents. Concepts, etc.
Seminars	7 Seminars on subjects related with the Theory: preparation of bibliographic works and exhibition
Studies excursion	Field trip to A Lanzada isthmus for the observation of natural environments and human modifications, impacts, management, etc.
Practices through ICT	P1-Legal territorial boundaries P2-Evaluation of environmental impact

Personalized assistance

Methodologies	Description
Seminars	7 seminars of 2 hours in which the lecturer will enter a subject and the students will work on a questionnaire. All the questions will be solved in the seminars. There will be personal tutorials for the preparation of the oral and written presentations in previously scheduled sessions.
Lecturing	23 classes of 1 hour. Students will have access to tutorials, mainly in the indicated schedules. It is advisable that the student contact the lecturer by e-mail.
Practices through ICT	7 hours, in the computer room and/or in cabinet. They will approach different subjects applied of coastal management, where the students will have to solve problems posed during the practice. The doubts and questions will be addressed during the practice.
Studies excursion	Field practices on the isthmus of A Lanzada. Attention in the field the day of the field trip.

Assessment

Assessment	Description	Qualification	Training and Learning Results			
Lecturing	The evaluation will consist of a written exam.	40	A2 A3	B1		D1 D3 D5
	To be approved, the student need to obtain a minimum of 4.5 points on the condition that the global average reaches 5 points.					
Seminars	Assistance is compulsory.	30	A3 A4	B4	C13 C14	D1 D3 D5
	To be approved, the student need to obtain a minimum of 4.5 points on the condition that the global average reaches 5 points.					
Studies excursion	Delivery of a memory of field/questionnaire	10	A3	B1	C13 C14	D1 D3 D5

Practices through ICT	Assistance is compulsory.	20	A4	B5	D1 D3 D5
	To pass the proofs, the students will need to obtain a minimum of 4.5 points on the condition that the global average reaches 5 points.				
	The students will present the required tests, memoirs, etc. the same day at the end of the practice.				

Other comments on the Evaluation

Date, time and place of exams will be published in the official web of Marine Sciences Faculty:
<http://mar.uvigo.es/alumnado/examenes/>

The students are required a responsible and honest behaviour. Any form of fraud (i.e. copies and/or plagiarism) directed to alter the level of knowledge or skill reached by the student/to in any type of proof, report or work designed with this purpose is considered inadmissible. The fraudulent behaviours will suppose the suspension of the subject during a complete course. An internal file containing these irregular behaviors will be started, and subsequently the lecturer would be able to request the opening of a disciplinary file in the rectorship.

The global evaluation will be carried out by means of a single test of all the contents of the subject with theoretical questions and practical exercises.

Activities completed from one course are not saved to another.

The second chance evaluation will be carried out through specific tests of each one of the failed parts (theory, seminars, practices and field trip).

Global assessment option: The application for this evaluation option must be submitted in the time and manner determined by the Center, which will be published prior to the academic start. Given the experimental nature of the practices, attendance at them is mandatory to be eligible for this evaluation option. **Failure to attend the practices, with no justified cause invalidates this possibility, as well as the opportunity for extraordinary evaluation (2nd opportunity).**

Sources of information

Basic Bibliography

Barragán Muñoz, J.M., **Las áreas litorales de España. Del análisis geográfico a la gestión integrada**, Ed. Ariel,
Doménech, J.L., Sardá, R., Carballo, A., Villasante, C.S., Barragán, J.M., Borja, A., Rodríguez, M.J, **Gestión integrada de zonas costeras**, AENOR ediciones,
Masselink, G. y Gehrels, R., **Coastal environments and global change**, Wiley,
Gómez Orea, D. y Gómez Villarino, A., **Evaluación de impacto ambiental**, MP,

Complementary Bibliography

Barragán Muñoz, J.M., **Coastal management and public policy in Spain**, Ocean and Coastal Management,
Comisión Europea, **Programa de demostración de la UE sobre la Gestión Integrada de las Zonas Costeras 1997-1999. Hacia una estrategia europea para la gestión integrada de las zonas costeras. Principios generales y opción**, Luxemburgo, Oficina de Publicaciones Oficiales de las Comunidades Europeas,
Prada, A., Vázquez-Rodríguez, M.X., Soliño-Millán, M., **Desarrollo sostenible en la costa gallega**, CIEF, Centro de Investigación Económica y Financiera, Fundación Novacaixagalicia,
Barragán Muñoz, J.M., **Política, Gestión y Litoral: Una nueva visión de la Gestión Integrada de Áreas Litorales**, Tébar Flores,
Barragán Muñoz, J.M., **Medio Ambiente y desarrollo en áreas litorales**, Servicio de publicaciones de la U. Cádiz. ,
Gómez Orea, D., **Evaluación ambiental estratégica**, Mundiprensa,

Recommendations

Subjects that continue the syllabus

Geographic analysis methods/V10G061V01409

Subjects that are recommended to be taken simultaneously

Applied marine geology/V10G061V01403

Subjects that it is recommended to have taken before

Coastal and marine sedimentary habitats/V10G061V01207

IDENTIFYING DATA				
Fishing				
Subject	Fishing			
Code	V10G061V01405			
Study programme	Grado en Ciencias del Mar			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	4th	1st
Teaching language	Spanish			
Department				
Coordinator	González Castro, Bernardino			
Lecturers	González Castro, Bernardino			
E-mail	bcastro@uvigo.es			
Web	http://https://moovi.uvigo.gal/course/view.php?id=11583			
General description	This course aims to serve as an introduction to the dynamics of exploited populations and to the basic methodologies used in their assessment and management.			

Training and Learning Results	
Code	
A1	Students have demonstrated knowledge and understanding in a field of study that builds upon their general secondary education, and is typically at a level that, whilst supported by advanced textbooks, includes some aspects that will be informed by knowledge of the forefront of their field of study
C11	Apply the knowledge and techniques acquired to the characterization and sustainable use of living resources and marine ecosystems.
D1	Develop the search, analysis and synthesis of information skills oriented to the identification and resolution of problems.
D5	Sustainability and environmental commitment. Equitable, responsible and efficient use of resources.

Expected results from this subject			
Expected results from this subject	Training and Learning Results		
Understand the population processes that affect the dynamics of living resources		C11	D1 D5
	A1	C11	D1
Understand the basic methods of fisheries resource assessment			
Understand and apply basic methods of fitting mathematical models for parameter estimation in population dynamics and assessment of marine living resources	A1	C11	D1 D5
	A1	C11	
Develop skills to use basic fisheries computer programs			

Contents	
Topic	
Characterization of marine fisheries resources	Types of resources. Marine areas of interest in the exploitation of resources. Degree of exploitation of marine living resources.
The fishing process	Fishing gears, boats and methods. Selectivity of fishing gears
The unit stock	Population and stock. Population parameters. Characterization of management units. Estimation of abundance of exploited stocks
Reproduction	Maturation and fecundity. Estimation of maturity. Age and size of first maturity. Estimation of fecundity.
Recruitment	Estimation of recruitment. Stock-recruitment relationship. Population dynamics and stock-recruitment relationships.
Age and growth	Concept of cohort. Determination of age. Length-weight relationship. Allometry and isometry. Condition indices. Mathematical expressions of growth. Age-length keys.
Growth parameters	The von Bertalanffy growth model. Estimation of growth parameters: length-frequency analysis, separation of cohorts, size-at-age analysis, length increments analysis. Conversión of length to age.
Mortality	Survivorship curves. Mortality rates. Natural and fishing mortalities. Fishing effort. Capturability. Catch: Catch equations, Catch rates. Estimation of total, natural and fishing mortalities. Estimation of catchability.

Population dynamics and assessment models of fish stocks Cohort Analysis: Virtual Population Analysis, Pope's Cohort Analysis. Biomass dynamic models. Yield and biomass per recruit models.

Fisheries Management	Biological reference points. Harvest strategies. Harvest tactics. International organizations and resource management.
Methodologies of parameter estimation	Estimation with Excel. Estimation with FiSAT. Application of an age-structured model of harvested populations.

Planning			
	Class hours	Hours outside the classroom	Total hours
Lecturing	32	60	92
Laboratory practical	4	4	8
Practices through ICT	12	17	29
Problem solving	4	12	16
Essay questions exam	2	0	2
Problem and/or exercise solving	1	0	1
Objective questions exam	2	0	2

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

Methodologies	
	Description
Lecturing	Oral presentation of the contents of the subject using the blackboard and computer presentations.
Laboratory practical	Size selectivity of a dredge for shellfish resources.
Practices through ICT	Learning and application of numerical methodologies for resolution of parameters and resolution of quantitative problems related to the contents of the subject. Learning and use of basic programs used in the evaluation of marine living resources. Simulation of the dynamics of an exploited population and calculation of Reference Points for fisheries management.
Problem solving	Solution of numerical problems related to the methods explained in the lectures and practices.

Personalized assistance	
Methodologies	Description
Lecturing	Students who wish to do so may attend face-to-face tutorials to resolve doubts. The time of the tutoring session will be determined through the "tutoría concertada" process by submitting a request via email.
Laboratory practical	Students who wish to do so may attend face-to-face tutorials to resolve doubts. The time of the tutoring session will be determined through the "tutoría concertada" process by submitting a request via email.
Practices through ICT	Students who wish to do so may attend face-to-face tutorials to resolve doubts. The time of the tutoring session will be determined through the "tutoría concertada" process by submitting a request via email.
Problem solving	Students who wish to do so may attend face-to-face tutorials to resolve doubts. The time of the tutoring session will be determined through the "tutoría concertada" process by submitting a request via email.

Assessment					
	Description	Qualification	Training and Learning Results		
Lecturing	There will be 3 written exams in which the theoretical contents of the subject will be evaluated	70	A1	C11	D1 D5
Laboratory practical	Written examination on the contents of the laboratory practices.	5	A1	C11	D1 D5
Practices through ICT	Written examination on the contents of the computer room sessions.	10	A1	C11	D1 D5
Problem solving	Written exam in which the ability to apply the population parameter estimation and evaluation methodologies explained in the theoretical and practical classes will be assessed.	15	A1	C11	D1 D5

Other comments on the Evaluation

Students who choose to take the global assessment will not be able to take any test (of any part of the subject), corresponding to continuous assessment, that is done after the date indicated by the Dean's Office to express the type of assessment chosen.

1) Continuous evaluation

The subject will be considered passed if the sum of the scores of the different tests to be taken is equal to or greater than 5 points, otherwise the whole of the Second Opportunity exam will have to be taken.

1.1- Evaluation of the theory

The evaluation of the "master classes" will be carried out in three written exams throughout the course, two of them within the hours of theory of the subject and one on the date of the First Opportunity exam. In each of the first two exams, all the theoretical contents prior to 5 calendar days from the date of the test will be evaluated, whether or not they have been previously evaluated. The first test is worth 2.0 points and the second 3.5. The 3rd exam, to be carried out on the date of the overall evaluation of the First Opportunity, will have a value of 1.5 points and will cover the entire theory.

1.2- Evaluation of Practices The evaluation of the "Laboratory Practices" will be carried out at the same time as the first exam of the "Lectures". It will have a maximum score of 0.5 points.

The evaluation of the "ICT-supported practices" will be carried out on the date assigned for the final evaluation of the First Opportunity. Its maximum score will be 1.0 points.

1.3- Evaluation of Problems

It will be carried out on the date of the First Opportunity final exam. The value of this part of the matter will be 1.5 points.

2) Overall evaluation

It will be carried out through a written exam with three parts: theory (maximum score=7.0), practices (maximum score=1.5) and problems (maximum score=1.5). The subject will be considered approved if the sum of the scores of the different parts of the exam is equal to or greater than 5 points. In the First Opportunity, only those students who have chosen this type of evaluation at the time will be able to carry it out.

In the Second Opportunity, it can be done by all students who have not passed the subject in the First Opportunity (whether in the continuous or global evaluation modality).

None of the assessable parts of the subject, which have been passed in this course, will be retained for later courses.

Students are strongly requested to fulfil a honest and responsible behaviour. It is considered completely unacceptable any alteration or fraud (i.e., copy or plagiarism) contributing to modify the level of knowledge and abilities acquired in exams, evaluations, reports or any kind of teacher's proposed work. Fraudulent behaviour may cause failing the course for a whole academic year. An internal dossier of these activities will be built and, when reoffending, the university rectorate will be asked to open a disciplinary record

Sources of information

Basic Bibliography

Jennings, S.; Kaiser, M. J. and Reynolds, J. D., **Marine Fisheries Ecology**, 1ª, Blackwell Science, 2001

King, M., **Fisheries biology, assessment and management**, 2ª, Blackwell Publishing, 2007

Sparre, P. y Venema, S. C., **Introducción a la evaluación de recursos pesqueros tropicales. Part 1**, 1ª, FAO, 1995

Complementary Bibliography

Cabral, H.; Lepage, M.; Lovry, J. and Le Pate, O., **Ecology of marine fish**, 1ª, Academic Press, 2025

Cadima, E. L., **Manual de evaluación de recursos pesqueros**, 1ª, FAO, 2003

Cochrane, K. L., **A fishery manager's guidebook**, 2ª, FAO, 2009

Ferrer Montaña, O. J., **Ciencia Pesquera. Manejo, explotación y conservación de recursos**, 1ª, Editorial Académica Española, 2016

Gayanilo, F. C. Jr. and Pauly, D., **FAO-ICLARM stock assessment tools. (FISAT). Reference manual.**, 1ª, FAO, 1997

Guerra, A. y Sánchez-Lizaso, J. L., **Fundamentos de explotación de recursos vivos marinos**, 1ª, Acribia, 1998

Gunderson, D. R., **Surveys of fisheries resources**, 1ª, John Willey & Sons, 1993

Haddon, M., **Modelling and quantitative methods in fisheries**, 2ª, Chapman and Hall/CRC, 2011

Haddon, M., **Using R for modelling and quantitative methods in fisheries**, 1ª, Chapman and Hall/CRC, 2021

Hilborn, R. and Hilborn, U., **Overfishing. What everyone needs to know**, 1ª, Oxford University Press, 2012

Hilborn, R. and Walters, C. J., **Quantitative Fisheries stock Assessment. Choice, Dynamics and Uncertainty**, 1ª, Chapman and Hall, 1997

Ogle, D. H., **Introductory Fisheries Analyses with R**, 1ª, Chapman and Hall/CRC, 2016

Pauly, D., **Fish population dynamics in tropical waters: a manual for use with programmable calculators.**, 1ª, ICLARM Studies and Reviews 8., 1984

Zale, A. V.; Parrish, D. L. and Sutton, T. M., **Fisheies Techniques**, 3ª, American Fisheries Society, 2013

Recommendations

Subjects that it is recommended to have taken before

Marine Ecology/V10G061V01206

Statistics/V10G061V01107

Other comments

To carry out the exams the student must have a calculator able to perform linear regression.

The information provided on the Moovi platform must be supplemented by the explanations given in the respective classes. It is recommended that you attend the classes with the corresponding figures and graphs, previously provided through the platform

IDENTIFYING DATA				
Basin Analysis				
Subject	Basin Analysis			
Code	V10G061V01406			
Study programme	Grado en Ciencias del Mar			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Optional	4th	2nd
Teaching language	Spanish			
Department				
Coordinator	García Gil, María Soledad			
Lecturers	Diz Ferreiro, Paula García Gil, María Soledad			
E-mail	sgil@uvigo.es			
Web	http://http://webs.uvigo.es/c10/webc10/			
General description	This matter allows the introduction to the analysis of sedimentary basins and of the interpretation of the history of his filling using technical multidisciplinary.			
	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 have the ability to gather and interpret relevant data (usually within their field of study) to inform judgments that include reflection on relevant social, scientific or ethical issues
A4	Students can communicate information, ideas, problems and solutions to both specialist and non-specialist audiences
B1	Know and use vocabulary, concepts, principles and theories related to oceanography and apply everything learned in a professional and/or research environment.
B5	Develop, implement and write basic or applied projects in oceanography from a multidisciplinary perspective.
C12	Acquire knowledge about processes and products related to internal and external geological cycles.
C14	Know basic concepts and events of global change obtained from geological records.
D1	Develop the search, analysis and synthesis of information skills oriented to the identification and resolution of problems.

Expected results from this subject				
Expected results from this subject		Training and Learning Results		
Interpretation of paleoceanographic proxies		A3 A4	B1 B5	C12 C14 D1

Contents	
Topic	
SUBJECT 1. INTRODUCTION TO THE ANALYSIS OF BASINS	1.1. Definitions. Sedimentary basins. Classification 1.2. Origin and evolution of the oceanic basins 1.3. Interest and applications of the analysis of basins
SUBJECT 2. EXTERNAL AND INTERNAL FACTORS CONTROLLING THE EVOLUTION OF THE SEDIMENTARY BASINS	2.1. Tectonics, Climate, Supply and Sea-level changes 2.2. Sequential stratigraphy: Types of sections, 3D architecture of facies and correlation criteria
SUBJECT 3. DATING METHODS	3.1. Introduction to dating methods.
SUBJECT 4. SEISMIC STRATIGRAPHY	4.1. Sedimentary discontinuity surfaces: Criteria of recognition 4.2. System tracks in the cycle of se-level oscillation 4.3. Sequences and models of sequences.
SUBJECT 5. PALEOCEANOGRAPHY AND PALAEOCLIMATOLOGY	5.1. Palaeoceanography and plaeoclimatology proxies 5.2. Natural mechanisms of climatic and oceanographic changes

Planning			
	Class hours	Hours outside the classroom	Total hours
Lecturing	18	36	54
Case studies	20	0	20
Seminars	14	14	28
Presentation	0	48	48

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

Methodologies	
	Description
Lecturing	Presentations of the theoretical concepts that allow the students to acquire or improve the skills to perform the analysis of sedimentary basins. This involves the relationship of multidisciplinary theoretical concepts. The classes will be of 1h. It can be possible to get 1 extra point in the final mark by participation in classroom discussions.
Case studies	Each student will have several real seismic profiles corresponding to a sedimentary basin. They will have to perform the interpretation of each one and to perform a resumen of each practical. (Assistance and reports are mandatories, 30% of the mark)
Seminars	The concepts explained in the lectures and other new ones (in theoretical and practical sessions) will be illustrated with exercises to emphasise their practical recognition (Attendance and deliverables compulsory, 40% of the mark).
Presentation	It is mandatory that each student will have to elaborate an individual report explaining the evolution of the basin based on the interpretation of the seismic records worked on in the practicals. (30% of the mark)

Personalized assistance

Methodologies	Description
Lecturing	Students that wish it will be able to attend to personalized tutorials to resolve doubts, mainly in the indicated schedules. To optimize time, it is necessary that the student to contact with the lecturer previously. The tutorials will be able to be individual or in group in accordance with the schedules of the lecturer: Prof. Soledad García Gil (Tuesday and Thursday: 11 - 14 h) that would be modified according to educational needs.
Seminars	Students that wish it will be able to attend to personalized tutorials to resolve doubts, mainly in the indicated schedules. To optimize time, it is necessary that the student to contact with the lecturer previously. The tutorials will be able to be individual or in group in accordance with the schedules of the lecturer: Prof. Soledad García Gil (Tuesday and Thursday: 11 - 14 h) that would be modified according to educational needs.
Case studies	Students that wish it will be able to attend to personalized tutorials to resolve doubts, mainly in the indicated schedules. To optimize time, it is necessary that the student to contact with the lecturer previously. The tutorials will be able to be individual or in group in accordance with the schedules of the lecturer: Prof. Soledad García Gil (Tuesday and Thursday: 11 - 14 h) that would be modified according to educational needs.
Presentation	Students that wish it will be able to attend to personalized tutorials to resolve doubts, mainly in the indicated schedules. To optimize time, it is necessary that the student to contact with the lecturer previously. The tutorials will be able to be individual or in group in accordance with the schedules of the lecturer: Prof. Soledad García Gil (Tuesday and Thursday: 11 - 14 h) that would be modified according to educational needs.

Assessment

Description		Qualification	Training and Learning Results		
Case studies	Sequential seismic analysis of a sedimentary basin from the interpretation of seismic records and profiles.	30	A3	C14	D1
Seminars	Reports of Seminars	40		B1 B5	C14 D1
Presentation	Each student will have to elaborate an individual report explaining the evolution of the basin based on the interpretation of the seismic records worked on in the practicals. (30% of the mark)	30	A3	C14	D1

Other comments on the Evaluation

Continuous assesment option

The student will be evaluated continuously and based on the delivery of the reports corresponding to the case studies, seminars and practicals in the percentages described. Given the experimental nature of the seminars and practicals, attendance is compulsory.

Attendance and participation in the discussions of the theoretical classes can mean 1 extra point in the final mark.

None of the assessable parts of the subject, which have been passed in this course, will be retained for later courses.

Global assesment option

The same percentages indicated above will be maintained. However, given the experimental nature of the seminars and practicals, non-attendance without justification invalidates this option, as well as the extraordinary evaluation.

The application for this evaluation option must be submitted in the time and manner determined by the Center, which will be published prior to the academic start.

Other considerations

Dates and times for reports will be published in <https://mar.uvigo.es/alumnado/asignaturas-y-horarios/>

Students are strongly requested to fulfil a honest and responsible behaviour. It is considered completely unacceptable any alteration or fraud (i.e., copy or plagiarism) contributing to modify the level of knowledge and abilities acquired in exams, evaluations, reports or any kind of teacher's proposed work. Fraudulent behaviour may cause failing the course for a whole academic year. An internal dossier of these activities will be built and, when reoffending, the university rectorate will be asked to open a disciplinary record.

Sources of information

Basic Bibliography

Rogers, J.W. y Santosh, M., **Continents and supercontinents**, 1, Oxford University Press, 2004

Allen, P.A. y Allen, J.R., **Basin Analysis: Principles and Application to Petroleum Play Assessment**, 3rd, Wiley-Blackwell, 2013

Bradley, RS, **Paleoclimatology (Third Edition) Reconstructing Climates of the Quaternary**, 1, Academic Press, San Diego, 2015

Shanmugam, G., **Deep-Water Processes and Facies Models: Implications for sandstone petroleum reservoirs**, 1, Elsevier, 2006

Treitel, S. y Helbig, K., **Handbook of Geophysical Exploration: Seismic Exploration**, 1, Elsevier, 2011

Huneke, H. y Mulder, T., **Deep-Sea Sediments**, 1, Elsevier, 2010

Catuneanu, O., **Principles of Sequence Stratigraphy**, 1, Elsevier, 2006

Ruddiman WF, **Earth's Climate: Past and Future. Third Edition.**, 3, W. H. Freeman and Company, New York, 2014

Complementary Bibliography

Leeder, M.R. y Pérez-Arlucea, M., **Physical processes in Earth and environmental sciences**, 1, Wiley, 2006

Recommendations

Subjects that it is recommended to have taken before

Geological oceanography II/V10G061V01308

Sedimentology/V10G061V01205

Coastal and marine sedimentary habitats/V10G061V01207

IDENTIFYING DATA				
Fish and shellfish biology				
Subject	Fish and shellfish biology			
Code	V10G061V01407			
Study programme	Grado en Ciencias del Mar			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Optional	4th	2nd
Teaching language	#EnglishFriendly Spanish Galician			
Department				
Coordinator	Domínguez Martín, José Jorge			
Lecturers	Domínguez Martín, José Jorge Fernández Pujó, Wendy Kim , Sin-Yeon Velando Rodríguez, Alberto Luís			
E-mail	jdiguez@uvigo.es			
Web	http://jdiguez.webs.uvigo.es/			
General description	This is a special Zoology which studies the main fish and shellfish in the spanish coast. 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	
A1	Students have demonstrated knowledge and understanding in a field of study that builds upon their general secondary education, and is typically at a level that, whilst supported by advanced textbooks, includes some aspects that will be informed by knowledge of the forefront of their field of study
A2	Students can apply their knowledge and understanding in a manner that indicates a professional approach to their work or vocation, and have competences typically demonstrated through devising and sustaining arguments and solving problems within their field of study
A3	Students have the ability to gather and interpret relevant data (usually within their field of study) to inform judgments that include reflection on relevant social, scientific or ethical issues
A4	Students can communicate information, ideas, problems and solutions to both specialist and non-specialist audiences
A5	Students have developed those learning skills that are necessary for them to continue to undertake further study with a high degree of autonomy
B2	Plan and execute surveys in the field and laboratory work, applying basic tools and techniques for sampling, data acquisition and analysis in the water column, sea bottom and marine substratum.
B4	Manage, process and interpret the data and information obtained both in the field and in the laboratory.
B5	Develop, implement and write basic or applied projects in oceanography from a multidisciplinary perspective.
C9	Acquire basic knowledge about the structural and functional organization and the evolution of marine organisms.
C10	Know the biological diversity and functioning of marine ecosystems.
C11	Apply the knowledge and techniques acquired to the characterization and sustainable use of living resources and marine ecosystems.
D1	Develop the search, analysis and synthesis of information skills oriented to the identification and resolution of problems.
D2	Acquire the ability to learn autonomously, continuously and collaboratively, organizing and planning tasks over time.

Expected results from this subject

Expected results from this subject	Training and Learning Results			
Ability to apply knowledge in practice	A1	B2	C9	D1
	A2	B4	C10	D2
	A3	B5	C11	
	A4			
	A5			
Research skills.	A1	B2	C9	D1
	A2	B4	C10	D2
	A3	B5	C11	
	A4			
	A5			

Identification of fish and shellfish.	A1	B2	C9	D1
Knowledge of the external and internal morphology of fish and shellfish.	A2	B4	C10	D2
Knowledge of the distribution, habitat and lifestyles of fish and shellfish.	A3	B5	C11	
Knowledge of reproduction and life cycles of fish and shellfish.	A4			
Management of fishery resources and shellfish.	A5			
Biological bases necessary for the study of Fisheries and Aquaculture.				

Contents

Topic	
Introduction	Fish and shellfish in the tree of life Shellfish species Fish species Life-cycle strategies
Biology of Molluscs	General characteristics of molluscs Classification
Biology of bivalves	External morphology: shell, mantle and foot Habits and life styles: soft bottom excavators, fixed surface inhabitants, surface free inhabitants. Feeding and growth. Digestion, circulation, respiration, excretion. Nervous system and sense organs. Reproduction. Embryonic and larval development. Classification.
Commercial bivalves	Mytilus galloprovincialis Cardium edule Tapes decussatus Venerupis pullastra Ostrea edulis Pecten maximus Chlamys opercularis Chlamys varia
Biology of cephalopods	Distribution and habitat External morphology Habits and life styles. Locomotion and buoyancy. Migrations. Color and bioluminescence. Predators Feeding and growth. Digestion, circulation and gas exchange and excretion Nervous system and organs of the senses Reproduction Embryonic and larval development. Classification
Commercial cephalopods	Sepia officinalis Loligo vulgaris Illex coindetti Octopus vulgaris
Biology of crustaceans	General characteristics Classification Decapods Distribution and habitat External morphology Habits and life styles Locomotion Feeding and growth. Molt Nervous system and organs of the senses Excretion Reproduction and Embryonic and larval development
Commercial crustaceans	Palaemon serratus Palinurus elephas Homarus gammarus Necora puber Maja squinado Nephros norvegicus Pollicipes pollicipes
Biology of fishes	General characteristics Phylogeny, systematic and taxonomy General biology of fishes

Pelagic fishes	General characteristics Distribution and Habitat Feeding and growth Biological cycle Reproduction: nesting areas, larvae and larval mortality, absolute fertility Sardine Anchovy Herring Mackerel Horse Mackerel
Demersal fishes	Hake Cod Plueronectiforms Labrids Others
Oceanic pelagic fishes	Tuna: generalities Commercial tuna Buefin tuna Thunnus alalunga

Planning

	Class hours	Hours outside the classroom	Total hours
Laboratory practical	20	40	60
Seminars	6	18	24
Lecturing	20	40	60
Problem and/or exercise solving	1	1	2
Objective questions exam	1	1	2
Essay questions exam	1	1	2

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

Methodologies

	Description
Laboratory practical	Lab classes are organized according to the following scheme: at the beginning of each class, the theoretical concepts needed to understand the examples to be observed are briefly explained, and a script is given to the student in which these concepts are remembered, and the techniques to follow and the objectives to be achieved explained.
Seminars	The students must carry out an independent and supervised work that they will expose to their classmates. The work will be done accompanied by the teacher in three seminars, the first will propose the subject and will be directed to the students to seek information on the subject. In the second seminar we will discuss the content found by the students and clarify doubts, and in the third one the presentation will be oriented. The seminars will evaluate the independent work of the students. The topics of the work will be varied, and subjects suggested by the students are welcome.
Lecturing	In these classes the teacher will present the different topics of the program using different formats according to the subject to be studied, formats that will be: theory, case studies and / or general examples. The teacher can be supported by audiovisual and computer media, but in general, students do not need to handle them in class. Attendance to these classes, although is highly recommended for the proper follow-up of the course.

Personalized assistance

Methodologies	Description
Lecturing	During them discussions are held on some of the most relevant topics. Tutoring: Mondays and Wednesdays from 12:00 h to 14:00 h. Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation.
Laboratory practical	At the beginning of each practice, the theoretical concepts necessary for the understanding of the specimens to be observed are briefly explained. All issues that are raised during the practice are resolved. Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation.

Seminars	The working groups are chosen and the work topics discussed. They are tracked. A critical review and a general discussion of each work is done. Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation.
Tests	Description
Problem and/or exercise solving	The student has to complete and pass very short questions, with four possible answers and chose the correct ones.
Objective questions exam	The studen has to answer short questions in his/her own words, including specific and objective questions and some in the form of sintesis, refection and elabrotaion of well constructed arguments.
Essay questions exam	Here, the students have to develop a long topic, including an important amount of info, but being able to make it in a well explained and siinthetic way in order to offer a whole vision and including the important details of the topics, mainly being these different lyfe ccyles of fishes and invertebrates.

Assessment						
	Description	Qualification	Training and Learning Results			
Laboratory practical	Exam	5	A1 A2 A3 A4 A5	B2 B4 B5	C9 C10 C11	D1 D2
Seminars	Written or expository work	5	A1 A2 A3 A4 A5	B2 B4 B5	C9 C10 C11	D1 D2
Lecturing	Exam	10	A1 A2 A3 A4 A5	B2 B4 B5	C9 C10 C11	D1 D2
Problem and/or exercise solving	Exam	20	A1 A2 A3 A4 A5	B2 B4 B5	C9 C10 C11	D1 D2
Objective questions exam	Exam	30	A1 A2 A3 A4 A5	B2 B4 B5	C9 C10 C11	D1 D2
Essay questions exam	Exam	30	A1 A2 A3 A4 A5	B2 B4 B5	C9 C10 C11	D1 D2

Other comments on the Evaluation

Parcial tests (laboratory, lecturing, problem solving and objective questions exam) will be conducted during official timetable during the course of the discipline. Lab classes, due to their experimental nature, are mandatory.

Global assesment option In the event that the global evaluation option is chosen, as long as the face-to-face requirements mentioned in the experimental activities are met, it will have to be requested during the period that the center stipulates for it, maintaining the % previously described for the different methodologies/tests.

If the subject is not passed, the practical and seminar grades will be kept for 18 months.

Extraordinary evaluation (2nd chance) In the 2nd opportunity exam, another final exam is conducted that will compute in a similar way to the case of the 1st opportunity.

Others considerations

Date, time and place of exams (1º & 2º opportunity) will be published in the official web of Marine Sciences Faculty:

<http://mar.uvigo.es/alumnado/examenes/>

Students are strongly requested to fulfil a honest and responsible behaviour. It is considered completely unacceptable any alteration or fraud (i.e., copy or plagiarism) contributing to modify the level of knowledge and abilities acquired in exams, evaluations, reports or any kind of teacher's proposed work. Fraudulent behaviour may cause failing the course for a whole academic year. An internal dossier of these activities will be built and, when reoffending, the university rectorate will be asked to open a disciplinary record.

Sources of information

Basic Bibliography

C.P.J. Hickman, **Principios integrales de Zoología**, 18, McGraw-Hill, 2021

Complementary Bibliography

Recommendations

Subjects that it is recommended to have taken before

Marine zoology/V10G061V01210

IDENTIFYING DATA				
Economics and legislation				
Subject	Economics and legislation			
Code	V10G061V01408			
Study programme	Grado en Ciencias del Mar			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Optional	4th	2nd
Teaching language	Spanish			
Department				
Coordinator	Amigo Dobaño, Josefina Lucy			
Lecturers	Amigo Dobaño, Josefina Lucy			
E-mail	lamigo@uvigo.es			
Web	http://https://mar.uvigo.es/			
General description	Approach to the main variables that allow to realise basic analyses of situation and evolution of the economy.			

Training and Learning Results	
Code	
A3	Students have the ability to gather and interpret relevant data (usually within their field of study) to inform judgments that include reflection on relevant social, scientific or ethical issues
A5	Students have developed those learning skills that are necessary for them to continue to undertake further study with a high degree of autonomy
C3	Describe how works the global ocean circulation, its forcings and its climate implications.
C7	Apply to the marine and coastal environment the principles and methods used in Chemistry.
C8	Know the main pollutants, their causes and effects in the marine and coastal environment.
C9	Acquire basic knowledge about the structural and functional organization and the evolution of marine organisms.
C10	Know the biological diversity and functioning of marine ecosystems.
D1	Develop the search, analysis and synthesis of information skills oriented to the identification and resolution of problems.
D2	Acquire the ability to learn autonomously, continuously and collaboratively, organizing and planning tasks over time.

Expected results from this subject			
Expected results from this subject	Training and Learning Results		
Capacity to identify problems related with the marine resources, his consideration from the economic perspective and interpretation of the possible necessary results for the management of the same.	A3 A5	C3 C7 C8 C9 C10	D1 D2
Capacity to develop works or brief reports in the field of the marine resources	A5	C3 C7	D1 D2

Contents	
Topic	
I. INTRODUCTION. BASIC APPEARANCES	1. The Spanish Economy. 2. The Spanish economy in the European or world-wide context 3. Income and Distribution
II. The PRODUCTIVE ACTIVITIES	4. Primary activities. 5. Energetic sector. 6. Industry. 7. Service sector
III. ANALYSIS OF THE MARINE ENVIRONMENT. The FISHING	8.-Institutional appearances and juridical frame 9- Analysis of the Market

Planning			
	Class hours	Hours outside the classroom	Total hours
Seminars	14	33	47
Practices through ICT	15	37	52
Lecturing	23	28	51

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

Methodologies	
	Description
Seminars	In the seminars, will realise fundamentally tasks of preparation and exhibition of works on appearances related with the temario.
Practices through ICT	Formulation and resolution of problems and/or exercises related with the matter. The student has to develop the solutions.
Lecturing	Exhibition by part of the professor of the contents of the matter. Realisation of partial examinations.

Personalized assistance

Methodologies	Description
Lecturing	Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation.
Seminars	Personal tutorials to solve doubts and/or uncertainties

Assessment

	Description	Qualification	Training and Learning Results		
Seminars	Workshops of work. Will be able to use the seminars for exhibitions and realisation of partial proofs. Results of learning: -Comprise to handle necessary economic concepts for the management of the marine resources. -Capacity to identify problems relate with the marine resources, economic treatments and interpretation of results.-Comprise to handle necessary economic concepts for the management of the marine resources. -Capacity to identify problems relate with the marine resources, economic treatments and interpretation of results.	30	A3	C3 C7 C8 C9 C10	D1 D2
Practices through ICT	Study of cases. Empirical analysis. Possibility to realise and present works. Results of learning: -Comprise to handle necessary economic concepts for the management of the marine resources. -Capacity to identify problems relate with the marine resources, economic treatments and interpretation of results.	30	A5	C3 C7 C8 C9 C10	D1 D2
Lecturing	-Comprise and handle necessary economic concepts for the economic analysis and the management of the marine resources. -Capacity to identify problems relate with the marine resources, economic treatments and interpretation of results.	40		C3 C7 C8 C9 C10	

Other comments on the Evaluation

Students are strongly requested to fulfil a honest and responsible behaviour. It is considered completely unacceptable any alteration or fraud (i.e., copy or plagiarism) contributing to modify the level of knowledge and abilities acquired in exams, evaluations, reports or any kind of teacher's proposed work. Fraudulent behaviour may cause failing the course for a whole academic year. An internal dossier of these activities will be built and, when reoffending, the university rectorate will be asked to open a disciplinary record.

Global assessment option: The application for this evaluation option must be submitted in the time and manner determined by the Center, which will be published prior to the academic start. Given the experimental nature of the practices, attendance at them is mandatory to be eligible for this evaluation option. **Failure to attend the practices, with no justified cause invalidates this possibility, as well as the opportunity for continuous assesment (1º and 2nd opportunity of evaluation).**

2nd Evaluation Opportunity (JULY): The student will be evaluated by taking an exam on the content of the subject and also by delivering a practical activity.

Sources of information

Basic Bibliography

Complementary Bibliography

GARCÍA DELGADO, J.L.; MYRO, R:(Dir), **Lecciones de Economía Española**, duodécima, 2015

GARCIA DELGADO, J.KL; MYRO, R., Economía Española. Una Introducción , 2012
GARCÍA DE LA CRUZ, J.M.; RUESGA BENITO, S. (coord.), Economía española. Estructura y regulación , 2014
GARZA, M.D., Coord., La actividad pesquera a escala mundial , 2008
VARELA, M., COORD., Unha estratexia marítima para Galicia , 2010
GONZÁLEZ LAXE, F., Lecciones de Economía Pesquera , 2008
J. Surís y M. Varela, Introducción a la Economía de los Recursos Naturales , Cívitas, 1995
INSTITUTO NACIONAL DE ESTADÍSTICA Anuario estadístico de España, España en cifras, otras publicacion, www.ine.es , 2016
EUROSTAT Anuarios e Informes, http://epp.eurostat.ec.europa.eu , 2016
FAO Informes anuales agricultura, pesca, alimentación, www.fao.org , 2016

Recommendations

IDENTIFYING DATA				
Geographic analysis methods				
Subject	Geographic analysis methods			
Code	V10G061V01409			
Study programme	Grado en Ciencias del Mar			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Optional	4th	2nd
Teaching language	#EnglishFriendly Spanish			
Department				
Coordinator	Torres Palenzuela, Jesús Manuel Fontán Bouzas, Ángela			
Lecturers	Fontán Bouzas, Ángela Torres Palenzuela, Jesús Manuel			
E-mail	afontan@uvigo.es jesu@uvigo.es			
Web	http://www.tgis.uvigo.es			
General description	Introduction to the physical principles of the Teledetection and his Oceanographic Applications. 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				
A2	Students can apply their knowledge and understanding in a manner that indicates a professional approach to their work or vocation, and have competences typically demonstrated through devising and sustaining arguments and solving problems within their field of study			
A3	Students have the ability to gather and interpret relevant data (usually within their field of study) to inform judgments that include reflection on relevant social, scientific or ethical issues			
A4	Students can communicate information, ideas, problems and solutions to both specialist and non-specialist audiences			
A5	Students have developed those learning skills that are necessary for them to continue to undertake further study with a high degree of autonomy			
B1	Know and use vocabulary, concepts, principles and theories related to oceanography and apply everything learned in a professional and/or research environment.			
B2	Plan and execute surveys in the field and laboratory work, applying basic tools and techniques for sampling, data acquisition and analysis in the water column, sea bottom and marine substratum.			
B3	Recognize and implement good practices in measurement and experimentation, and work responsibly and safely both in field surveys and in the laboratory.			
B4	Manage, process and interpret the data and information obtained both in the field and in the laboratory.			
B5	Develop, implement and write basic or applied projects in oceanography from a multidisciplinary perspective.			
C1	know at a general level the fundamental principles of sciences: Mathematics, Physics, Chemistry, Biology and Geology.			
C4	Know, analyze and interpret the physical properties of the ocean according to current theories, as well as to know the most relevant sampling tools and techniques.			
D1	Develop the search, analysis and synthesis of information skills oriented to the identification and resolution of problems.			
D2	Acquire the ability to learn autonomously, continuously and collaboratively, organizing and planning tasks over time.			

Expected results from this subject				
Expected results from this subject	Training and Learning Results			
Learn to use programs of Treatment of Images of Satellite in marine applications.	A2	B1	C1	D1
	A3	B2	C4	D2
Work with thermal images, optical and of microwaves in studies of *batimetría coastal, currents and oceanic twists, classification of covers in coastal zone, algorithms of colour and follow-up of poured of hydrocarbons.	A4	B3		
	A5	B4		
		B5		

Contents	
Topic	

METHODS IN GEOGRAPHIC ANALYSIS: VECTORIAL ANALYSIS	1. Introduction to the cartography and to the systems of geographic information 2. Systems of reference and systems of projection 3. Types of geographic data 4. Sources of geographic and cartographic information. 5. Software of systems of geographic information 6. Applications of the systems of geographic information. Thematic maps. 7. Acquisition and processed of vectorial data 8. Resolution of practical cases applied to oceanography and coastal management
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METHODS IN GEOGRAPHIC ANALYSIS: RASTER ANALYSIS	1. Raster Data Sources. Remote Sensing 2. Access to Raster Data and Copernicus 3. Georeferencing, Orthophotography 4. Land Cover Classification with QGIS 5. Digital Elevation Models (DEM) 6. Use of Drones for Obtaining Orthophotos and Elevation Models 7. Applications of Geographic Information Systems in Studies with DEM 8. Coastal Resource Management with GIS 9. Use of GPS and Tracking with Google Earth
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Planning

	Class hours	Hours outside the classroom	Total hours
Practices through ICT	20	10	30
Seminars	7	15	22
Lecturing	25	40	65
Mentored work	6	10	16
Problem and/or exercise solving	1.7	5	6.7
Presentation	0.3	10	10.3

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

Methodologies

	Description
Practices through ICT	The methodology that uses in the practical is the one of study directed.
Seminars	It will make a follow-up *individualizado of technicians and contents for the development of the works scheduled . His main aim is to clear the concepts that have been explained in the class of theory or resolve any of the problems of the practical classes.
Lecturing	The lesson *magistral is the method mainly employee, using in the measure of the possible the lesson had a conversation.
Mentored work	The/The student, of individual way or in group, elaborates a document on the thematic of the matter or prepares seminars, investigations, memories, essays, summaries of readings, conferences, etc.

Personalized assistance

Methodologies	Description
Lecturing	The lesson *magistral is the method mainly employee, using in the measure of the possible the lesson had a conversation. The student that wish it will be able to attend to *tutorías personalised to resolve doubts, mainly in the schedules that indicate . To optimise the time, is necessary that the student contact with the professor with *antelación sufficient
Practices through ICT	The methodology that uses in the practical is the one of study directed.
Seminars	It will make a follow-up *individualizado of technicians and contents for the development of the works scheduled . His main aim is to clear the concepts that have been explained in the class of theory or resolve any of the problems of the practical classes.
Mentored work	It will be evaluated the work by means of an oral presentation, a theoretical work and a specific practice

Assessment

Description	Qualification	Training and Learning Results
Practices through ICT	15	A2 B2 C4 D2 A3 B3 A4 B4

Seminars	It Will realize a tracking individualizado of techniques and contents stop the development of the works scheduled. The seminars are of mandatory assistance.	10	A2 A3 B2 B3 C1 C4 D1 D2
Lecturing	The lesson maxistral is the method mainly employee, using in the measure of the possible to lesson dialogada. Some activities will be of mandatory assistance. The students will receive previous notifications stop this assistance through moovi.	5	A2 A3 B1 B3 C1 C4 D1 D2 A4
Mentored work	IT/The student, of individual way or in group, elaborates a document envelope to thematic of the subject or prepares seminars, investigations, memories, essays, summaries of readings, conferences, etc. This work and his presentation can be substituted by a theoretical and practical proof in assessment of the professor.	30	A2 A4 A5 B2 B3 B4 B5 C1 C4 D1
Problem and/or exercise solving	The problems are related with the capacity of the student purchased in the practices and the theory. They are of mandatory character.	30	A2 A5 B2 B3 B4 C4 D1
Presentation	Exhibition by part of the students in front of it teaching and/or a group of students of one fear on contents of the subject or of the resulted of one work, exercise, project... Can be carried out of individual way or in group.	10	A2 A3 A4 B1 B4 C4 D1 B5

Other comments on the Evaluation

Continuous evaluation:

The realization of works (30%) and his exhibition (10%) can be substituted by a theoretical and practical examination with the percentage sum 40% of the final note. This option will be valued pole professor to surpass the subject. To surpass the subject, demands that the global qualification of each of the modules by separate was not inferior to 4 points. Incidentally, in the case of the work *tutelado, is necessary that, at least join of the parts (Vectorial Analysis or RásterAnalysis) have an equal or upper qualification to 5 points so that it can do average with the another part, which has to have an equal or upper qualification to the 4 points.

Any Lectures will have compulsory attendance given the practical content of the same. This will notify with sufficient advance

The date, hour and place of realization of the proofs of evaluation, as well as the mandatory activities will be published in the web of Moovi of the subject.

Global evaluation and Extraordinary Announcement:

The application stop this option of evaluation #have present in the time and form that determine the Centre, that will be published with *anterioridade to the academic beginning.

Given the experimental character of the activities, the assistance to the same is mandatory for power opt the this option of evaluation.

To no assistance to practices, lectures with compulsory attendance and seminars, without cause justified invalidates this possibility, as well as the opportunity of extraordinary evaluation (2ª opportunity).

So much the practical how the seminars, supervised work and the final evaluation owe to had approved with a 40% of the partial note of each, In case of fail the second opportunity (extraordinary announcement) will realize with an examination of objective questions and an examination of problems with the percentage sum of the no surpassed proofs.

If the course is not passed, the evaluation results obtained in the different sections will not be carried over to the following academic year.

Other considerations

It requires of the students that study this subject a responsible behaviour and honest. It considers inadmissible any form of fraud (copy or *plaxio) aimed at falsifying the level of knowledges and skills reached in all type of proof, report or work. The fraudulent behaviours will be able to suppose suspend the subject during a complete course. It will carry an internal register of these performances so that, in case of recidivism, request the opening to the Rectorship of a disciplinary file

Sources of information

Basic Bibliography

Oceanografía y Satélites, Tebar, 2009

CRACKNELL, A.P. u HAYES, L.W.B., **Introduction to Remote Sensing**, Taylor & Francis, 1991

Complementary Bibliography

Recommendations

Subjects that are recommended to be taken simultaneously

Remote sensing/V10G061V01413

Other comments

The date, hour and place of realisation of the proofs of evaluation, will be published in the official web of the Faculty of Sciences of the Sea:

<http://mar.uvigo.es/alumnado/examenes/>

IDENTIFYING DATA				
Modelling				
Subject	Modelling			
Code	V10G061V01410			
Study programme	Grado en Ciencias del Mar			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Optional	4th	2nd
Teaching language	#EnglishFriendly Spanish			
Department				
Coordinator	Souto Torres, Carlos Alberto			
Lecturers	Souto Torres, Carlos Alberto			
E-mail	ctorres@uvigo.es			
Web	http://https://www.uvigo.gal/estudar/organizacion-academica/departamentos/fisica-aplicada			
General description	The student will learn how to operate an oceanographic numerical simulation model. In order to achieve this goal, besides the specifics of the simulation code, he/she will learn some basics of the operative system Linux, NetCDF file format and Matlab.			
	This is an 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				
A4	Students can communicate information, ideas, problems and solutions to both specialist and non-specialist audiences			
A5	Students have developed those learning skills that are necessary for them to continue to undertake further study with a high degree of autonomy			
B3	Recognize and implement good practices in measurement and experimentation, and work responsibly and safely both in field surveys and in the laboratory.			
C4	Know, analyze and interpret the physical properties of the ocean according to current theories, as well as to know the most relevant sampling tools and techniques.			
D1	Develop the search, analysis and synthesis of information skills oriented to the identification and resolution of problems.			
D2	Acquire the ability to learn autonomously, continuously and collaboratively, organizing and planning tasks over time.			

Expected results from this subject				
Expected results from this subject	Training and Learning Results			
Theoretical and practical knowledge on numerical modelling in oceanography. The student will have capacity to understand the results of a numerical simulation, in what consists, which are the necessary forcings, etc. As well as be able to implement a numerical opensource model, to simulate the physics and the biogeochemistry.	A4 A5	B3	C4	D1 D2

Contents	
Topic	
Ocean equations.	Discretization and introduction of the ocean equations in the model.
Matlab.	Basics of Matlab coding (loops, conditional, input and output of data). Examples.
Numerical integration methods	Implicit and explicit methods. Runge-Kutta, Predictor-Corrector, Leap-Frog, etc.
NetCDF data files.	Structure of a NetCDF file: Global and local attributes, dimensions, data. Reading and writing of NetCDF files.
The CROCO model.	Introduction. Model input structure. Bathymetry, forcing and boundary condition.
Examples with CROCO.	Run and analysis of simple examples.
Nesting with CROCO.	Nested grids: Why and how. Structure, run and analysis of results.
Biogeochemical models.	Examples with simple biogeochemical models. NPDZ and N2P2Z2D2. The PISCES module.

Planning			
	Class hours	Hours outside the classroom	Total hours
Practices through ICT	20	20	40
Lecturing	18	18	36

Seminars	14	14	28
Presentation	5	5	10

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

Methodologies	
	Description
Practices through ICT	Using Linux as the operative system and Matlab as a tool, the student will learn to use the NetCDF data file format and the use of a numerical simulation model.
Lecturing	The equations of the ocean and different methods to solve those equations numerically with a computer code will be introduced to the student.
Seminars	Simple differential equations will be solved numerically, learning basic programming commands and some visualisation tools.

Personalized assistance	
Methodologies	Description
Lecturing	Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation
Practices through ICT	Will be adapted to the timeframe determined by the Faculty's dean.
Seminars	The students will implement different programming codes to solve differential equations. The fulfillment of the aims fixed in the seminars will be evaluated.
Tests	Description
Presentation	The final work will be presented to all the other students and the teacher.

Assessment				
	Description	Qualification	Training and Learning Results	
Practices through ICT	The student must be able to write the code necessary to numerically integrate simple differential equations.	30	B3	D2
Seminars	The ability to open and visualize NetCDF files, as well as to create simple files, will be evaluated.	30	A5	D1 D2
Presentation	The presentation of the results from a numerical simulation will be evaluated.	40	A4 A5	C4 D1

Other comments on the Evaluation

Global evaluation option.

In the case to opt by global evaluation, the student have to request it in the period and form marked by centre, that will be published previous to the start of the course. The proofs will take place the same official testing date, having more time for his development.

Extraordinary evaluation (2nd opportunity)

There will be the possibility of a standalone proof, in the form of a presentation of the work done, or to recover individually each one of the three sections of the first opportunity, with the same evaluation criteria.

All of the three tests must be passed within the same year.

Ethic Commitment

It requires of the students that *curse this matter a responsible and honest behaviour. It considers inadmissible any form of fraud (copy or plagiarism) directed to *falsear the level of knowledges and skills reached in all type of proof, report or work. The fraudulent behaviours *podrÃn suppose suspend the subject during a complete course. CarryÃn an internal register of these performances so that, in case of *reincidencia, request the opening to the rectorship of a disciplinary file

The date, hour and place of the proofs will be published in the Faculty's official webpage:

<http://mar.uvigo.es/alumnado/examenes>

Sources of information

Basic Bibliography

Cushman-Roisin, Benoit and Beckers, Jean-Marie, **Introduction to Geophysical Fluid Dynamics. Physical and Numerical Aspects**, Academic Press, 2009

Complementary Bibliography

Recommendations

Subjects that it is recommended to have taken before

Ocean Dynamics/V10G061V01402

IDENTIFYING DATA				
Marine microbiology and parasitology				
Subject	Marine microbiology and parasitology			
Code	V10G061V01411			
Study programme	Grado en Ciencias del Mar			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Optional	4th	2nd
Teaching language	Spanish			
Department				
Coordinator	García Estévez, José Manuel			
Lecturers	García Estévez, José Manuel González Abril, Ana Osorio Novas, Elisa			
E-mail	jestevez@uvigo.es			
Web				
General description	It should be borne in mind that parasitism is the most widespread life strategy in nature. The study of the impact of parasitism can provide important information for better management and exploitation of resources. Thus, this subject describes the diversity of parasitic animals in all their manifestations and the adaptations of each species to its habitat, and studies parasite-host relationships: anatomy, morphology, biology, epidemiology, diagnosis and treatment. The Microbiology module will deal with aspects related to biological contamination, microbial pathogens in aquaculture and the biotechnological potential of marine microbiota.			

Training and Learning Results

Code				
A1	Students have demonstrated knowledge and understanding in a field of study that builds upon their general secondary education, and is typically at a level that, whilst supported by advanced textbooks, includes some aspects that will be informed by knowledge of the forefront of their field of study			
A2	Students can apply their knowledge and understanding in a manner that indicates a professional approach to their work or vocation, and have competences typically demonstrated through devising and sustaining arguments and solving problems within their field of study			
A3	Students have the ability to gather and interpret relevant data (usually within their field of study) to inform judgments that include reflection on relevant social, scientific or ethical issues			
A4	Students can communicate information, ideas, problems and solutions to both specialist and non-specialist audiences			
B1	Know and use vocabulary, concepts, principles and theories related to oceanography and apply everything learned in a professional and/or research environment.			
B4	Manage, process and interpret the data and information obtained both in the field and in the laboratory.			
C9	Acquire basic knowledge about the structural and functional organization and the evolution of marine organisms.			
C10	Know the biological diversity and functioning of marine ecosystems.			
C11	Apply the knowledge and techniques acquired to the characterization and sustainable use of living resources and marine ecosystems.			
D1	Develop the search, analysis and synthesis of information skills oriented to the identification and resolution of problems.			
D2	Acquire the ability to learn autonomously, continuously and collaboratively, organizing and planning tasks over time.			
D5	Sustainability and environmental commitment. Equitable, responsible and efficient use of resources.			

Expected results from this subject

Expected results from this subject	Training and Learning Results			
Know and purchase skill in the technicians of diagnostic in Parasitology.	A2	B4	C11	D1
Understand the complexity of the biological cycles of the parasites of the marine environment like key appearance for the control of the parasitic diseases.	A4	B1	C9 C10	D5
Know the importance and the possible applications of the main parasites of the aquatic marine environment. Implications in public health and fisheries.	A3	B4	C11	D5
Know the main strategies of control of the parasitic illnesses	A2	B4	C11	D1
Know and know handle documentary sources related with the Parasitology of the aquatic environment	A1			D1 D2
Know the microbial activities in relation with the half biotic and abiotic	A2	B4	C11	D1
Know the main illnesses infectious diseases by marine microorganisms	A1	B4	C11	D1
Know interpret the origin and consequences of the microorganisms in the aquatic environment	A3	B4	C11	D1
Possess general notions on the interest applied of the microorganisms of the half marine	A3	B4	C11	D5

Contents	
Topic	
BLOCK I. INTRODUCTION AND GENERAL CONCEPTS	I.1. Parasitology and Marine Parasitology. Concept of parasitism. Adaptations to the parasitism. Actions of the parasite on the host. Parasite specificity. Parasites and biological cycles. I.2. Ecological terms in Parasitology.
BLOCK II. PROTOZOA	II.1. Introduction to the study of the Protozoa parasites. Classification Protozoa. II.2. Dinoflagellates. Flagellates. Amoeboae. Apicomplexa. Ciliates. II.3. Microsporidia. II.4. Myxosporidia. II.5. Protozoa of bivalve molluscs: Perkinsus, Haplosporidia, Marteilia, Bonamia.
BLOCK III. HELMINTHS AND ARTHROPODS	III.1. Plathelminths: Monogenea. Digenea. Cestoda. Turbellaria. III.2. Nematelminths: Nematoda. Acanthocephala. III.3. Crustacea.
BLOCK IV. APPLICATIONS OF THE MARINE PARASITOLOGY	IV.1. The parasites as biological markers. IV.2. Applications of the parasites in the control of the fisheries: His employment in the differentiation of stocks. IV.3. Economic and hygienic importance of the marine parasites.
BLOCK V. MICROBIAL POLLUTION IN THE MARINE ENVIRONMENT	V.1. Types of pollutants biological that access to the marine aquatic environment. V.2. Causes and consequences of the biological pollution in coastal waters. V.3. Control and Monitoring of the biological pollution in coastal waters. V.4. Methods of quantification of Microorganisms indicators in waters and foods of marine origin.
BLOCK VI. INFECTIOUS ICTIOPATHOLOGY: PROCARIOTS and VIRUSES	VI.1. Host-pathogen environment interaction. VI.2. Pathogenicity and virulence factors. VI.3. Main pathogens in aquaculture and mariculture. VI.4. Microbiological diagnosis. VI.5. Prevention and treatment. Antibiotherapy. Alternative methods. Immunostimulation.
BLOCK VII. BIOTECHNOLOGICAL POTENTIAL OF THE MARINE MICROBIOTA	VII.1. Bioactive compounds of marine origin. VII.2. Molecular techniques applied to bioprospecting. VII.3. Bioremediation of marine pollutants. VII.4. Biofouling: Microbial process and antifouling treatments.

Planning			
	Class hours	Hours outside the classroom	Total hours
Lecturing	8	15	23
Laboratory practical	20	50	70
Seminars	10	10	20
Flipped Learning	12	25	37

*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 teachers of the subject structure and/or explain the objectives and contents of each block. For their study, students have at their disposal the presentations seen in class and support cards for each topic, in the Moovi platform.
Laboratory practical	Their completion is mandatory in order to pass the subject. In them, the teacher gives an explanation of the theoretical foundations and protocols of the practices, supervising their execution and solving the doubts that the students may have. The practices will deal with useful techniques in the practice of the profession.
Seminars	Their realization is mandatory. In them, topics related to the theory and practices of the subject are discussed, elaborated and presented (individually or in groups). Topics will be proposed to be prepared by the students.
Flipped Learning	(*) Los alumnos estudian y preparan los temas fuera de clase, accediendo a los contenidos de la asignatura por la plataforma Moovi. Posteriormente, en el aula, se realizarán actividades más participativas. Al haber trabajado los contenidos y conceptos en casa, el tiempo en el aula se dedicará a resolver dudas, solucionar dificultades de comprensión o aprendizaje y a trabajar los temas de manera individual y colaborativa.

Personalized assistance	
Methodologies	Description

Lecturing	Any doubts that students may have will be answered in class or during tutoring hours. The student will be able to attend personalized tutorials to solve doubts, mainly in the schedules that are indicated and arranging an appointment with the professors previously, by e-mail.
Laboratory practical	They will be participative and will allow to establish personalized reinforcement actions. During the realization of the laboratory practices the teachers will give individualized attention to each student for the correct understanding of the experimental objectives and of the methodology or technique used.
Seminars	Elaboration and exposition by groups of students of topics related to the theory and practices of the subject. The student will be able to attend personalized tutorials to solve doubts, mainly in the schedules that are indicated and arranging appointment with the professors previously, by e-mail.
Flipped Learning	Reverse classroom: Students study and prepare the topics outside the classroom. In the classroom, the teacher will resolve doubts, solve comprehension or learning difficulties and deal with the topics individually and collaboratively.

Assessment						
	Description	Qualification	Training and Learning Results			
Lecturing	The theoretical knowledge acquired by the student will be evaluated by means of different multiple-choice tests and short questions, organized in tests corresponding to the contents of Parasitology and Microbiology.	40	A1 A2	B1 C9 C10 C11	D5	
Laboratory practical	The knowledge acquired by the student in the practical classes will be evaluated by means of multiple-choice tests/short questions and resolution of exercises, organized in tests corresponding to the contents of Parasitology and Microbiology. Attendance is mandatory to pass the course.	40	A3 A4	B1 B4 C9 C10 C11	D1 D5	
Seminars	They are compulsory. The quality of the memory of the works presented, the quality of the exposition and the active participation in them will be valued.	20	A1 A4	B1 C10	D1 D2 D5	

Other comments on the Evaluation

To pass the subject it will be necessary:

A) In continuous evaluation:

- 1) To attend the practices and seminars of the two modules of the subject.
- 2) Obtain a minimum grade of 5 points out of 10 in each of the activities (Theory, Practicals and Seminars) of the two modules that compose it. A minimum grade of 4 points will be admitted in a single activity for each module, as long as the final average of the subject equals or exceeds 5 points. If the subject is not passed in its entirety, the highest grade of the activities not passed will be reflected in the final grade.

In the second call: The grades of the tests passed in the first call will be kept for the second call, evaluating the students of the activities not passed.

For successive courses: In the Parasitology module, the qualifications are not kept for the following year. In the Microbiology module, the qualifications of the approved parts of theory, practicals and seminars are earned for 2 years.

B) In global evaluation:

1. The student will request it within the period established by the center.
2. The student will not be able to request the global evaluation if he/she has not carried out the practices and seminars of the subject whose attendance is obligatory.
3. Both in the first and in the second call, students who choose this type of evaluation will be evaluated of all the contents of the subject, having to obtain to pass the subject a minimum grade of 5 points out of 10 in each of the modules.

Students who take this subject are required to behave responsibly and honestly. Any form of fraud (copying and/or plagiarism) aimed at falsifying the level of knowledge and skills achieved in any type of test, report or work is considered inadmissible. Fraudulent conduct may result in the student being suspended from the course for a full academic year. An internal record of these actions will be kept so that, in case of recurrence, a disciplinary file may be requested from the rector's office.

The date, time and place of the evaluation tests will be published on the official website of the Faculty of Marine Sciences: <http://mar.uvigo.es/alumnado/examenes>

Sources of information

Basic Bibliography

Eiras, J.; Segner, H.; Wahli, T. & Kapoor, B.G., **Fish Diseases**, 2008

Rohde, K., **Marine Parasitology**, 2005

M.T. Madigan; J.M. Martinko; K.S. Bender; D.H. Buckley; D.A. Stahl & T. Brock, **Brock Biology of Microorganisms**, 14, 2015

J.M. Willey; L.M. Sherwood & C.J. Woolverton, **Prescott Microbiology**, 10, 2017

Munn, C. B., **Marine Microbiology Ecology and Applications. (2ª Edición)**, 2011

Patrick T.K. Woo & Kurt Buchmann, **Fish Parasites: Pathobiology and protection**, 2012

Loker, E.S. & Hofkin, B.V., **Parasitology: A Conceptual Approach**, 2015

Complementary Bibliography

Goater, T.M.; Goater, C.M. & Esch, G.W., **Parasitism: The Diversity and ecology of animal parasites**, 2, 2013

L. Roberts J. Janovy, Jr. & S. Nadler, **Foundations of Parasitology**, 9, 2013

Williams, H. & Jones, A., **Parasitic Worms of Fish**, 1994

Woo, P.T.K., **Fish Diseases and Disorders. Volumen 1. (2ª Edición). Protozoan and Metazoan Infections.**, 2006

Noga, E. J., **Fish Disease. Diagnosis and treatment**, 2010

Austin, B., **Infectious Disease in Aquaculture**, 2012

LeBoffe, M.J. & Pierce, B.E., **Microbiology: Lab Theory and Application**, 4, 2015

Recommendations

Other comments

When treating of a matter *optativa, that can be *cursada by all the students of the degree in Sciences of the Sea, do not consider necessary previous knowledges further of the purchased in the matters of Principles of Marine Microbiology (V10G061V01208) and Marine Zoology (V10G061V01210) already *cursadas previously.

The knowledges that the student purchases in the matter can be him of big utility and application in other disciplines, as they are the Biological Oceanography (V10G061V01306), *Pesquerías (V10G061V01405), Aquaculture (V10G061V01310) or the Biology of fish and seafoods (V10G061V01407).

IDENTIFYING DATA				
Marine genetic resources				
Subject	Marine genetic resources			
Code	V10G061V01412			
Study programme	Grado en Ciencias del Mar			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Optional	4th	2nd
Teaching language	#EnglishFriendly #FrançaisAmical Spanish Galician			
Department				
Coordinator	Presa Martínez, Pablo			
Lecturers	Caballero Rúa, Armando González Vázquez, Luis Daniel Presa Martínez, Pablo Tedone , Gabriele			
E-mail	pressa@uvigo.gal			
Web	http://https://moovi.uvigo.gal/			
General description	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. Subject from the Français amical. International students may request the following from the teaching staff: a) materials and bibliographic references to follow the subject in French, b) attend tutorials in French, c) tests and evaluations in French. SYNOPSIS The "Marine Resources" appear with frequency in the profile of the Marine Sciences Degree. They are thus a fundamental object of academic study and of professional management. The central role of the marine biota has to be dealt from industrial, technological, physico-chemical, oceanographic and biological (Biochemical, Physiology, Genetics, Ecology, etc.) disciplines. The genetic "approach" is crucial in the management of biological resources as much from the natural point of view (genetic conservation) as from the exploitation view from an intensive production (aquaculture). Where is the point of elaborating a complex plan of exploitation on economic feasibility, technical and sociological viability if the resource lacks the sufficient genetic diversity to adapt to environmental challenge, to allow strategies of genetic selection or simply to keep it at its reproductive optimum?. Genetics plays a central role in the management of living resources, whose knowledge can not be obviated given the actual current easy going analyses of the genomes.			

Training and Learning Results	
Code	
A1	Students have demonstrated knowledge and understanding in a field of study that builds upon their general secondary education, and is typically at a level that, whilst supported by advanced textbooks, includes some aspects that will be informed by knowledge of the forefront of their field of study
A2	Students can apply their knowledge and understanding in a manner that indicates a professional approach to their work or vocation, and have competences typically demonstrated through devising and sustaining arguments and solving problems within their field of study
A3	Students have the ability to gather and interpret relevant data (usually within their field of study) to inform judgments that include reflection on relevant social, scientific or ethical issues
B1	Know and use vocabulary, concepts, principles and theories related to oceanography and apply everything learned in a professional and/or research environment.
B2	Plan and execute surveys in the field and laboratory work, applying basic tools and techniques for sampling, data acquisition and analysis in the water column, sea bottom and marine substratum.
B3	Recognize and implement good practices in measurement and experimentation, and work responsibly and safely both in field surveys and in the laboratory.
B4	Manage, process and interpret the data and information obtained both in the field and in the laboratory.
C1	know at a general level the fundamental principles of sciences: Mathematics, Physics, Chemistry, Biology and Geology.
C9	Acquire basic knowledge about the structural and functional organization and the evolution of marine organisms.
C10	Know the biological diversity and functioning of marine ecosystems.
C11	Apply the knowledge and techniques acquired to the characterization and sustainable use of living resources and marine ecosystems.
D1	Develop the search, analysis and synthesis of information skills oriented to the identification and resolution of problems.
D2	Acquire the ability to learn autonomously, continuously and collaboratively, organizing and planning tasks over time.
D5	Sustainability and environmental commitment. Equitable, responsible and efficient use of resources.

Expected results from this subject

Expected results from this subject	Training and Learning Results			
Cognitive (knowledge): comprehension of the concepts and basic processes of genetic variability, genetic differentiation and evolution and divergence of the species in qualitative and quantitative genetic characters.	A1	B1	C1 C9	D2
Procedures/Instrumental (know-how): to obtain and to organise information; to design experiments and interpreting results; to apply molecular techniques to practical cases of management of marine genetic resources; to analyse and to characterise DNA samples; to perform computational phylogenetic analyses.	A3	B2 B3 B4	C10 C11	D1
Transversal abilities: Critical reasoning; autonomous work and team work; capacity to carry knowledge into practice; computational analytical solvency; professional interpersonal communication.	A2	B1	C11	D5

Contents

Topic

INTRODUCTION	Presentation of the subject. Level test of genetic knowledge of the students. Analysis of the program. Taking of decisions on the process of learning and the system of evaluation. Professional postgraduation opportunities.
CHAPTER I. Genetic variability.	Origin and maintenance of the genetic variability. Mendelian analysis and relations between alleles. Genic interaction. Genetic analysis of the continuous variation and biometric methods of Quantitative Genetics.
CHAPTER II. Population genotyping.	Strategies of population genotyping. Types of molecular polymorphisms and markers. Score and tabulation of polymorphisms.
CHAPTER III. Populational genetic structure.	The ideal population and the populational equilibrium. Systematic factors of change: mutation, migration, selection. Factors of random change: drift and endogamy. Computational basis of populational structures.
CHAPTER IV. Management of marine genetic resources.	Structural genetics in fishery management. Genetic evaluation. Genetics and genomics in the management of fisheries. Genetic management in aquaculture. Genetic management of biological invasions.
PRACTICE 1. Identification of marine species with genetic markers diagnostic.	Amplification Of DNA, electrophoretic migration of PCR products, interpretation of genetic patterns. Bioinformatic analysis of interspecific allocation and phylogenetic inference. Scientific and industrial applications of the genetic assignment.
PRACTICE 2. Calculation of populational genetic structures of marine species.	Population genotyping and data tabulation. Bioinformatic computation of genetic structures and connectivity between fish stocks with Bayesian methods. Scientific and industrial applications of the genetic structure.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	18	25	43
Practices through ICT	8	4	12
Laboratory practical	12	6	18
Seminars	14	10	24
Problem and/or exercise solving	0	16	16
Report of practices, practicum and external practices	0	6	6
Presentation	1	10	11
Debate	2	0	2
Essay questions exam	2	16	18

*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 professor will present the conceptual basis of each subject and the strategies of the corresponding calculation process. The student will apprehend such concepts by means of the bibliographic query and daily exercises.
Practices through ICT	The students will analyse the experimental data of their previous practices in the laboratory, using specific software and on-line servers.
Laboratory practical	The educational guide of the practices will allow to develop several experiments for the genetic traceability of marine products and genotyping the populations for the calculation of the structure of fisheries.
Seminars	Students will solve out practical cases in the classroom, which are associated to each theoretical concept, analytical technique or biological situation of marine genetic resources.

Personalized assistance	
Methodologies	Description
Practices through ICT	There will be a personalised attention according to the needs of each student
Lecturing	The questions or synchronous explanations are part of the participatory class.
Laboratory practical	The personalised guide will apply according to the needs of each student.
Seminars	Seminars allow to identifying the understanding or executive difficulties of each student in real time.
Tests	Description
Problem and/or exercise solving	The face-to-face virtual tutorship will be held synchronously or asynchronously, by email and by the virtual classroom of remote campus UVIGO, respectively.
Report of practices, practicum and external practices	A predesigned protocol will be presented during the lab. practices for the preparation of the final report.
Presentation	The rules of an efficient presentation will be discussed in order to work out an outstanding dissemination of the practical case assigned to each student.
Debate	

Assessment					
	Description	Qualification	Training and Learning Results		
Problem and/or exercise solving	Daily execution of exercises from each class, aiming its conceptual apprehension: problems, multiple questions or practical cases with mathematical applications.	20	A3	B2 B3	C9 C11 D2
Report of practices, practicum and external practices	Practicum report with solutions given, illustrations of the proofs, statistical tests performed and conclusions.	20	A1	B4	C10 D1
Presentation	Presentation and defence of the practical case assigned. The teacher will evaluate the effort, the clarity of the presentation, the structure of the work and the argumentative level of the conclusions.	20	A2	B1 B4	C11 D1 D2 D5
Debate	Attendance and active participation in classes, seminars and practices, comprising a scientific and ethical position on the exploitation of living marine resources.	10	A1 A3	B1	C10 D5
Essay questions exam	A comprehensive subject knowledge exercise, with concept definitions, formal genetic calculation questions, essay questions, and applied case problems.	30	A1 A2 A3	B1 B2 B3 B4	C1 C9 C10 C11 D1 D2 D5

Other comments on the Evaluation

Continuous Assessment Option (Regular): The content taught in lectures and in the experimental and computer labs will be assessed, respectively, through daily homework completion (online grading), the execution of and attitude toward the labs (in-person performance), the final lab report (report grading), and the oral defense of the practical case (on the scheduled date of the final problem-solving seminar). In addition, an objective question exam is offered to all students, accounting for 30% of the final grade.

Comprehensive (Global) Assessment Option: For students who are unable to attend the course in person daily for personal or work reasons, an extraordinary written exam will be held at the same time as the regular written exam for continuous assessment (normally mid-May 2026). The exam will be worth 5 points out of 10, the cut-off mark for passing the course. Given the experimental nature of the labs, attendance is mandatory to qualify for this assessment option. If you wish to opt for this assessment, the student must apply within the period and in the manner indicated by the Center, which will be published prior to the start of the academic year.

Extraordinary assessment option (2nd opportunity): This option is administered on a second exam date (usually in early July 2016) and its requirements are the same as those of continuous assessment or global assessment; that is, the student must first complete the practical assignment.

In all cases, the continuous assessment grades obtained during the course are retained and added to the grades from the last written exam taken.

The date, time, and location of the assessment tests will be published on the official website of the Faculty of Marine Sciences: <http://mar.uvigo.es/alumnado/examenes/>

Sources of information

Basic Bibliography

A. Moya y A. Fontdevila, **Introducción a la genética de poblaciones**, 84-7738-691-9, 1, Síntesis, 1999

Andy Beaumont , Pierre Boudry, Kathryn Hoare, **Biotechnology and Genetics in Fisheries and Aquaculture**, 978-1-4051-8857-9, 2nd, Ames, Iowa : Blackwell, 2010

Complementary Bibliography

Daniel L. Hartl and Andrew G. Clark, **Principles of Population Genetics**, E-book ISBN:9780197778739, 4th, Oxford Univ. Press, 2006

Avise, John C., **Molecular markers, natural history and evolution**, 0-87893-041-8, 2nd, Sinauer Associates Inc.,U.S., 2004

Hedrick, P.W., **Genetics of Populations**, 978-0-7637-5737-3, 4th, Jones & Bartlet Publ, 2011

Matthew Hahn, **Molecular Population Genetics**, 9780878939657, 1st, Sinauer Associates, 2018

Recommendations

Subjects that are recommended to be taken simultaneously

Fishing/V10G061V01405

Subjects that it is recommended to have taken before

Biology: Biology I/V10G061V01101

Marine Ecology/V10G061V01206

Biology: Biology 2/V10G061V01106

Other comments

The students registered in this subject would need to have previous knowledge on the nature of the hereditary material (DNA), i.e. structure, transmission rules and evolution, tackled in the subject Biology of the first course of the Degree in Marine Sciences. It is essential to account for basic knowledge of calculation of probabilities, proofs of significance (e.g. the test of chi-square), and the concepts and calculations of regression and analysis of variance. The dynamics of fisheries and the marine biological cycles, are as well essential to understand the connectivity of the exploited fishery stocks.

IDENTIFYING DATA				
Remote sensing				
Subject	Remote sensing			
Code	V10G061V01413			
Study programme	Grado en Ciencias del Mar			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Optional	4th	2nd
Teaching language	#EnglishFriendly Spanish			
Department				
Coordinator	Torres Palenzuela, Jesús Manuel			
Lecturers	Torres Palenzuela, Jesús Manuel			
E-mail	jesu@uvigo.es			
Web	http://www.tgis.uvigo.es			
General description	Introduction to the physical principles of the Teledetection and his Oceanographic Applications. 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	
A2	Students can apply their knowledge and understanding in a manner that indicates a professional approach to their work or vocation, and have competences typically demonstrated through devising and sustaining arguments and solving problems within their field of study
A3	Students have the ability to gather and interpret relevant data (usually within their field of study) to inform judgments that include reflection on relevant social, scientific or ethical issues
A4	Students can communicate information, ideas, problems and solutions to both specialist and non-specialist audiences
B1	Know and use vocabulary, concepts, principles and theories related to oceanography and apply everything learned in a professional and/or research environment.
B2	Plan and execute surveys in the field and laboratory work, applying basic tools and techniques for sampling, data acquisition and analysis in the water column, sea bottom and marine substratum.
B3	Recognize and implement good practices in measurement and experimentation, and work responsibly and safely both in field surveys and in the laboratory.
B4	Manage, process and interpret the data and information obtained both in the field and in the laboratory.
B5	Develop, implement and write basic or applied projects in oceanography from a multidisciplinary perspective.
C4	Know, analyze and interpret the physical properties of the ocean according to current theories, as well as to know the most relevant sampling tools and techniques.
C8	Know the main pollutants, their causes and effects in the marine and coastal environment.
D1	Develop the search, analysis and synthesis of information skills oriented to the identification and resolution of problems.
D2	Acquire the ability to learn autonomously, continuously and collaboratively, organizing and planning tasks over time.

Expected results from this subject

Expected results from this subject	Training and Learning Results			
Know you physical principles gives Teledetection in applications of the field of the Oceanography	A2	B1	C4	D1
	A3	B2	C8	D2
Learn to use tools of treatment of Images in marine applications.	A4	B3		
		B4		
		B5		

Contents

Topic	
1.-INTRODUCTION To THE Objective	1.1.- Teledetection in Oceanography 1.2.- Brief history of the space observation of the oceans
TELEDETECTION	1.3.- Possibilities for the oceanography 1.4.- Temporary and space scales of the phenomena of interest.
Pretend with this first subject enter to the student in the world of the teledetection and the paper that this plays in the modern oceanography.	

2.- BASES OF THE Objective

Contents

TELEDETECTION

In this unit give the bases of the teledetection oceanográfica, interaction with the atmosphere, the covers and the oceans. The colour, temperature and roughness of the masses of water and his measurable properties from satellite or dron. Like designing a project of teledetection.

- 2.1.- Field and electromagnetic spectrum.Applications
- 2.2.- Terms and units of measure.
- 2.3.- Characteristic spectral of the covers.
- 2.4.- Interaction of the atmosphere with the radiation.
 - Absorption.
 - Dispersion.
 - Broadcast.
- 2.5. Measurable parameters

3.- ELEMENTS OF A SYSTEM OF Objective

TELEDETECTION:

In this unit enters to the student in the characteristics that define to a sensor and space platform and airlifted, as well as the use of drones.

They will study the steps required from the capture of an image by a sensor until his application and utilisation by part of an user.

4.- ANALYSIS And DIGITAL TREATMENT OF Objective

IMAGES:

it will study the fotointerpretación and the creation of ortofotos and lifting 3D using drones. In this unit will study from zero the use of digital treatment of images. Finally it will enter to the student in the digital classification and the integration of information in systems of geographic information.

5. APPLICATIONS

will make practices with the information purchased:

- It practices of flight of dron, creation of ortofoto and mapping 3D
- Practises of improvement of contrast and creation of a palette of colours
- Practises of study of currents and *Eddies superficial marine with images of temperature
- Practises of spill of petroleum and detection with *SAR, colour and temperature
- Creation of barometric map from satellite images.
- You practise of polar thaw, detection of waters of mouth in estuaries, studies of choral, etc..
- It practises of classification supervised and unsupervised in the mouth of the Valmiñor

Contents:

- 3.1. System of reception of images
- Elements of the system
- Platform and sensor
- Orbits
- Resolution of a sensor
- Types of sensors
- Platforms satelitales and airlifted.
- Aerial photography and drones

Contents:

- 4.1. *Fotointerpretación And Ortofotos
- 4.2. Visual analysis
 - Criteria of visual Interpretation
- 4.3. Digital treatment
 - Digital Image
 - Corrections
 - Enhance
 - Transformations

Aims:

In this last unit, enumerate the applications of the teledetection in meteorology and oceanic studies. For each one of these applications, offers a description of the physical principles that make them possible, as well as the interpretation of the results obtained and the sensors used.

Planning

	Class hours	Hours outside the classroom	Total hours
Practices through ICT	20	10	30
Seminars	7	15	22
Lecturing	15	40	55
Mentored work	4	10	14
Problem and/or exercise solving	1.7	5	6.7
Presentation	0.3	10	10.3
Objective questions exam	2	10	12

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

Methodologies

	Description
Practices through ICT	The methodology that uses in the practical is the one of study directed.
Seminars	It will make a follow-up *individualizado of technicians and contents for the development of the works scheduled . His main aim is to clear the concepts that have been explained in the class of theory or resolve any of the problems of the practical classes.
Lecturing	The lesson *magistral is the method mainly employee, using in the measure of the possible the lesson had a conversation.
Mentored work	The/The student, of individual way or in group, elaborates a document on the thematic of the matter or prepares seminars, investigations, memories, essays, summaries of readings, conferences, etc.

Personalized assistance

Methodologies	Description
Lecturing	The lesson *magistral is the method mainly employee, using in the measure of the possible the lesson had a conversation. The student that wish it will be able to attend to *tutorías personalised to resolve doubts, mainly in the schedules that indicate . To optimise the time, is necessary that the student contact with the professor with *antelación sufficient
Practices through ICT	The methodology that uses in the practical is the one of study directed.
Seminars	It will make a follow-up *individualizado of technicians and contents for the development of the works scheduled . His main aim is to clear the concepts that have been explained in the class of theory or resolve any of the problems of the practical classes.
Mentored work	It will be evaluated the work by means of an oral presentation, a theoretical work and a specific practice

Assessment

	Description	Qualification	Training and Learning Results			
Practices through ICT	The methodology that uses in the practical is the one of study directed. They are of compulsory assistance.	15	A2 A3 A4	B2 B3 B4	C4	D2
Seminars	It will make a individualized follow-up of technicians and contents for the development of the works scheduled. The seminars are of compulsory assistance.	10	A2 A3 A4	B3 B4	C4	D1 D2
Lecturing	The Master lesson is the method mainly employee, using in the measure of the possible the lesson had a conversation. Some activities will be of compulsory assistance. The students will receive previous notifications for this assistance through MOOVI.	5	A2 A4	B1 B3	C4 C8	D1 D2
Mentored work	The student, of individual way or in group, elaborates a document on the thematic of the matter or prepares seminars, investigations, memories, essays, summaries of readings, conferences, etc. This work and his presentation can be substituted by a theoretical and practical proof in assessment of the professor.	30	A2 A3 A4	B2 B3 B4	C4	D1 D2
Problem and/or exercise solving	The problems are related with the capacity of the student purchased in the practices and the theory. They are of compulsory character.	30	A2 A3 A4	B2 B3 B4	C4	D1
Presentation	Exhibition by part of the students in front of the educational and/or a group of students of a subject on contents of the matter or of the results of a work, exercise, project... Can carry out of individual way or in group.	10	A2 A3 A4	B1 B4 B5	C4	D1

Other comments on the Evaluation

Continuous evaluation:

The realisation of works (30%) and his exhibition (10%) can be substituted by a theoretical and practical examination with the great percentage *d 40% of the final note. This option will be valued by the professor to surpass the subject. Some masterclasses will have *caracter *obligatorio given the practical content of the same. This will notify with sufficient *antelación through the web *Moovi to the students enrolled.

The date, hour and place of realisation of the proofs of evaluation, as well as the compulsory activities will be published in the web of *moovi of the subject.

Global evaluation and Extraordinary Announcement:

The application for this option of evaluation will have to present in the time and form that determine the Centre, that will be published prior to the academic start.

Given the experimental character of the activities, the assistance to the same is compulsory to be able to opt to this option of evaluation.

The no assistance to practices, classes *obligatorias and seminars, without cause justified invalidates this possibility, as well as the opportunity of extraordinary evaluation (2ª opportunity).

So much the practices like the seminars, work *tutelado and the final evaluation have to have approved with 40% of the partial note of each one. In case of suspense the second opportunity (extraordinary announcement) will make with an examination of objective questions and an examination of problems with the percentage adds of the no surpassed proofs.

Other considerations

Requires of the students that *course this matter a responsible and honest behaviour. It considers inadmissible any form of fraud (copy or plagiarism) directed to *falsear the level of knowledges and skills reached in all type of proof, report or work. The fraudulent behaviours will be able to suppose suspend the subject during a complete course. It will carry an internal register of these performances so that, in case of *reincidencia, request the opening to the rectorship of a disciplinary file

Sources of information

Basic Bibliography

Oceanografía y Satélites, Tebar, 2009

CRACKNELL, A.P. u HAYES, L.W.B., **Introduction to Remote Sensing**, Taylor & Francis, 1991

Complementary Bibliography

Recommendations

Subjects that are recommended to be taken simultaneously

Geographic analysis methods/V10G061V01409

Other comments

The date, hour and place of realisation of the proofs of evaluation, will be published in the official web of the Faculty of Sciences of the Sea:

<http://mar.uvigo.es/alumnado/examenes/>

IDENTIFYING DATA				
Internships				
Subject	Internships			
Code	V10G061V01981			
Study programme	Grado en Ciencias del Mar			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Optional	4th	2nd
Teaching language	#EnglishFriendly Spanish			
Department				
Coordinator	Sánchez Fernández, José María			
Lecturers	Sánchez Fernández, José María			
E-mail	jmsbot@uvigo.es			
Web				
General description	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.			
The external academic practices constitute an activity of formative nature realised by the university students and supervised by the Universities, whose aim is to allow to the same reinforce and complement the knowledges obtained ein his academic training, favouring the acquisition of capacities in view to prepare them for the exercise of professional activities (BOE 297, 10 December 2010).				

Training and Learning Results	
Code	
A1	Students have demonstrated knowledge and understanding in a field of study that builds upon their general secondary education, and is typically at a level that, whilst supported by advanced textbooks, includes some aspects that will be informed by knowledge of the forefront of their field of study
A2	Students can apply their knowledge and understanding in a manner that indicates a professional approach to their work or vocation, and have competences typically demonstrated through devising and sustaining arguments and solving problems within their field of study
A3	Students have the ability to gather and interpret relevant data (usually within their field of study) to inform judgments that include reflection on relevant social, scientific or ethical issues
A4	Students can communicate information, ideas, problems and solutions to both specialist and non-specialist audiences
A5	Students have developed those learning skills that are necessary for them to continue to undertake further study with a high degree of autonomy
B1	Know and use vocabulary, concepts, principles and theories related to oceanography and apply everything learned in a professional and/or research environment.
B2	Plan and execute surveys in the field and laboratory work, applying basic tools and techniques for sampling, data acquisition and analysis in the water column, sea bottom and marine substratum.
B3	Recognize and implement good practices in measurement and experimentation, and work responsibly and safely both in field surveys and in the laboratory.
B4	Manage, process and interpret the data and information obtained both in the field and in the laboratory.
B5	Develop, implement and write basic or applied projects in oceanography from a multidisciplinary perspective.
C7	Apply to the marine and coastal environment the principles and methods used in Chemistry.
C8	Know the main pollutants, their causes and effects in the marine and coastal environment.
C9	Acquire basic knowledge about the structural and functional organization and the evolution of marine organisms.
C13	Acquire the basic sedimentological, geochemical and geophysical techniques and methodologies used in identification, use and sustainability of the natural resources of coastal and marine environments.
D1	Develop the search, analysis and synthesis of information skills oriented to the identification and resolution of problems.
D2	Acquire the ability to learn autonomously, continuously and collaboratively, organizing and planning tasks over time.
D3	Understanding the meaning and application of the gender perspective in different fields of knowledge and in professional practice with the aim of achieving a more just and equal society.
D4	Ability to communicate orally and in writing in Galician language.
D5	Sustainability and environmental commitment. Equitable, responsible and efficient use of resources.

Expected results from this subject	
Expected results from this subject	Training and Learning Results

The practices are diverse and depending on the company where they are carried out, one or another competence will be achieved.

A1	B1	C7	D1
A2	B2	C8	D2
A3	B3	C9	D3
A4	B4	C13	D4
A5	B5		D5

Contents

Topic

The contents of the external academic practices have to obtain the following objectives:	a) Contribute to the integral training of the students complementing his theoretical and practical learning. b) Facilitate the knowledge of the methodology of work adapted to the professional reality in that the students will have to operate, contrasting and applying the knowledges obtained. c) Stimulate the development of technical capacities, methodological, personal and participatory. d) Obtain a practical experience that facilitate the insertion in the market of work and improve his future employability. e) Favour the values of the innovation, the creativity and the ventures.
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Planning

	Class hours	Hours outside the classroom	Total hours
Practicum, External practices and clinical practices	0	135	135
Portfolio/dossier	0	15	15

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

Methodologies

	Description
Practicum, External practices and clinical practices	The training project that defines each external academic internship must establish the educational objectives and the activities to be carried out. The objectives will be established considering the learning results that the student must achieve.
Portfolio/dossier	The student will prepare a practical report following the model available on the website of the Faculty of Marine Sciences

Personalized assistance

Methodologies	Description
Practicum, External practices and clinical practices	The student will have a tutor at the company where they will do their internship and an academic tutor at the Faculty of Marine Sciences. The company tutor will guide the student through the tasks to be performed during the internship.

Assessment

	Description	Qualification	Training and Learning Results																				
Practicum, External practices and clinical practices	The tutor from the collaborating entity will prepare and submit a final report to the academic tutor of the Faculty of Marine Sciences at the conclusion of the internship. This report will include the number of hours completed by the student and will assess the various aspects related to the learning outcomes planned for the corresponding training project.	100	<table> <tr><td>A1</td><td>B1</td><td>C7</td><td>D1</td></tr> <tr><td>A2</td><td>B2</td><td>C8</td><td>D2</td></tr> <tr><td>A3</td><td>B3</td><td>C9</td><td>D3</td></tr> <tr><td>A4</td><td>B4</td><td>C13</td><td>D4</td></tr> <tr><td>A5</td><td>B5</td><td></td><td>D5</td></tr> </table>	A1	B1	C7	D1	A2	B2	C8	D2	A3	B3	C9	D3	A4	B4	C13	D4	A5	B5		D5
A1	B1	C7	D1																				
A2	B2	C8	D2																				
A3	B3	C9	D3																				
A4	B4	C13	D4																				
A5	B5		D5																				
	The student will prepare and submit a final report to the academic tutor of the University following the template available on the Faculty of Marine Sciences website.																						
	The academic tutor of the Faculty will evaluate the internship, based on the reports from the student and the company tutor, completing the corresponding evaluation report with the final grade.																						

Other comments on the Evaluation

The entire procedure can be found in Official State Gazette (BOE) No. 184, dated July 30, 2014 (BOE-A-2014-8138), the regulations for external internships at the University of Vigo and the Faculty of Sciences. Students taking this course are required to behave responsibly and honestly. Any form of fraud (copying or plagiarism) aimed at falsifying the level of knowledge and skills achieved in any type of test, report, or assignment is considered unacceptable. Fraudulent conduct may result in failing the course for an entire academic year. An internal record of these actions will be kept so that, in the

event of a repeat offense, a disciplinary procedure may be requested from the Rector's Office.

The final grading will take into account all reports (tutors and student)

Sources of information**Basic Bibliography****Complementary Bibliography**

Recommendations

IDENTIFYING DATA				
Final Year Dissertation				
Subject	Final Year Dissertation			
Code	V10G061V01991			
Study programme	Grado en Ciencias del Mar			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	12	Mandatory	4th	2nd
Teaching language	#EnglishFriendly #PortuguêsAmigável Spanish Galician English			
Department				
Coordinator	Méndez Martínez, Gonzalo Benito			
Lecturers	Méndez Martínez, Gonzalo Benito			
E-mail	mendez@uvigo.es			
Web	http://webs.uvigo.es/facultadeccdomar/index.php/es/trabajo-fin-de-grado			
General description	The final degree project is a matter inside the plan of studies of the Degree of Marine Sciences. It is a personal work that each student will prepare in an autonomous form under the tutor's supervision and has to allow him to show of form integrated the acquisition of formative contents and the competitions associated with the title of Marine Sciences. 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	
A1	Students have demonstrated knowledge and understanding in a field of study that builds upon their general secondary education, and is typically at a level that, whilst supported by advanced textbooks, includes some aspects that will be informed by knowledge of the forefront of their field of study
A2	Students can apply their knowledge and understanding in a manner that indicates a professional approach to their work or vocation, and have competences typically demonstrated through devising and sustaining arguments and solving problems within their field of study
A3	Students have the ability to gather and interpret relevant data (usually within their field of study) to inform judgments that include reflection on relevant social, scientific or ethical issues
A4	Students can communicate information, ideas, problems and solutions to both specialist and non-specialist audiences
A5	Students have developed those learning skills that are necessary for them to continue to undertake further study with a high degree of autonomy
B1	Know and use vocabulary, concepts, principles and theories related to oceanography and apply everything learned in a professional and/or research environment.
B2	Plan and execute surveys in the field and laboratory work, applying basic tools and techniques for sampling, data acquisition and analysis in the water column, sea bottom and marine substratum.
B3	Recognize and implement good practices in measurement and experimentation, and work responsibly and safely both in field surveys and in the laboratory.
B4	Manage, process and interpret the data and information obtained both in the field and in the laboratory.
B5	Develop, implement and write basic or applied projects in oceanography from a multidisciplinary perspective.
C1	know at a general level the fundamental principles of sciences: Mathematics, Physics, Chemistry, Biology and Geology.
C2	Acquire basic knowledge of mathematics (differential and integral calculation) and statistics.
C3	Describe how works the global ocean circulation, its forcings and its climate implications.
C4	Know, analyze and interpret the physical properties of the ocean according to current theories, as well as to know the most relevant sampling tools and techniques.
C5	Formulate the mass, energy and moment conservation equations for geophysical fluids and solve them in basic oceanic processes.
C6	Acquire the fundamentals and terminology of chemical processes.
C7	Apply to the marine and coastal environment the principles and methods used in Chemistry.
C8	Know the main pollutants, their causes and effects in the marine and coastal environment.
C9	Acquire basic knowledge about the structural and functional organization and the evolution of marine organisms.
C10	Know the biological diversity and functioning of marine ecosystems.
C11	Apply the knowledge and techniques acquired to the characterization and sustainable use of living resources and marine ecosystems.
C12	Acquire knowledge about processes and products related to internal and external geological cycles.
C13	Acquire the basic sedimentological, geochemical and geophysical techniques and methodologies used in identification, use and sustainability of the natural resources of coastal and marine environments.
C14	Know basic concepts and events of global change obtained from geological records.

D1	Develop the search, analysis and synthesis of information skills oriented to the identification and resolution of problems.
D2	Acquire the ability to learn autonomously, continuously and collaboratively, organizing and planning tasks over time.
D3	Understanding the meaning and application of the gender perspective in different fields of knowledge and in professional practice with the aim of achieving a more just and equal society.
D4	Ability to communicate orally and in writing in Galician language.
D5	Sustainability and environmental commitment. Equitable, responsible and efficient use of resources.

Expected results from this subject

Expected results from this subject	Training and Learning Results			
Application of the knowledge acquired throughout the Degree.	A1 A2 A3 A4 A5	B1 B2 B3 B4 B5	C1	D1 D2 D5
Application of the principles of the scientific method in work practices.	A1 A2 A3 A4 A5	B1 B2 B3 B4 B5	C1	D1 D2 D3 D4 D5
Use of information technologies to carry out bibliographic searches on a work topic.	A1 A2 A3 A4 A5	B1 B2 B3 B4 B5	C1 C2 C3 C4 C5 C6 C7 C8 C9 C10 C11 C12 C13 C14	D1 D2 D3 D4 D5
Work planning adapting to previously stipulated conditions and deadlines.	A2 A5	B2 B5		D1 D2
To work autonomously following procedures described in the bibliography or previously agreed with the supervisor.	A5	B2 B3 B4 B5		D1 D2 D3 D5
Interpretation of the results achieved.	A1 A2 A3 A4 A5	B1 B2 B3 B4 B5		D1 D2
To write a report about the work carried out and following the indicated guidelines.	A1 A2 A3 A4 A5	B1 B2 B3 B4 B5	C1	D1 D2 D3 D4 D5
Oral dissertation about the obtained results.	A1 A2 A3 A4 A5	B1 B2 B3 B4 B5		D1 D2 D3 D4 D5

Contents

Topic

Given its special nature, the subject does not have its own content, it will depend on the subject assigned to the student, who may choose any of the lines contained in the Faculty's TFG offer.

It has to have in consideration the rules of final degree projects of the Faculty, published in the web page, whereby assign the different kind of projects and the respective supervisors.

The works can be done and defended in Spanish, Galician and English. Both the language of performance and the language of presentation will be recorded in the individual record of each student.

The following aspects will be considered:

- The structure of the TFG
- The writing of the TFG
- Inclusion of citations and how to cite
- The defense of the TFG
- Preparation of the presentation
- Formalization of the defense document

Planning

	Class hours	Hours outside the classroom	Total hours
Presentation	1	10	11
Lecturing	2	2	4
Mentored work	0	282	282
Essay	2	1	3

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

Methodologies

	Description
Presentation	The TFG must be defended in front of a tribunal formed by three professors of the degree, in the terms established in the regulations of the Faculty. http://mar.uvigo.es/index.php/es/alumnado-actual/trabajo-fin-de-grado
Lecturing	Two hours of class are reserved, where the coordinator of the subject of Final Degree Work will present the keys for the elaboration and defense of the TFG.
Mentored work	As a final result, a report adjusted to the conditions established in the regulations of the Faculty will be presented. http://mar.uvigo.es/index.php/es/alumnado-actual/trabajo-fin-de-grado

Personalized assistance

Methodologies Description

Mentored work	It will correspond to the tutor assigned for each final degree project supervise the student in the development of the work chosen. Students must attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated. To better optimize the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation
Lecturing	The professor coordinator of the subject will be the responsible of the master sessions, in which will be able to give some advice to the students in reference to the structure, editorial, inclusion of references and how to obtain the final document for the defence in the special software application for this subject. Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated. To better optimize the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation.

Assessment

Description	Qualification	Training and Learning Results			
Essay	100	A1	B1	C1	D1
Evaluation by part of the tutor of the competitions developed by the student in the work and in the editorial of the final memory. Value: 30%		A2	B2		D2
Evaluation of the written memory and oral presentation by the tribunal. Value: 70%		A3	B3		D3
		A4	B4		D4
		A5	B5		D5
In the rule of final degree project of the Faculty you can find in detail all the procedure that has to adopt the student and his tutor, both for the written part and for the evaluation.					

Other comments on the Evaluation

The final degree project is governed by the rule approved in the Marine Science Faculty, which is published in the web page of the centre (<http://mar.uvigo.es/alumnado/trabajo-fin-de-grado/>).

The Academic Commission of the final degree project, prior to the start of the work, will make public the criteria of evaluation that will use so much the tutor to issue his report like the court to evaluate the memory of the work and his defence.

They will make public in the web page all the terms that reach the presentation of the memories, the defences and the presentation of the reports by the tutors. These terms will be approved by the Academic Commission of the final degree project. In case that the student surpass the evaluation of the Tutor and do not surpass the court of evaluation will issue a justificative report. Once attended the recommendations of the report, said student will be able to go back to present the final degree project in the following period of evaluation.

Students are strongly requested to fulfil a honest and responsible behaviour. It is considered completely unacceptable any alteration or fraud (i.e., copy or plagiarism) contributing to modify the level of knowledge and abilities acquired in exams, evaluations, reports or any kind of teacher's proposed work. Fraudulent behaviour may cause failing the course for a whole academic year. An internal dossier of these activities will be built and, when reoffending, the university rectorate will be asked to open a disciplinary record

Sources of information

Basic Bibliography

Warburton, Nigel, **Pensar de la A a la Z : una ayuda para argumentar bien y pensar de forma crítica**, 9788416572380, 1ª, Gedisa, 2016

Cierlica, Paulina, **Cómo hacer tu trabajo de fin de grado : guía paso a paso para escribir tu TFG con éxito**, 9788409052967, Amazon, 2018

Romero Oliva, Manuel Francisco, **Escribir en la universidad : elaboración y defensa de trabajos académicos - TFG/TFM-**, 978-3-631-81174-0, Peter Lang, 2020

Complementary Bibliography

Warburton, Nigel, **Cómo aprender a escribir**, 978-84-493-2680-6, 1ª, Paidós, 2012

Juárez Calvillo, María, **Escribir en la universidad.: Elaboración y defensa de trabajos académicos- TFG/TFM**, ISSN: 2171-9624, Openly Available Collection - DOAJ, 2021

Recommendations

Other comments

How in all the subjects, the personal effort is essential, as well as attend to the instructions of the *titor and deliver the report in the *decanato inside the terms established pole Academic Committee of TFG.

It recommends to read with attention the rules related with the manufacture and defence of the TFG of the Centre and all the documentation related that can find in

#http://mar.uvigo.es/*index.*php/You are/students-current/*trabajo-end-of-degree

Recommends to follow the course "How face your TFG" that offers the Library.