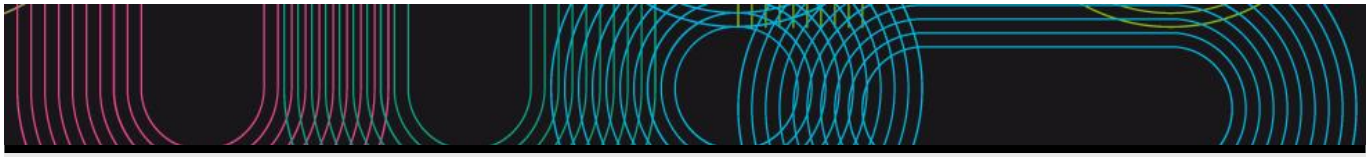

(*)Facultade de Ciencias do Mar

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 contamination	1st	6
V10G061V01402	Ocean Dynamics	1st	6
V10G061V01403	Applied marine geology	1st	6
V10G061V01404	Marine and coastal management	1st	6
V10G061V01405	Fisheries	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	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 herditary 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		
CELL BIOLOGY	B5		
4. Recognize the diversity and organisation of cells and tissues			
5. Establish relations between cell compartments and cell functions			
6. Differentiate clearly vegetal and animal cell organisation			
7. Establish relationships between cell organisation and cell function			
8. Recognize the types of microscopes associated to the study of cells and tissues.			
9. Morphological identification of the cells and their components.			
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 structurer, 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. General organisation of the eukaryotic cell	Cell evolution. Endosimbiosis: Evolutionary importance. Similarities and differences of animal and plant cells. Cell membranes: composition. Functional properties. Plasma membrane and cell surface. Cell junctions and cell adhession. Cell communication. Cytoplasm and cell organelles (I): Endoplasmic reticulum, Golgi and lysosomes. Vesicular traffic (II): peroxysomes, mitochondria and cloroplasts. Cytoeskeleron and cell movement. The nucleus: chromatin and chromosomes. The nucleolus.
Cell biology, 2nd part. Bases of embryonic development	Cell cycle: interphase and M phase. Apoptosis. Gametogenesis. Fertilization and development of the zyigote. Cell specialization.
Cell biology, 3rd part. Tissues	Animal tissues. Epithelium: General organisation and function. Conjunctive tissue and derivatives. General organisation. Specialized conjunctive tissues : general characteristics of cartilage, bone and blood. Muscular tissue. Nervous tissue.
Genetics	DNA estructure, organisation, replication, alterations and expression. Mendelian heredity and its variations Liinkage 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 exercices 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 %) questionaries.	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 questionaries along the course (60 %: Cell Biology 30 %, Genetics 30 %). This mark wil be kept for the second oportunity

b) The mark obtained in the first or second oportunity 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 explicity 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 theofficial 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 tofulfil a honest and responsible behaviour. It is considered completelyunacceptable any alteration or fraud (i.e., copy or plagiarism)contributing to modify the level of knowledge and abilities acquired inexams, evaluations, reports or any kind of teacher□s proposed work.Fraudulent behaviour may cause failing the course for a whole academicyear. An internal dossier of these activities will be built and, whenreoffending, the university rectorate will be asked to open adisciplinary 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

Brown TA, **Genomes 4**, 4ª ed, Garland Science, 2017

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 sylabus. 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, comprending, 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	Mato Corzón, Marta María Souto Torres, Carlos Alberto Varela Benvenuto, Ramiro Alberto			
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 enviroment and the development of models related with it. Furthermore, it is important to understand the fundamental physic 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	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 demostration 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).

Seminars: In the case of GLOBAL assessment, the 30% corresponding to this methodology will be included in the final test.
Extraordinary oportunity (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 Sciencies 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
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
S. Burbano de Ercilla, E. Burbano y C. Gracia, **Problemas de Física**, Ed. Tébar, 2006

Complementary Bibliography

Recommendations

Subjects that continue the syllabus

Physics: Physics II/V10G061V01203

Subjects that are recommended to be taken simultaneously

Statistics/V10G061V01107
Mathematics: Mathematics I/V10G061V01104

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	Alejo Flores, Irene Diz Ferreiro, Paula Francés Pedraz, Guillermo García Gil, María Soledad Nombela Castaño, Miguel Angel Pérez Arlucea, Marta María			
E-mail	mnombela@uvigo.es			
Web	http://webs.uvigo.es/c10/webc10/ficha.php?id=6			
General description	The Geology I (Internal Geology) pretends that the student purchase in the first *cuatrimestre of the 1*er course of the Degree of Sciences of the Sea, the knowledges on the appearances related with the structure and internal composition of the Earth, as well as of the internal processes, with an approach from the field of the Tectonics of Plates and the Marine Geology. 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
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	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 interpreteison of geological maps.	A2	B1 B4		D1 D5
6. Identify the main minerals and igneous metamorphic and 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 (Geological Processes Interns)	The **subtemas correspond with the subjects.

Subject 1. Introduction: Origin of the Earth, Principles of the Geology and the Geological Time	The **subtemas correspond with the subjects.
Subject 2. Structure of the Earth and his materials: minerals and rocks	The **subtemas correspond with the subjects.
Subject 3. Units of the Terrestrial Relief-Oceanic Bottoms: types and origin of margins.	The **subtemas correspond with the subjects.
Subject 4. Crust deformation: fragile and ductile	The **subtemas correspond with the subjects.
Subject 5. Plate Tectonics: introduction and mechanisms	The **subtemas correspond with the subjects.
Subject 6. Metamorphism, metasomatism, metamorphic rocks and Plate Tectonic.	The **subtemas correspond with the subjects.
Subject 7. Magmatism, Ígneous rocks and Plate Tectonic.	The **subtemas correspond with the subjects.
Subject 8. Vulcanism and Plate Tectonic.	The **subtemas correspond with the subjects.
Subject 9. Seismicity and Plate Tectonic.	The **subtemas correspond with the subjects.
Subject 10. Synthesis: economic and environmental of the Inner Geological system.	The **subtemas correspond with the subjects

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 student will be presented with the way in which the classes will be taught, the form of evaluation, the field trips, the practical classes and the seminars. 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	You will learn to deal with topographic and geological 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.
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.	5	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.	15	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.) 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 3.5/10. In order to take the exam, attendance at theoretical classes must be at least 50%	40	A1	B1 B4	C12	D5

Other comments on the Evaluation

The course evaluation system will be continuous evaluation, in which the following items will be valued: class attendance (5%); seminars (15%); laboratory practices (30%); leaving studies (10%); exam (40%).

Given the experimental nature of the subject, it is considered that attendance at at least 80% of the practices, seminars and study trips is mandatory to acquire the learning results of the subject, whatever the opportunity (ordinary and extraordinary) and/or the system of study. assessment (continuous or global). Therefore, if said assistance is not met, the subject cannot be passed.

In order to average the exam grade, the minimum grade in Problem Solving and/or Exercises; Laboratory practices; and Internship Report, Practicum and External Practices must be 5/10. In the same way, to be able to add the rest of the tests, in the exam you have to have at least a 3.5/10.

Students who have not passed the subject in the 22/23 academic year will not be obliged to repeat, during the 23/24 academic year, the laboratory practices, seminars and study trips, keeping the grade.

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

For communications with teachers, the use of the "messaging" of the MooVi platform is recommended, in addition to the use

of the institutional email account (@alumnos.uvigo.es)

The students of the University Program for the Elderly of the University of Vigo who choose this subject within the Integration cycle in order to pass it will have to attend at least 80% of the master sessions as well as at least 80% of the rest of the methodologies employed (seminars, laboratory practices and field practices). On the other hand, the degree of integration with the students of the degree will be valued.

During classes, the use of mobile phones will not be allowed except for activities exclusively related to the subject.

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/

S*tudents 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

Leeder, M.R., Pérez Arlucea, M., **Physical processes in Earth and Environmental Sciences**, Blackwell Publishing, 321 pp,

Tarbuck, E.J., Lutgens, F.K., **Ciencias de la Tierra. Una introducción a la Geología Física**, 10th Edition. Prentice Hall. Madrid. 710 pp.,

Tarbuck, E.J., Lutgens, F.K., **Ciencias de la Tierra. Una introducción a la Geología Física**, 10th Edition 2013,

Frisch, W., Meschede, M. & Blakey, R.C., **Plate Tectonics: continental drift and mountain bulding.**, Springer Science & Business Media, 2010

Complementary Bibliography

Anguita, F., Moreno, F., **Procesos Geológicos Internos.**, Editorial Rueda.,232 pp,

Azañón, J.M., Azor, A., Alonso, F.M., Orozco, M., **Geología Física.**, Paraninfo & Thomson Learning, 302 pp,

Davies, G. H., Reynolds, S.J., **Structural Geology, of rocks and regions**, 3rd Edition. John Willey and Sons, Inc, New York, 776 pp,

Kearey, P., Vine, F., **Global Tectonics**, 3rd Edition. Blackwell Science, 333 pp,

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

Wicander, R., Monroe, J.S., **Historical Geology. Evolution of Earth and Life Through Time**, 7th Edition. Edit.Brooks/Cole, 580 pp,

Recommendations

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	García Cutrín, Francisco Javier Alonso Álvarez, José Nicanor			
Lecturers	Alonso Álvarez, José Nicanor García Cutrín, Francisco Javier			
E-mail	jnalonso@uvigo.es fjgarcia@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		
Handle with ease techniques for calculating eigenvalues of a square matrix and determining the sign of a quadratic form. Solve problems in which it is necessary to apply the techniques above.	A1 A2 A3 A4 A5	C1 C2	D1 D2 D3 D4 D5

Understand some basic concepts of differential calculus: partial derivatives, continuously differentiable function, chain rule, implicitly defined function, extreme/optimal of scalar functions.	A1 A2 A3 A4 A5	C1 C2	D1 D2 D3 D4 D5
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 A2 A3 A4 A5	C1 C2	D1 D2 D3 D4 D5
To know the primitives of elementary functions and the main techniques to calculate these. Understand the mechanics of calculating double integrals.	A1 A2 A3 A4 A5	C1 C2	D1 D2 D3 D4 D5
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 A2 A3 A4 A5	C1 C2	D1 D2 D3 D4 D5
Use a symbolic calculation computer program to solve problems related to the subject.	A1 A2 A3 A4 A5		D1 D2 D3 D4 D5

Contents

Topic	
Matrix calculus	Operations with vectors in the plane and in space. The vector space Rn. Matrices and determinants. Basic operations with matrices and determinants. Discussion and resolution of systems of linear equations.
Differential calculus	Introduction to the functions of several variables. Differentiable functions. Chain rule. Implicit derivation. 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 appropiate 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 20 percent of the grade.	60	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.	5	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 35 percent of the final grade.	35	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 subjet 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 assesment will mantein 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., **Un mar de matemáticas**, 2016

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

Besada, M.; García, J.; Mirás, M. e Vázquez, C., **Cálculo diferencial en varias variables**, Garceta, 2011

Besada, M.; García, J.; Mirás, M.; Quinteiro, C. e Vázquez, C., **Matemáticas para Química**, 2008

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	Estévez Guiance, Laura			
Lecturers	Alonso Gómez, José Lorenzo Hermida Ramón, José Manuel Losada Barreiro, Sonia Pérez Lorenzo, Moisés			
E-mail	lestevez@uvigo.es			
Web				
General description	The subjet Chemical I enters the students of first course of the Degree in Marine Sciences in the basic concepts of the intermolecular interactions, the chemical thermodynamics, the chemical equilibria, the chemical kinetics and a introduction to the chemical reactivity and to the 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
- Achieve the basic rules of laboratory working, as well as the risks associated to handle dangerous chemical substances.	A5	B3 B4	C6	D1 D2
- Calculation of concentrations of solutions.	A1 A5			
- Identify chemical reactions of interest in the marine medium.	A1 A5			
- To predict the properties of substances in function of the present intermolecular forces.	A1 A5			
- Definition of concepts such entalphy, standard entalphy, calorimetry, heat of dissolution and heat of reaction, and their calculation.	A1 A5			
- Know how to use the expressions of the chemical balances to calculate the distribution of the substances involved in them. Know the factors that affect the balance and use the Le Chatelier principle.	A1 A5			
- Definition of pH and pOH, acidity/basicity constant, constants, hidrólisis constnt, and their calculatión.	A1 A5			
- Learn about buffer solutions and the different types of acid-base reactions and know how to use them.	A1 A5			

- Definition of concepts such solubility and product of solubility, and know as if they calculate.	A1 A5
- To know what a oxidation-reduction process is, to define REDOX potential, standard potentials, and to know how they are calculated.	A1 A5
- Understand the principles of operation of an electrochemical cell and predict the products of a electrochemical.	A1 A5
- To define reaction rate and rate equation, and know how to use.	A1 A5
- Learn and know how to use the main methods of analysis of kinetic data.	A1 A5
- To calculate the effect of the temperature in the reaction rate.	A1 A5
- To know the general characteristics of catalysis and their types.	A1 A5
- Differentiate between chemically-controlled reactions and diffusion-controlled reactions.	A1 A5
- Know the functional groups describing the structure of the organic molecules and their reactivity.	A1 A5

Contents

Topic	
Thermochemistry	Internal energy. Heat, work and first principle of thermodynamics. Enthalpy, standard enthalpy. Measure of heats of reaction: Calorimetry. Entropy and Gibbs energ.
Chemical Equilibrium in Gas Systems	Chemical equilibrium. Equilibrium constant. Temperature dependence of equilibrium constant. Altering equilibrium: Le Châtelier principle.
Acid- Base Equilibrium	Theories of acids and bases. Scale of pH. Strong and weak acids and bases. Acid-base Equilibrium. Reactions of hydrolisys. Buffer solutions. Acid-Base reactions. Acid-Base titrations.
Solubility Equilibrium	Solubility and solubility product constant. Altering solubility equilibrium: Common-ion effect. Equilibria involving complex ions.
Redox Processes	Adjustment of redox equations. Redox Equilibrium. Thermodynamics of redox reactions: The Nernst equation. Standard electrode potentials. Galvanic cells. Electrolytic cells
Chemical Kinetics	Reaction rate. Rate equation. Analysis of kinetic data. The effect of the temperature on reaction rates. Catalysis.
Intermolecular Forces	Molecular geometry and polarity. Types of intermolecular forces: Electrostatic forces, inductive forces, dispersion forces, hydrogen bonding. Some properties of liquids.
Introduction to Organic Chemistry	Functional groups. Structure and reactivity. Basic stereochemistry: chirality and configurational stereochemistry.
Laboratory Practices	Application of the experimental techniques related to the subjet. Implementation in the laboratory of the knowledge acquired in themes of thermochemistry, chemical equilibrium and chemical kinetics.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	26	0	26
Seminars	14	20	34
Laboratory practical	12	12	24
Essay questions exam	0	18	18
Objective questions exam	0	10	10
Essay questions exam	0	38	38

*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 exposition of the fundamental aspects of each topic by the teacher, based on the material available on the e-learning platform. In addition to the exposition of topics, numerical problems will also be formulated to help to understand and establish the concepts.

Seminars	The seminar classes will be devoted primarily to problem solving and, when necessary, to delve into the aspects of the topics that present greater difficulties to the students. In the seminar sessions, the teacher may propose problems or exercises that the students must solve individually and submit to the teacher for evaluation. Attendance will be positively valued.
Laboratory practical	Performance, under the supervision of the teacher but autonomously, of laboratory practices related to the subject. The practices will be carried out in pairs. Before starting, the students will have, in the corresponding platform, the scripts of the practices. The script will present the essential elements to carry out the practice at experimental level, as well as the basic points of its theoretical basis and data processing. At the end of the practicals, an evaluation will be carried out by means of a written test, delivery of a report and/or oral test according to the teacher's criteria. Attendance to the practical sessions IS MANDATORY.

Personalized assistance

Methodologies	Description
Lecturing	Those doubts/questions of the students that may arise along the course concerning the classes of theory will be solved in the tutoring schedule. The preferential modality for the tutoring will be a mixed model decided by the student and teacher. The student will have to request an appointment with the professor to arrange the date, hour, and method (virtually or on-site).
Laboratory practical	Those doubts/questions of the students that may arise along the course concerning the laboratory practices or the preparation of the corresponding reports will be solved in the tutoring schedule. The preferential modality for the tutoring will be a mixed model decided by the student and teacher. The student will have to request an appointment with the professor to arrange the date, hour, and method (virtually or on-site).

Assessment

	Description	Qualification	Training and Learning Results		
Seminars	For each subject or block of subjects, the estudiantado, of individual form, will resolve a problem or exercise, to proposal of the *profesorado, that will deliver to be evaluated. It will value the assistance.	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 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 criterion of the educational make an evaluation by means of an oral proof and/or written the last day of practices.	15	A1 A5	B3 C1 B4 C6	D1 D2
Essay questions exam	First test. The date of the test will be agreed with the students, as far as possible, but always after the completion of topic 2. The evaluation will be based on theory questions and the resolution of exercises.	15	A1 A5	C1 C6	D1 D2
Objective questions exam	Self-assessment tests that students must solve individually, through the MOOVI platform.	15	A1 A5	C1 C6	D1 D2
Essay questions exam	Second test to be taken on the date of the official exam. The contents evaluated will be all the contents of the subject. The evaluation will be based on theory questions and the resolution of exercises.	40	A1 A5	C1 C6	D1 D2

Other comments on the Evaluation

In order to pass the subject, **it is essential to attend the practical sessions and to achieve a minimum grade of 5.0 points out of 10 in the second test**. If this score is not reached, the grade that will be reflected in the minutes will be only the grade of this exam, not counting any of the other sections.
The overall grade will be the weighted sum of the tests (55%), the laboratory practices (15%), the self-evaluation tests (15%) and the Seminars (15%). The computation of the evaluable methodologies: laboratory practices (15%), self-evaluation test (15%) and Seminar (15%) will be effective as long as a minimum score of 3.5 points is obtained in each of them.
The completion of any evaluable test will imply the condition of "presented" and, therefore, the assignment of a grade according to what is stated in this teaching guide.

Second Round:

For the evaluation in the second call, the percentages of the laboratory practices, tests and Seminar will be maintained. The exam in this call will be weighted 55%. In order to pass the subject in this call, it will be necessary to obtain a minimum qualification of 5.0 points out of 10 in the exam, in which all the contents of the subject will be evaluated.

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). To pass the subject, they must complete and pass the Laboratory Classes evaluation (15% of the final mark) with a score equal to or greater than 4.0 points over 10. In addition, they must achieve at least 5.0 points out of 10, in a test on all the contents of the subject, which will account for 85% of the final mark, both in the ordinary and in the extraordinary opportunity.

Other considerations:

It considers inadmissible any form of fraud (i.e. copies and/or plagiarism) directed to *falsear the level of knowledge or skill reached in any type of proof, report or work. The fraudulent behaviours will be able to suppose suspend the matter during a complete course. It will carry an internal register of these performances for, in case of *reincidencia, request to the rectorship the opening of a disciplinary file.

Sources of information

Basic Bibliography

PETRUCCI R.H., **Química General**, (11ª edición), Ed. Pearson Educación, 2017

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

Complementary Bibliography

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

Peter Atkins, Loretta Jones, **Química. La ciencia central**, (12ª edición), Pearson Educación, 2014

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, basic laws , different forms to express the concentration and basic chemical nomenclatura will be used very often resolving numerical problems and can be considered fundamental tools in this subject.

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	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 (*zooplancton, *necton, *bentos).	A1	C9 C10 C11	D1 D2
6. Know the adaptations *morfolóxicas 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 autoecoloxía. 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

	Description	Qualification	Training and Learning Results		
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	Attendace 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: 3.8 points. Seminars and technical visit: 3 points. Practices: 3 points.

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 theacademic start. Given the experimental nature of the practices, attendance at them is mandatory to be eligible for this evaluation option. Failure to attendthe practices, with no justified cause invalidates this possibility, as well as the opportunity for extraordinary evaluation (2nd opportunity).

2nd Opportunity (July call)

Students will be able to recover up to a maximun of 4 points in the 2nd chance exam.

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

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

Other comments

The key to sucssess is took 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 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	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 A4 A5	B4		D2
Understand the concept of hypothesis testing.	A3 A5		C2	D1 D2
Understand the principles of multivariate analysis.	A3 A5		C2	D1 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. And so favor a positive attitude towards the quantitative methods, in general, and statistics, in particular, as well as their computer manipulation.	A3 A5	B2 B4		D1 D2
Understand the importance of statistical analysis when taking decisions and learn when to apply each technique and interpret the results obtained.	A3 A4	B2		D1 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 A5			D1 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: binomial, multinomial, 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
Essay 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	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.

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 carry out four practical case studies of data analysis using R software. Each case study will account for 7.5% of the final grade. The evaluation will be carried out by means of a test through the Moovi platform and the delivery of the code (script) necessary for its resolution.	30	A2 A3 A4 A5	B2 B4	D1 D2
Objective questions exam	Tests throughout the course. Two mid-term exams (multiple-choice test). Each exam will account for 15% of the final grade.	30	A2 A3 A4 A5	C2	D1
Essay questions exam	Final exam on the contents of the course. The exam will consist of solving problems and exercises. A qualification higher than 3.5 points (out of 10) must be obtained in order to pass the course.	40	A2 A3 A4	C2	D1

Other comments on the Evaluation

Continuous evaluation: The student's work throughout the course will be evaluated. In the final qualification, the evaluations/tests carried out throughout the course (practicals and mid-term tests) will represent 60% and the final exam (to be made on the official date) 40%. To pass the subject, it will be compulsory to attend the final exam and to obtain a qualification higher than 3.5 points (out of 10). In case of not obtaining in the final test the minimum qualification to pass the subject, the grade to appear in the official record will be the minimum between 4.9 and the final qualification (weighted).

Second opportunity: In the second opportunity the same scale will be applied as in the continuous evaluation, with the evaluations/tests carried out throughout the course accounting for 60% and the final exam for 40%. In this case, the qualifications of the evaluations/tests carried out throughout the course will be maintained and only the final exam will be repeated, in which a qualification higher than 3.5 points (out of 10) must be obtained in order to pass the subject. In case of not obtaining in the final test the minimum qualification to pass the subject, the grade to appear in the official record will be the minimum between 4.9 and the final qualification (weighted).

Global evaluation: As an alternative to the continuous evaluation 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 qualification higher than 5 points (out of 10) in order to pass the subject. The application for this evaluation option must be submitted in the time and manner determined by the Center, which will be published before the academic start.

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/examenes/

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.

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			
Department				
Coordinator	Diz Ferreiro, Paula			
Lecturers	Alejo Flores, Irene Diz Ferreiro, Paula Gago Duport, Luís Carlos Nombela Castaño, Miguel Angel Pérez Arlucea, Marta María			
E-mail	pauladiz@uvigo.es			
Web	http://https://mar.uvigo.es/			
General description	Geology II is a theoretical and practical subject that integrates the action and the results of the external geological processes on the rocks and sediments that constitute the surface of the Earth. Matter of the program English Friendly: The international students can request material and bibliographic references for the follow-up of the subject in English, personal tuition and written examination will be given 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
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.
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.
D5	Sustainability and environmental commitment. Equitable, responsible and efficient use of resources.

Expected results from this subject	Training and Learning Results			
Identify the main mineral constituents and biological in sediments and sedimentary rocks by observations "de visu" in field and laboratory.	A1	B1	C1	D1
Know and differentiate the external geological agents and their effects.	A5		C1 C12	
Recognize the relief forms		B1		
Handle the systems of cartographycal maps		B4		
Handle the principles and the basic instruments of positioning and georeference	A1	B4	C12	D1
Look for and handle specific information.	A5			D1 D5

Contents	
Topic	
0: PRESENTATION	Presentation of the subject. General explanation of theoretical contents-practical and evaluation system.
1: INTRODUCTION	The external geological cycle.
2: THE ATMOSPHERE AND THE HIDROSPHERA	Atmosphere: origin, composition, structure and dynamicS. Oceanic waters and its circulation. Continental waters: the hydrological cycle.

3: METEORIZATION, SOILS AND SEDIMENTARY ROCKS	Meteorization and erosion, types and velocities. Soil formation and soil types. Formation and classification of sediments and sedimentary rocks. Diagenesis
4: THE CONTINENTAL ZONES	Geological processes in glacial environments geological Processes in desert environments Geological processes in fluvial environments Geological processes in lacustrine environments.
5: THE COASTAL ZONE	Terminology associated to the coastal zone. Coastal environments. Morfodynamics.
6: THE CONTINENTAL SHELF AND THE OCEANIC BASINS	Morphology and distribution of marine floors. The continental shelf Reefs The continental slope The deep ocean floor (abyssal basins and mid ocean ridges)
7: GRAVITATIONAL PROCESSES	Gravitational processes in emerged and underwater areas.
SEMINARS	Seminar 1: Clocks in rocks. Seminar 2: ¿What does the Earth do with the CO2?. Seminar 3: Processes of meteorización in rocks.
PRACTICALS	Practical 1: Drawing geological sections. Practical 2:Analysis of maps and geological sections. Calculations dip and strike and thicknesses of layers. Unconformities Practical 3: Space representation in geology: contour maps of marine sediment thickness. Practical 4: Identification of sedimentary rocks. Calculation of the CaCO3 content of marine sediments.
STUDIES EXCURSION	Geological inspection in the itinerary Ramallosa-Baiona to examine the control that exerts the geology, the marine and fluvial dynamics in coastal geomorphology. Identificacion of human impact on the coast

Planning			
	Class hours	Hours outside the classroom	Total hours
Laboratory practical	12	20	32
Seminars	7	15	22
Studies excursion	6	4	10
Lecturing	19	40	59
Report of practices, practicum and external practices	0	12	12
Essay questions exam	2	0	2
Problem and/or exercise solving	1	0	1
Report of practices, practicum and external practices	0	11	11
Report of practices, practicum and external practices	0	1	1
*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 nature of the practicals, attendance is mandatory. Practical 1: Drawing geological sections. Practical 2:Analysis of maps and geological sections. Calculations dip and strike and thicknesses of layers. Unconformities Practical 3: Space representation in geology: contour maps of marine sediment thickness. Practical 4: Identification of sedimentary rocks. Calculation of the CaCO3 content of marine sediments.

Seminars	Given the experimental nature of the seminars, attendance is mandatory. Seminar 1: Clocks in rocks. Seminar 2: ¿What does the Earth do with the CO2?. Seminar 3: Processes of meteorización in rocks.
Studies excursion	Geological evaluation of the itinerary Ramallosa-Baiona to examine the control that exerts the geology, the marine and fluvial dynamics in coastal geomorphology. Identificatiion of human impact on the coast.
Lecturing	Lectures are focused on theoretical contents external geology. Students are encouraged to participate and raise question. Participation will be a plus in the final evaluation of the student.

Personalized assistance

Methodologies	Description
Seminars	The students are encouraged to formulate questions during the development of the seminars. For supplementary tuition, students are required to email the lecturer in advance.
Studies excursion	The students will receive tuition during the development of the studies excursion.
Lecturing	The students are encouraged to formulate questions during the development of the lectures. For supplementary tuition, students are required to email the lecturer in advance.
Laboratory practical	The students are encouraged to formulate questions during the development of the practicas. For supplementary tuition, students are required to email the lecturer in advance.
Tests	**Description**
Report of practices, practicum and external practices	For supplementary tuition regarding the report of practices, students are required to email the lecturer in advance.
Essay questions exam	For supplementary tuition regarding the essay questions exam, students are required to email the lecturer in advance.
Problem and/or exercise solving	Questions raised by students will be solved during lectures.
Report of practices, practicum and external practices	For supplementary tuition regarding the report of seminars, students are required to email the lecturer in advance.
Report of practices, practicum and external practices	Students will be able to formulate specific questions regarding the report of the excursion during the excursion itself

Assessment

	Description	Qualification	Training and Learning Results			
Laboratory practical	Given its experimental character, the assistance to the practical is compulsory.	0		B1 B4	C1 C12	D1
Seminars	Given its experimental character, the assistance to the seminars is compulsory.	0	A1	B1	C1	D5
Studies excursion	Given its experimental character, the assistance to the the excursion is compulsory.	0	A1 A5	B1 B4	C12	D5
Report of practices, practicum and external practices	It requires handing in a report or problem solving exercices in each one of the 4 practicals. It will be evaluated the contents, and the quality of the reports, etc, of each one of the 4 practicals programmed for the subject. Given the compulsory and face-to-face character, reports of non-attendees will not be taken into account.	30	A1	B4	C1 C12	D1
Essay questions exam	The exam will contain specific questions about the contents developed during lectures.	30	A1 A5	B1	C1 C12	
Problem and/or exercise solving	This is a short (10-15 minutes) questionaraire about any theoretical contents explained previously during lectures. It will take place three times during lectures. The dates are indicated in timeline.	10		B1 B4	C12	

Report of practices, practicum and external practices	It requires handing in a report or problem solving exercices in each one of the 3 seminars. It will be evaluated the contents, and the quality of the reports, etc, of each one of the 3 seminars programmed for the subject. Given the compulsory and face-to-face character, reports of non-attendees will not be taken into account.	20	A1	B1 B4	C1 C12		
Report of practices, practicum and external practices	It requires handing in a report or questionnaire about the studies excursion. Given the compulsory and face-to-face character, reports of non-attendees will not be taken into account.	10	A1 A5	B1 B4	C12	D5	

Other comments on the Evaluation

FIRST OPPORTUNITY ASSESSMENT:

The students that have not attended all sesions of practicals, seminars and the studies excursion (except for justified reasons, see regulation*) will not be evaluated, either by continuous or global options.

The final score will be the sum of the mark obtained in each one of the tests as long as they are marked 4 over 10 in seminars, practicals and the essay questions exam. In case they do not reach 4/10 in any of these three test, the final score will be multiplied by 0.5.

SECOND OPPORTUNITY ASSESSMENT:

In the case failing the first opportunity, the assessment in the second opportunity will be a theorical-practical test accounting for 100% of the final mark.

GLOBAL ASSEMMENT OPTION: The application for thisevaluation option must be submitted in the time and manner determined by theCenter, which will be published prior to the academic start. However, it can only be requested if attendance at all mandatory activities is fulfilled (practicals, seminars and the studies excursion) unless adequate justificaction is provided. The global assessment will be a theorical-practical test accounting for 100% of the final mark.

GENERAL CONSIDERATIONS

It is expected the students to behave respectfully and honestly.

It inadmissible any form of fraud (copy and/or plagiarism) to fake the level of knowledge or skills reached by the student in any type of proof, report or work. The fraudulent behaviours entail failing the subject during the whole year.

The use of mobile phones for purposes other than educational, is not allowed during the duration of classroom activities.

Communication by e-mail between students and lecturers must be done using only the institutional e-mail (@alumnos.uvigo.gal). Likewise, this e-mail is the one that must appear in moovi. *See REGULATIONS

*See Regulation: REGULAMENTO SOBRE A AVALIACIÓN, A CALIFICACIÓN E A CALIDADE DA DOCENCIA E DO PROCESO DE APRENDIZAXE DO ESTUDANTADO (Aprobado no claustro do 18 de abril de 2023)

The date, hour and place of the evaluable activities will be published in the official web of the Faculty of Marine Sciences: http://mar.uvigo.es/index.php/es/alumnado/examenes/

Sources of information

Basic Bibliography

Anguita, F y Moreno, F., **Procesos Geológicos Externos y Geología Ambiental**, Rueda,

Tarbuck, E.J. y Lutgens, F.K, **Ciencias de la Tierra. Una introducción a la geología física. 8ª ed.**, Pearson,

Wicander and Monroe, **Geology, Earth in Perspective**, Cengage,

Coastal Geology, Springer, 2022

River Dynamics, Cambridge University Press, 2020

Complementary Bibliography

Geomorphology of Desert Dunes, Cambridge University Press, 2023

Recommendations

Subjects that continue the syllabus

Subjects that it is recommended to have taken before

Geology: Geology 1/V10G061V01103

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			
E-mail	javiherves@uvigo.es			
Web	http://faitic.uvigo.es			
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	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/examenes/

The assessment system will select the best grade between the following:
a) the one obtained from the five previous items with their respective weights.
b) 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., **Un mar de matemáticas**, Servizo de publicacións da Universidade de Vigo, 2016

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.; Edwars, B., **Cálculo. Vol 1 e 2.**, 9º, McGraw-Hill, 2010

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

Complementary Bibliography

Besada, M.; García Cutrín, J.; Mirás Calvo, M.A.; Quinteiro, C.; Vázquez, C., **Matemáticas á Boloñesa**, Servizo de publicacións da Universidade de Vigo, 2014

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			
Lecturers	Fernández Nóvoa, Alejandro Mandado Alonso, Marcos Prieto Jiménez, Inmaculada			
E-mail	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 we will define the equilibrium conditions and apply them to the study of phases and chemical processes. We will also consider how Thermodynamics approaches 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. Osmotic pressure.
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: Enthalpy of dissolution. Method of solubility: enthalpy. Hot. Heat capacity. Effect of ionic strength on solubility. Chemical balance. Solubility product. Balance constant. Activity. Coefficient of activity. Ionic strength and its effect on the equilibrium constant. Dissolution and neutralization heat. Calorimetric method. Enthalpy, heat, heat of reaction, thermal capacity. Integral and differential heat. Ebulloscopic increase. Raoult's Law. Chemical potential. Enthalpy of vaporization. Study of the liquid-vapor equilibrium of mixtures of two liquids. Rule of the phases. Liquid-vapor balance. Phase diagram. Raoult's Law. Chemical potential. Coefficient of activity

Planning			
	Class hours	Hours outside the classroom	Total hours
Lecturing	23	35	58
Seminars	14	35	49
Laboratory practical	15	5	20
Essay questions exam	0	2	2
Essay questions exam	3	6	9
Problem and/or exercise solving	0	12	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	Theoretical classes taught through a presentation (available to students in the Moovi platform). In these classes will be introduced the basic contents, with emphasis in more important and difficult topics. Numerical problems will be also solved. The bulletins of problems will be available in the Moovi platform.
Seminars	Destined to the resolution of numerical problems and debate of the questions and exercises. The necessary material will be available in the Moovi platform. In addition, the students will solve proposed exercises and questions, according to the guidelines established by professors in the classes or seminars of the subject
Laboratory practical	Application of techniques of laboratory in practical problems related with the subject. The material will be available in 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
Tests	**Description**

Essay questions exam	Ídem
Problem and/or exercise solving	Ídem
Essay questions exam	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. Attendance at laboratory experiments is required. To overcome the subject the student should reach at least 50% of the maximum possible score for this activity.	15		B4		D2
Essay questions exam	Written exam in which the level of theoretical knowledge and problem solving skills will be checked. It will be made in the middle of the semester. See "Other comments on the evaluation"	30	A1 A5	B4	C6	D1 D2
Essay questions exam	Written exam in which the level of theoretical knowledge and problem solving skills will be checked. It will be made in the date determined by the Faculty. See "Other comments on the evaluation"	30	A1 A5	B4	C6	D1 D2
Problem and/or exercise solving	The resolution of problems and questions proposed in the classroom and/or on the Moovi platform will be valued	25	A1		C6	D1 D2

Other comments on the Evaluation

The participation of students in any of the assessment activities of the subject will involve the assignment of a grade. Regarding this point, attendance at the laboratory sessions (two or more), realization of 20% of the exercises proposed by the professor and the realization of written tests will be considered.

The final grade of the subject will be the weighted addition of the marks for all the sections, provided that the minimum score required in each of them is reached.
The students who only carry out the laboratory practices will receive the qualification resulting from the application of the percentage corresponding to this section.The qualification corresponding to the written tests will be the average of the grade obtained in both and, to pass the subject, a score equal to or greater than 4 points out of 10 must be achieved. In case of obtaining a grade of less than 4 points out of 10, the grade that will be obtained will be the weighted grade of the written tests.

Evaluation in extraordinary call

In the July call, the previous percentages will be respected, maintaining the qualifications obtained in the laboratory practices and in the resolution of exercises and questions.
In this call, students will be able to recover the qualification corresponding to the written tests (60%) by taking a global test. To pass the subject, you must achieve a score equal to or greater than 4 points out of 10 in this test.The final grade of the subject will be the weighted addition of the marks for all the sections, as long as the required score are reached. If this is not the case, the final mark for the subject will be the weighted grade of the global test.

Global evaluation

Students who wish to opt for the global evaluation (EG) must request it within the period and in the manner established by the Faculty. This information will be available to students before the start of the academic period.To pass the subject, it is necessary to carry out the practices and also achieve at least 50% of the maximum possible score for this activity.The students who opt for the EG will take a test in which all the content of the subject will be assesed. This test will constitute 85% of the final grade for the subject, both in the ordinary and extraordinary calls. To pass the subject, it is necessary to obtain a grade equal to or greater than 5.0 points out of 10 in this test.

Other considerations

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

IMPORTANT: 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 professor proposed work. This fraudulent behavior will be sanctioned

with the firmness and rigor established by current regulations.

Sources of information

Basic Bibliography

Levine, **Fisicoquímica**, McGraw-Hill. 5ª Ed. (2004),

Atkins, **Química Física**, 8ª Ed. , Ed. Omega (2008),

Levine, **Problemas de Fisicoquímica**, 6ª Ed. McGraw-Hill (2014),

Complementary Bibliography

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

Laidler, Meiser, Sanctuary, **Physical Chemistry**, Edition, Houghton Mifflin (2002),

Klotz, Rosenberg, **Chemical Thermodynamics: Basic Theory And Methods**, 6th Ed., John Wiley (2000),

Rock, **Termodinamica Quimica**, Vicens-Vives (1989),

Rodríguez Renuncio, Ruiz Sánchez, Urieta Navarro, **Problemas resueltos de termodinámica química**, Síntesis. (2000),

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

D. Eisenberg e D. Crothers, **Physical Chemistry with Applications to the Life Sciencies**, Benjamin/Cummings Publishing Company.(1979),

J. Wright e A. Colling, **Sea-water: its composition, properties and behaviour**, Oceanography, vol.2. The Open University. Pergamon Press.(1991),

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

Mathematics: Mathematics I/V10G061V01104

Chemistry: Chemistry I/V10G061V01105

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	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 B3	C9	
Approach of the biological phenomena in molecular terms, relating the structure of each biomolecules family with the biological function that exert	A2 A3	B1	C9	
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 B4		D1
Development of scientific thinking style	A2 A3 A4	B1		D1 D2

Contents
Topic

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.
Carbohydratess:	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. Kinetical 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 byosinthesis. 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. Tutoring hours: Tuesday, Wednesday and Thursday from 13:00 to 14:00 p.m
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. Tutoring hours: Tuesday, Wednesday and Thursday from 13:00 to 14:00 p.m
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. Tutoring hours: Tuesday, Wednesday and Thursday from 13:00 to 14:00 p.m
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. Tutoring hours: Tuesday, Wednesday and Thursday from 13:00 to 14:00 p.m
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. Tutoring hours: Tuesday, Wednesday and Thursday from 13:00 to 14:00 p.m

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 B1 C9 D1 A3 C11 D2 A4
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, procesamento and interpretation of the results obtained. Given its experimental nature, attendance is mandatory.	20	A2 B1 C9 D1 A3 B3 C11 D2 A4 B4
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 B1 C9 A3 A4
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 B1 C9 D1 A3 B4 C11 D2 A4

Other comments on the Evaluation
The student will have to cumplimentar 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 t**he 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/

Require of the alumnado that curse this subject a responsible behaviour and honesta. Consider inadmissible any form of fraud (copy or plaxio) encaminado to falsear the level of knowledges and destrezas achieved in all type of proof, report or work. The fraudulent behaviour pode involve suspend the subject a complete course. It will carry one internal register of these actuacions and, in case of reincidencia, it will ask the wool Reitoria to abertura of a file discipline .

Sources of information

Basic Bibliography

Feduchi E., Blasco I., Romero C.S. y Yáñez E., **Bioquímica. Conceptos esenciales**, 2ª Ed, 2015

Nelson D.L. and Cox M.M., **Lehninger. Principios de Bioquímica**, 7ª Edición, 2018

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

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

Complementary Bibliography

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

Herrera E., **Bioquímica Básica**, 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**, 5ª Edición, 2015

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

Stryer L., Berg J.M. y Tymoczko J.L., **Bioquímica.**, 7ª Edicion, 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
Biology: Biology 2/V10G061V01106
Chemistry: Chemistry I/V10G061V01105
Chemistry: Chemistry 2/V10G061V01110

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	García Molares, Aida García Moreiras, Iria Muñoz Sobrino, Castor Navarro Echeverría, Luis 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
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.
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	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		D3 D5
To acquire the skills to collect, prepare, analyze, identify and preserve plant samples		C4	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		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 featuress 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. Phylum Gaucophyta 4.3. Phylum Euglenophyta
5. Unicellular phyla; main features	5.1. Phylum Cryptophyta 5.2. Phylum Haptophyta 5.3. Phylum Pyrrophyta
6. Phylum Ochrophyta (Heterokontophyta) I	Main features
7. Phylum Ochrophyta (Heterokontophyta) II	7.1. Class Xantophyceae 7.2. Class Bacillariophyceae
8. Phylum Ochrophyta (Heterokontophyta) III	8.1. Class Phaeophyceae. Main features
9. Phylum Ochrophyta (Heterokontophyta) III	9.1. Main features of Bangiophyceae 9.2. Main features of Floridophyceae
10. Phylum Chlorophyta I	10.1. Main features of Prasinophyceae 10.2. Main features of Chlorophyceae 10.3. Main features of Bryopsidophyceae 10.4. Main features of Ulvophyceae 10.5. Main features of Zygnematophyceae
11. Ecology and ethnobotany of algae	11.1. Introduction to the study of the marine algae communities 11.2. Uses of the algae
12. Introduction to the flowering plants	12.1. Main features and life cycle 12.2. Adaptations to the coastal environment
13. Coastal vegetation	13.1. Introduction
14. Fungi and lichens	14.1. Main features

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	4	23	27
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		
Problem and/or exercise solving	Three QUESTIONNAIRES (tests) related to the main blocks of the subject (introductory, unicellular groups, multicellular groups and vegetation). 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		
Report of practices, practicum and external practices	Evaluation of INDIVIDUAL REPORTS referring to the activities on the practical classes in the field and laboratory. In case of not passing this part in the First Opportunity, a practice exam must be taken in the Second Opportunity.	25	A5	C4	D3
Case studies	INDIVIDUAL REPORT on 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		D1 D2
Essay	Collaborative preparation of a written report, and public presentation of the supervised works. In case of not passing this part in the First Opportunity, an individual report must be done for the Second Opportunity.	15	A2 A3 A4 A5		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 of 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 had not reached half of the grade of the Collaborative Essay in the First Opportunity (0.7), must repeat the Work but individually and 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 of 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, 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, **Artículos en Revistas**,

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 Galician			
Department				
Coordinator	Lugo Latas, Luis			
Lecturers	Lugo Latas, Luis			
E-mail	luis.lugo@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 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 enviroment and the development of models related with it. Furthermore, it is important to understand the fundamental physic 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	Training and Learning Results			
1.- Know the fundamental principles of the Themodynamic and know applied to realize global analyses of thermodunamic 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 *refrixeración 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
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

	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 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, 9ºEd., 2014

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, Barcelona., 1986

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	Vázquez González, Margarita			
Lecturers	Puértolas Lacambra, Begoña Sousa Castillo, Ana			
E-mail	margarita.vazquez@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	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	28	42
Laboratory practical	15	10	25
Essay questions exam	3	12	15
*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 pratical lesson, students must do a questionarie. Once it is finished, students will have to answer some questions related to the work developed.

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	The problems, exercises and/or questions proposed will be evaluated, according to the guidelines established by the professor in the classes or in the seminars of the subject. Attendance at the seminars is mandatory.	20	A2 A4 A5	B1 B4	C6	D1 D2
Laboratory practical	In this section will be valued: - The work carried out by the students in the laboratory. - The questionnaire done at the end of each practicel lessons. - The test with questions related to the work carried out during the practical lessons. It will be done after the practical lessons, in the final test of the subject. Attendance at laboratory experiments is mandatory. To overcome the subject the student should reach at least 50% of the maximum possible score for 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 pass the subject, a minimum mark of 3,5 points (of 10) must be achieved.	60	A2 A4 A5	B1 B4	C6	D1 D2

Other comments on the Evaluation

The participation of students in any of the assessment activities of the subject will involve the assignment of a grade. Regarding this point, attendance at the laboratory sessions (two or more), realization of 20% of the exercises proposed by the professor and the realization of tests will be considered.

The final grade of the subject will be 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 minimun, 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.

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 I/V10G061V01105
Chemistry: Chemistry 2/V10G061V01110

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	Bernabéu Tello, Ana María Gago Duport, Luís Carlos García Gil, María Soledad Gil Lozano, Carolina Marino , Gianluca Nombela Castaño, Miguel Angel Rey García, Daniel			
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 environmets.
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 Hjülstrom'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; postsedmentaries; 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. Processes that control ocean chemistry and its evolution through time; 8.2. Relationship between (bio)chemical sediments, climate, and weathering; 8.3. Ocean carbonate chemistry: carbonate species and carbonate precipitation in seawater; 8.4. Carbonate minerals; 8.5. Carbonate saturation, lysocline, and carbonate compensation depth and their evolution through time in connection with weathering and sea-level changes.

Topic 9. Chemical and biochemical sediments II: description and classification of carbonate sediments	9.1. Allochemical carbonate constituents; 9.2. Orthochemical carbonate constituents; 9.3. Classification of carbonate sediments and rocks and their sedimentary environments; 9.4. Diagenesis of carbonate sediments and lithification into carbonate rocks.
Topic 10. Chemical and biochemical sediments III: carbonate sedimentary environments	10.1. Carbonate production and factory; 10.2. Depositional systems: from shallow water settings to the deep ocean; 10.3. Physical processes that control carbonate production and facies distribution in the ocean; 10.4. Chemical processes that control carbonate production and facies distribution in the ocean; 10.5. Case studies from modern environments.
Topic 11. Chemical and biochemical sediments IV: siliceous, evaporitic, and other (bio)chemical sediments	11.1. Siliceous sediments; 11.2. Evaporitic sediments; 11.3. Other (bio)chemical sediments.
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 12 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 THE FINAL GRADES

1. GRADING FROM CONTINUOUS ASSESSMENT (60%):

   a. Field trips and laboratory practical (10%);

   b. Seminars (20%);

   c. Topical questionnaires (30%).

2. FINAL EXAM: 40%

The average of each of these sections (blocks 1a, 1b, 1c) must be >/= 5.00, while individual assignments must be each >/= 4.00.

Final grade: continuous assessment mark (60%) + Final exam mark (40%).

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

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 1/V10G061V01103
Geology: Geology 2/V10G061V01108

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			
Department				
Coordinator	Fernández Suárez, Emilio Manuel			
Lecturers	Fernández Suárez, Emilio Manuel Lasa Gonzalez, Aide Olabarria Uzquiano, Celia			
E-mail	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 A3 A4 A5	B1	C10 C11	D1
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	Construction of the sociocultural human niche. The anthropocene. Planetary boundaries. Ecology in an anthropogenic biosphere. Presentation of the subject.
Biogeochemical reactions in the sea	Energy in the ecosystem. Cycles of matter and energy flows. Metabolic diversity of the biosphere. Compartments, mass balances and residence time. Oxygen: distribution and redox gradients. Reactions of the carbon cycle: acidification. Reactions of the nitrogen cycle: eutrophication. Reactions of the phosphorus cycle: dynamics in the water-sediment interphase.
Energy flows and biological production	Primary production. Magnitudes. Control of primary production: efficiency of the photosynthesis, irradiance and nutrients. Hydrodynamic control of primary production: Sverdrup model. spatial and temporal variability of primary production. Secondary production. Efficiencies. Organic matter decomposition and remineralization. Microbial heterotrophic production.
Dynamics of isolated populations	Concept of individual and population. Characteristics of populations. Evolutionary strategies. Fundamental equation of population growth. density independent growth: exponential model. Density independent growth in aged-structured populations: life tables, survival curves, Allen diagrams. Density dependent growth: logistical model. Variations of the logistical model: Time-lag, Allee effect, discrete growth. growth.
Interactions between species	Interspecific competition. Experimental evidences of competition. Competition and ecological niche. Lots and Volterra model of competition. Predation. Functional and numerical responses. Variations of the Lotka and Volterra predation model.
Community structure and function	Concept, assembling and filters. Specific diversity, biodiversity, specific wealth and functional diversity. Equitativity: Abundance distribution models. Diversity indexes. Relation diversity-ecosystem function Diversity in space: spectrums and gradients. Food web topology. Key species and trophic cascades. Top-down vs bottom-up control.
Ecological succession and stability	Temporal changes in the community: succession and fluctuation. Explanatory models of succession. Succession and diversity. Effect of physical perturbations: Intermediate perturbation hypothesis. Succession and energy flow. Diversity-stability hypothesis. Meanings of stability. Concept of resilience: principles for sustaining ecosystem services.
Ecosystem conservation and management	Socio-ecological systems. Ecosystem services: offer and demand. Analysis of interactions and identification of conflicts. Bases of conservation ecology. Resilience-based ecosystem management. Non linear responses and histeresis. Principles for the maintenance of the ecosystem services.

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. Presentation 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, sampling, experimentation, sample processing, data analysis, preparation and discussion of results and, finally, presentation of these results by the students. They will, therefore, develop all the phases of an investigation. The experimental work will be carried out in groups of 5 people advised by teachers. The results will be presented as a poster. The laboratory phase of the experimental work will proceed from 1st to 31st March and will last approximately one week. Seminars will tackle the necessary practical contents for the preparation of the work. The adequate organisation and development of the experimental work, requires to strictly respect the following recommendations: 1. Members of each group should belong to the same group of seminars. 2. Laboratory work should be by all members of the group. 3. All members of the group should be involved in the advisory sessions devoted to the design of the experiment as well as to the analysis and interpretation of results.

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 at least 10 ahead. The assistance to the seminars is compulsory. The relative contribution of both proofs to the final qualification will be of 15% (10% the examination of seminars and 5% the proof). 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.	15	A2 A3 A4 A5	B4	D1 D2
Project	The qualification of the experimental work will be based on the quality of the content and the experimental design, on the treatment and presentation of the results and on the level of knowledge reached. A guide with the evaluation criteria will be provided. The evaluation will consist of two sections. First, each group will elaborate a poster. Each group will defend the poster in oral format. Second, in this same session each student will make a short proof on the contents of the poster he/she 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 30% 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%. 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. 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 qualification equal or higher than 4 points in the joint qualification of the section of seminars and experimental work.	30	A2 A3 A4 A5	B1 C10 B2 C11 B4	D1 D2

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 A3 A4 A5	C10 C11	D1 D2 D5
Objective questions exam	During the course, 3 proofs will be conducted on the concepts treated in the subject. These proofs will represent 15% of the final qualification. These short proofs will be done during the class. The date of realisation will be announced at least 10 days ahead.	15	A2 A3 A4 A5	C10 C11	D1 D2 D5

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).**

Second oportunity

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**, 6ª, 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	García Gil, María Soledad			
Lecturers	Francés Pedraz, Guillermo García Gil, María Soledad Pérez Arlucea, Marta María			
E-mail	sgil@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 environmets.
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 environmnts 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. Sedimentary structures. Seminar 2. Videos of marine sedimentary environments Seminar 3. Talud e glacis (Attendance and reports, 30% the mark)

Personalized assistance	
Methodologies	**Description**
Lecturing	Individual or in group titorial 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 C13	D1 D5
Studies excursion	Reports of the exits of field. It will evaluate the assistance to the field.	20	A3 A4	B2 B4	C12 C13	D1 D5
Seminars	Preparation of a work of synthesis and results for each one of the seminars	30	A4	B4	C12 C13	D1 D5
Objective questions exam	Exam with a short answer on the subject matter developed during master classes, practical, fiel-trips and seminars.	40	A3 A4	B1	C12	D1 D5

Other comments on the Evaluation

To surpass the matter, will be necessary to surpass and have an average of approved (50%). **The assistance to practical and seminars, as well as the exits to the field are mandatory** and they will consider in the percentage of qualification.

The final examination in any one of the announcements will include any theoretical or practical appearance that have exposed during the course, including the field-trips. **The students that do not assist to the seminars or to the practices will not be able to present the corresponding reports**.

To surpass the matter in **the second opportunuty** the students will have to do an examination of each one of the parts of the matter that had not surpassed.

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 studies excursions, attendance at them is mandatory to be eligible for this evaluation option. **Failure to attend, 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/

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 I/V10G061V01303
Geological oceanography II/V10G061V01308
Basin Analysis/V10G061V01406

Subjects that it is recommended to have taken before

Geology: Geology 1/V10G061V01103
Geology: Geology 2/V10G061V01108
Sedimentology/V10G061V01205

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	Spanish			
Department				
Coordinator	Longo González, Elisa			
Lecturers	Bodelón González, Gustavo			
E-mail	elongo@uvigo.es			
Web	http://https://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.			

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	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 phisiology	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: unespeciphic 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 posed by the students. At final for each topic, the students will have at their disposal at Faitic the presentations discussed in the classroom, demonstration videos and links to free access texts. During the semester the teacher will evaluate the students by means of five tests of a maximum of 20 minutes each, with developmental and objective questions and exercises. Any tests that are missed or not taken may be made up in the second call.
Laboratory practical	The teacher explains the fundamentals and protocols of the practice, supervises its execution and solves the doubts of the students. The students will have a Practice Guide with the protocols and fundamentals of each practice. The teacher will evaluate the students at the end to the week by means of a single test of objective questions, which, in case of failure, can be recovered in the final exam of the first and/or second call.
Seminars	The students, organized in groups, will make a work to the computer that they will have to deliver at the end of the seminar for its evaluation. The teacher explains the procedure to follow and advises on the development of the work. The work will be handed in at the end of the seminar and will be used by grade the student.

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, 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	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, 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	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 tests, or not presented, are retaken in the Second Call. - The dates of the different exams can be found in the Schedule available by the Deanship to disposal of the student. - Exceptionally, the students can opt by a Global Assessment (see further down)	56	A2 A3 A4	B1 B4	C9 C10	D1 D5
Laboratory practical	Final exam, of objective questions, at the end of the practices. Failed exam, or not presented, is retaken in the Second Call.	34	A2 A3	B4	C10	D1 D5
Seminars	Seminar I (5%): delivery of a group work. Seminar II (5%): individual written test of short/assay questions. Both the work and the test will be performed during the seminars. Neither the group work, nor the individual test, will be retaken.	10	A3 A4	B4	C9 C10	D1 D2

Other comments on the Evaluation

CONTINUOUS ASSESSMENT:

- The students will have to pass, with at least 5 points out of 10, each one of the five partial examinations (four of Theory and one of Practices). In case of not reaching the minimum note in any of the partial proofs, the qualification in Records (First Call) will be always the average note of the failed partial examinations. Students will be able to retake in Second Call only the failed partial examinations, keeping the grades approved during the semester

GLOBAL ASSESSMENT:

Exceptionally, students who decide to do so and communicate it within the period established by the center, may apply for Global Assessment and take the full subject exam only in a global exam at the end of the semester (and/or in Second Call).

IN BOTH MODALITIES OF ASSESSMENT:

The students who, having failed the global examination or any of the partial tests of the semester, do not appear for their retaken in Second Call will appear in the Records as "Not Presented".

To pass the subject, students must attend Laboratory Practices. A single lack of attendance is allowed, if documentally justified.

Date of final exams: https://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

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

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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

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Rigel, N, Izquierdo, J., **Laboratory Exercices 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			
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	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
New	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	Determination of trace elements in seawater.

Planning			
	Class hours	Hours outside the classroom	Total hours
Introductory activities	1	1	2
Lecturing	19	50	69
Problem solving	6	18	24
Laboratory practical	20	0	20
Seminars	7	0	7
Report of practices, practicum and external practices	0	10	10
Essay questions exam	0	14	14
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 alchalinity. - Dissolved oxygen. - Phospate in seawater. - Metals in seawater by atomic spectroscopy. 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 2022-23and 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 2022-23 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 it will be able to attend personalized tutorials to solve doubts, mainly in the schedules indicated at the University webbsite. To optimize the time, it is necessary for the student to 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 it will be able to attend personalized tutorials to solve doubts, mainly in the schedules at the University webbsite. To optimize the time, it is necessary for the student to 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.
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Lecturing	The student who wishes it will be able to attend personalized tutorials to solve doubts, mainly in the schedules at the University webbsite. To optimize the time, it is necessary for the student to 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 it will be able to attend personalized tutorials to solve doubts, mainly in the schedules at the University webbsite. To optimize the time, it is necessary for the student to 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 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.	7.5	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 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.	7.5	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	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.	17.5	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.	17.5	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/examenes/

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

1.- Part of theory: which is divided into "*Objective questions exam*", 17.5%, and the tests included in "*Lecturing*", 7.5%. To consider passed this part, students will have to obtain a grade equal to or greater than 5 points in each of the tests.

2.- Part of problems: which is divided into "*Problem and/or exercise solving*", 17.5% and the tests included in "*Problem solving*", 7.5%. To consider passed this part, students will have to obtain a grade equal to or greater than 5 points in each of the tests.

3.- Seminar work (Essay questions exam, 25%). The average score of the seminars will be calculated with the geometric mean obtained with the qualifications of each of the questionnaires carried out. To be considered passed this test, students will have to obtain a grade equal to or greater than 5 points.

4.- Laboratory practice. The work carried out in the laboratory (3.75%, 1.5 points out of 10) and the corresponding practice report (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, students will have to obtain a grade equal to or greater than 5 points.

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.

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 total grade that will be in Block 1 will be the "*Objective questions exam*".
If the grade obtained in the "*Problem and/or exercises 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 exercises solving*".
In case of not reaching the minimum score in blocks 1.- and/or 2.-, the part of the "*Objective questions exam*" and/or "*Problem and/or exercise solving*" not passed will have to be taken again in the 2nd opportunity exam.
In case of not reaching the minimum score in block 3.-, the students, individually, will have to carry out again the questionnaires of those sessions of seminaries in which it has obtained a qualification inferior to 5 points in the term that the/the corresponding teacher will consider appropriate.

In case of not reaching the minimum score in blocks 4.-, the students will have to send again the reports of practices with the relevant corrections, in the time that the/the corresponding teacher will consider appropriate.
The performance by the students of any test 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 non evaluation of the corresponding block, being repeated in the following 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.

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).**

Sources of information

Basic Bibliography

Grasshof K., Kremling K., Ehrhardt M. (Eds.), **Methods of Seawater Analysis**, 3, Wile-VCH, 1999
Aminot A., Kérouel R. (Eds.), **Hydrologie des écosystèmes marins: paramètres et analyses**, Editions Quae,
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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 I/V10G061V01105
Chemistry: Chemistry 2/V10G061V01110
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			
Department				
Coordinator	Vázquez Otero, María Elsa Ramil Blanco, Francisco José			
Lecturers	Ramil Blanco, Francisco José Vázquez Otero, María Elsa			
E-mail	framil@uvigo.es eotero@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	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. (Corporal organisation) Form and function. Reproduction. Systematic summary
LESSON 5: The BILATERIA: INTRODUCTION. PHYLA ACOELOMORPHA, PLATYHELMINTHES, MESOZOA and NEMERTEA	Introduction to Bilateria. Phylum Acoelomorpha: Form and function. Phylum Platyhelminthes: General characteristics and classification; Turbellaria: form and function. Phylum Mesozoa: General characteristics and classification. Phylum Nemertea: General characteristics; (corporal organisation) form and function; reproduction and development; systematic summary.
LESSON 6. LOPHOTROCHOZOOA: THE LOWER PHYLA	Phyla Gnathostomulida, Rotifera, Acanthocephala, Cycliophora, Gastrotricha 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. (Corporal organisation) Form and function. Classification. Synopses of the lower class (Caudofoveata, Solenogastra, Polyplacophora, Monoplacophora and Scaphopoda)
LESSON 9: PHYLUM MOLLUSCA (II)	Class Gastropoda: general characteristics; coiling; torsion; (corporal organisation) form and function; reproduction and development; systematic summary
LESSON 10: PHYLUM MOLLUSCA (III)	Class Bivalvia: general characteristics; (corporal organisation): form and function; reproduction and development; systematic summary
LESSON 11: PHYLUM MOLLUSCA (IV)	Class Cephalopoda: general characteristics; (corporal organisation): form and function; reproduction and development; systematic summary
LESSON 12: PHYLUM ANNELIDA (I)	General characteristics; metamerism; classification. Class Polychaeta: general characteristics; (corporal organisation): form and function; reproduction and development.
LESSON 13: PHYLUM ANNELIDA (II): The SIBOGLINIDAE. PHYLA ECHIURA and SIPUNCULA	The Siboglinidae: general characteristics; form and function; reproduction and development. Phylun Echiura: Form and function. Phylum Sipuncula: Form and function.
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. Classification. Class Malacostraca: (corporal organisation) form and function, life forms and classification (Phyllocarida, Hoplocarida and Eumalacostraca).
LESSON 17: PHYLUM ARTHROPODA: SUBPHYLUM CRUSTACEA (II)	Class Remipedia, Cephalocarida, Branchiopoda and Ostracoda: external anatomy and life forms.
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 Maxillopoda: General characteristics and classification; Mistacocarida, Copepoda, Tantulocarida and Branchiura: a external anatomy and life forms; Cirripedia: general characteristics; form and function; classification.
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; (corporal organisation:) 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 anatomie: disection 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 anatomie: and disection 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 anatomie: disection of a Echinoidea: Paracentrotus lividus. Lesson 10.- Chordata. Observation of Tunicata and Cephalochordata; external morphology, identification and disection 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
Objective questions exam	0.5	0	0.5
Problem and/or exercise solving	2	0	2
Laboratory practice	1	0	1
Essay	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
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 regulamentations. Finally, students have to study the biology of theses 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 asks 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 0,6 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 asignments.	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	C1 C9 C10	

Other comments on the Evaluation

The update oficial 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.
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 applicated to students who will not present or the final exam of theory or the practical exam.
The marks obtained in seminars and tutorized works will be kept for the next course.

Global assessment option

The global assesment 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

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DE LA FUENTE, J. A., **ZOOLOGIA DE ARTROPODOS.**, 1ª EDICION, INTERAMERICANA - McGRAW HILL, 1994

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

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 Galician			
Department				
Coordinator	Lastra Valdor, Mariano			
Lecturers	Aranguren Gassis, María Lastra Valdor, Mariano			
E-mail	mlastra@uvigo.es			
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	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 antrophic activities in the open ocean.	A3 A4 A5	B2 B3 B4 B5	C1 C9 C10 C11	D2 D3 D5

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 zooplancton 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
Objective questions exam	1	10	11
Essay	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
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 field trip to the sea, the students will learn the separation, identification and headcounts of pertaining organisms to distinct groups of the benthos. With the table of data obtained will work the statistical section from univariate analysis, bivariate and multivariate.
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)
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. It 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. Schedule of tutorials: Tuesday and Thursday of 17:00 to 18:00 h.
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 groups in subgroups 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 that will send to the professor in dates fixed in the calendar of *entregables of the Faculty.	30	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.	30	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).

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/

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.

- **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

Moore P.G. & R. Seed, **The ecology of Rocky coast**, First Edition, Columbia University Press, 1986

Keninish Michael J., **Coastal Lagoons: Critical habitats of Environmental Change**, First Edition, CRC Press Taylor and Francis Group, 2010

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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
Biology: Biology 2/V10G061V01106
Biochemistry/V10G061V01201
Marine botany/V10G061V01202
Marine zoology/V10G061V01210

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 Spanish			
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	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. Fundaments 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 it 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 @alumnos.uvigo.es. 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 @alumnos.uvigo.es. 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 @alumnos.uvigo.es. 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 @alumnos.uvigo.es. 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 @alumnos.uvigo.es. 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 @alumnos.uvigo.es. 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 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), 40% of an intermediate test (ie), and a 20% from the seminars test (st), according to the formula:

N=0.4*ot+0.2*ie+0.4*st

The grade in the official test must be at least 5 (from 0 to 10).

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%). The students must assist to the seminars, and do the reports again, the following, year if they don t pass the subject.

The seminars and partial test qualification s will be saved for the second opportunity.

Final oficial test (3 hours, 40%).

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:

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

Sources of information

Basic Bibliography

SENDIÑA, I Y . PÉREZ MUÑUZURI, V, **Fundamentos de meteorología,**, Universidad de Santiago de Compostela, Servizo de Publicacións e Intercambio Científico,

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

Complementary Bibliography

PICKARD, G.L. y W. EMERY, **Descriptive Physical Oceanography**, 6ª edition. Pergamon Press.320 p.,

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

ANGELA COULING and the Open University course Team., **Ocean circulation**, Pergamon press, 238 p.,

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

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

Other comments

IMPORTANT MARKS:

The delivery of the individual seminar report for teacher assessment has a deadline of 7 days after the day when seminar took place. After that deadline no reports will be collected. In this circumstance, mark will be 0.

The delivery of any report by the student for teacher assessment implies student goes to PRESENTED mode automatically, regardless of the student sit for final exam.

The final mark of this matter will be an average of three marks (between 0 and 10): the partial exam (pe), the official exam (oe) and the average mark of the seminars, both in first and second opportunity, accordingly with: (se)

n = 0,2*pe + 0,4*oe + 0,4*se

The official exam as well as average mark of the seminars must be passed separately.

Repeat students should attend and deliver again seminars.

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	Bernabéu Tello, Ana María			
Lecturers	Alejo Flores, Irene Bernabéu Tello, Ana María Fontán Bouzas, Ángela			
E-mail	bernabeu@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 proceses 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 environmets.
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 A2 A5	B1 B2	C12 C13	D1 D2
Geological mapping and representation capabilities	A2 A3	B1	C12 C13	D2
Ability to prepare and present reports	A3 A5	B1 B5	C14	D1

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 poropermebility - 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	33	56
Autonomous problem solving	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
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
Autonomous problem solving	Throughout the theoretical development of the subject, questions and problems related to the contents covered will be raised that the student must solve autonomously.

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. This activity is of compulsory assistance given his experimental character	10	A1 A2 A3 A5	B1 B5	C12	D1 D2
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. This activity is of compulsory assistance given his experimental character	10	A2 A5	B1		D1 D5
Case studies	Group report that reflects the activities carried out during the practices, which will include objectives, methodology, results and conclusions. This activity is of compulsory assistance given his experimental character	25	A2 A3 A5	B1 B5	C13 C14	D1 D2
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
Autonomous problem solving	Resolve questions and problems related with theoretical contents that the students have to tackle of autonomous form.	15	A1 A2 A3	B1	C12 C13 C14	D1 D2

Other comments on the Evaluation

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

If one of the parts is not qualified, the grade that will be assigned will be the pure average divided by 2.

You must reach reach at least 50% of the maximum partial score in each of blocks to be able to compensate by taking the average with the qualification obtained in the others blocks.

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

2º chance

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

Global evaluation option

TThe 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).**

Other considerations:

The official exam dates can be found at: http://mar.uvigo.es/alumnado/*examenes/

Students who takes this subject are required to behave responsibly and honestly. It considers inadmissible any form of fraud (copy or plagiarism) directed to distort level of knowledges and skills reached in all type of proof, report or work.

Fraudulent conduct may suppose suspend the subject during 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

E.A. Hailwood, R. Kidd, **Marine Geological Surveying and Sampling**, 978-94-010-6763-8 (Print) 978-94-009-0615-0 (Online), Springer, 1990

E. J. W. Jones, **Marine Geophysics**, 978-0-471-98694-2, Wiley, 1999

H.D. Schulz, Matthias Zabel, **Marine Geochemistry**, 978-3-540-32143-9 (Print) 978-3-540-32144-6 (Online), Springer, 2006

M. E. Tucker, **Techniques in Sedimentology**, 978-0632013722, Wiley-Blackwell, 1991

Bernabeu, A.M., Abilleira, P., Fernández-Fernández, S., Lersundi-Campistegui, A. V., **Capítulo XXIX. Métodos para la evaluación del transporte de sedimentos en el litoral. En: Métodos Y Tecnicas En Investigacion Marina**, 9788430952083, TECNOS, 2011

K Mohamed, D. Rey, **Capítulo XXX. Técnicas de magnetismo ambiental de utilidad en el estudio de sedimentos marinos. En: En: Métodos Y Tecnicas En Investigacion Marina**, 9788430952083, TECNOS, 2011

B. Rubio, D. Rey, A.M. Bernabeu, F. Vilas, I. Rodríguez Germade, A. Ares, **Capítulo XXXI. Nuevas técnicas de obtención de datos geoquímicos de alta resolución. En: Métodos Y Tecnicas En Investigacion Marina**, 9788430952083, TECNOS, 2011

I.W. Croudace; R.G. Rothwell, **Micro-XRF Studies of Sediment Cores: Applications of a non-destructive tool for the environmental sciences**, Springer, 2015

CC W Finkl; C. Makowski, **Seafloor Mapping along Continental Shelves: Research and Techniques for Visualizing Benthic Environments**, Springer, 2016

Complementary Bibliography

http://walrus.wr.usgs.gov/pubinfo/margeol2.html,

Comission of marine cartography, **http://www.shoa.cl/ica/index.html**,

GEODAS Geophysical Data Management System of the NOAA National Geophysical Data Center (NGDC), **http://www.ngdc.noaa.gov/mgg/geodas/geodas.html**,

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 1/V10G061V01103
Geology: Geology 2/V10G061V01108
Coastal and marine sedimentary habitats/V10G061V01207
Sedimentology/V10G061V01205

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	Couce Fortúnez, María Delfina Besada Pereira, Pedro			
Lecturers	Besada Pereira, Pedro Castro Fojo, Jesús Antonio Couce Fortúnez, María Delfina Teijeira Bautista, Marta			
E-mail	delfina@uvigo.es 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, farmacological 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	Training and Learning Results			
To describe global cycles of the elements, including the input and output processes.	A1 A2 A3 A5	B1	C6	D1

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 enviroments. 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. Oxigen 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 compouds 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	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
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, 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 hours: P. Besada: monday, wednesday and thursday from 11:00 to 13:00 h D. Couce: tuesday, wednesday and thursday from 12:00 to 14:00 h
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, 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 hours: P. Besada: monday, wednesday and thursday from 11:00 to 13:00 h D. Couce: tuesday, wednesday and thursday from 12:00 to 14:00 h
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, 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 hours: P. Besada: monday, wednesday and thursday from 11:00 to 13:00 h J. Castro: tuesday and thursday from 10:00 to 13:00 h
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, 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 hours: P. Besada: monday, wednesday and thursday from 11:00 to 13:00 h D. Couce: tuesday, wednesday and thursday from 12:00 to 14:00 h

Assessment							
	Description	Qualification	Training and Learning Results				
Mentored work	Students will carry out a brief tutored work, evaluating the report presented and its presentation	25	A1 A2 A3 A5	B1	C6 C8	D1 D5	
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	C6 C7 C8	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.	25	A1 A2 A3 A5	B1 B2 B3 B4	C6 C7	D1 D5	

Objective questions exam	Final exam in which the theoretical contents of the subject worked in the master sessions and in the seminars will be evaluated. The contents of this subject are divided in two blocks (Chapters 1-7 and 8-13) so the test will also be divided into two parts. To get promoted the student must obtain a minimun of 3.5 out of 10 in each of the two parts into which the exam is divided.	40	A1 A2 A3 A5	B1	C6 C7 C8	D1

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 paragraphs whenever the required minimum is reached. If the required minimum is not reached the final qualification will be the one of the final exam.

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.

The percentages in each of the paragraphs will be maintained in the 2nd assesment call (July).

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

J. W. Moore, **Inorganic Contaminants of Surface Water**, Springer, 1991

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. Csákÿ, **Técnicas experimentales en síntesis orgánica**, 2, Síntesis, 2012

Journal of Natural Products,

Natural Products Reports,

Marine Chemistry,

Marine Pollution Bulletin,

Recommendations

Subjects that continue the syllabus

Marine contamination/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	Pedrol Bonjoch, María Nuria Conde Sieira, Marta			
Lecturers	Blanco Imperiali, Ayelén Melisa Conde Sieira, Marta Pedrol Bonjoch, María Nuria			
E-mail	pedrol@uvigo.es mconde@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.
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.
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	Training and Learning Results			
2. To know the relationships among the photosynthetic marine organisms and the marine environment by means of the study of changing physiological processes	A2 A3 A5	B1	C9 C10	D2 D5
3. To handle equipments and techniques to study plant physiology.	A2 A3 A5	B1 B4 B5	C11	D2 D4 D5
4. To understand the scientific methodology and the technologies applied to plant physiology research.	A3 A5			D2 D4 D5

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 A5	B1	C10	D4 D5
ANIMAL PHYSIOLOGY: 7. To know the mechanisms of acquisition and integration of the sensory information in marine animals	A2 A3 A5	B1		
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 occurr.	A2 A3	B1		
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 complete the planning. To be developed in the corresponding classroom, with all the enrolled students. Theory sessions will be supported by PowerPoint presentations. The educational materials will be at the disposal of the students on the Moovi platform.
Laboratory practical	The students will assist 3 sessions of practice in the laboratory: two sessions of 2.5 h each in Animal Physiology, and one session of 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	PLANT PHYSIOLOGY, through the platform Moovi: -virtual Forum of review: scientific Articles and websites of cytology and histology of photosynthetic marine organisms -virtual Forum of innovation and state of the art: scientific Articles and websites of physiological /ecophysiological subjects of photosynthetic marine organisms -virtual Exercises proposing questions for the final exam Each quality contribution to the forum can add up to 0.1 points to the final mark of PLANT PHYSIOLOGY, although they do not penalize 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, Monday and Friday from 11:00 to 12:00.
Lecturing	Resolution of doubts and difficulties to the group or personal if necessary. During the session and in tutorials, Monday and Friday from 11:00 to 12:00. 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.
Laboratory practical	Resolution of doubts and difficulties to the groups or personal if necessary. During the practices and in tutorials, Monday and Friday from 11:00 to 12:00.
Mentored work	Resolution of doubts and difficulties to the groups the groups or personal if necessary. In the classroom and in tutorials, Monday and Friday from 11:00 to 12:00.
Discussion Forum	Feedback through the platform Moovi
Tests	**Description**
Debate	Feedback through the platform Moovi

Assessment

	Description	Qualification	Training and Learning Results
Lecturing	Attendance will be evaluated 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.	0	A2 B1 D5 A3 B4 A5 B5
Laboratory practical	In the module of Plant Physiology (5% of the qualification) the evaluation will be by attendance and questions in the final exam. In the module of Animal Physiology (5% of the qualification) the evaluation will be by attendance.	10	A2 B1 C9 D1 A3 B4 C10 D5 A5 B5 C11

Mentored work	Volunteer for the module of Plant Physiology. (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).	0	A2 A3 A5	B1	C9 C10	D1 D2 D4 D5
Discussion Forum	Voluntary for the module Plant Physiology (Each quality contribution to the forums adds one tenth to the final grade of PLANT PHYSIOLOGY, although they do not penalize if you do not participate).	0	A2 A3 A5		C10 C11	D1 D2 D4 D5
Seminars	Attendance is mandatory for the continuous evaluation, given its experimental and practical nature. 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%). For the 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 mark up to two points.	20	A2 A3 A5	B1 B4 B5	C9 C10 C11	D1 D2 D4 D5
Objective questions exam	Mandatory	25	A2	B1	C9 C10 C11	D4
Essay questions exam	Mandatory	35	A2 A5	B1 B5	C9 C10	D4
Problem and/or exercise solving	Mandatory	10	A3	B4	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.

The exams of the Animal Physiology module will take place during class hours once the theoretical module is finished. The exams and problem-solving of the Plant Physiology module will be held once the theoretical module has been completed on the date, time, and place of the official evaluation exams, which will be published on the official website of the Faculty of Marine Sciences (http://mar.uvigo.es/alumnado/examenes/).

All exam and delivery dates will be published on the teledocency platform Moovi. **The evaluation tests of both modules in the 2nd opportunity** will be held on the date, time, and place of the official evaluation tests of the 2nd opportunity, which will be published on the official website of the Faculty of Marine Sciences (http://mar.uvigo.es/alumnado/examenes/). Students who take the continuous assessment may take the 2nd opportunity only for the failed module, and the mark of the approved module, practices and seminars will be kept.

Global 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 prior to the academic start. Given the experimental nature of the practicals, attendance is mandatory in order to be eligible for this evaluation option.

The evaluation tests (exams and problem solving) will be held on the date, time and place of the official evaluation tests, which will be published on the official website of the Faculty of Marine Sciences (http://mar.uvigo.es/alumnado/examenes/). The evaluation tests of both modules in the 2nd opportunity will be held on the date, time and place of the official evaluation tests of the 2nd opportunity, which will be published on the official website of the Faculty of Marine Sciences (http://mar.uvigo.es/alumnado/examenes/). Students who opt for a global evaluation may also take the 2nd opportunity only to the failed module, and the mark of the approved module will be kept. Failure to attend the practicals without a justified cause invalidates this possibility, as well as the opportunity for extraordinary evaluation (2nd opportunity).

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 kind of test, report or work is considered unacceptable. Fraudulent behavior may result in the suspension of the subject for an entire course. An internal record of these actions will be kept so that, in case of recurrence, a disciplinary file may be requested to be opened to the rector's office.

Sources of information

Basic Bibliography

Hill, R.W. et al, **Fisiología animal.**,

Moyes, C. y Schulte, P., **Principios de fisiología animal.**,

Withers, P.C., **Comparative Animal Physiology.**,

Complementary Bibliography

Randall,D. et al., **Fisiología animal.**,

Willmer, P., Stone, G., Johnston, I., **Environmental physiology of animals,**,

Azcón-Bieto J, Talón M, **Fundamentos de Fisiología Vegetal**, 2ª ed. Madrid: McGraw-Hill Interamericana,

Taiz L, Zeiger E, **Fisiología vegetal**, Publicacions de la Universitat Jaume I,

Lobban CS, Harrison PJ, **Seaweed Ecology and Physiology**, Cambridge University Press, New York,

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,

Taiz L et al., **Plant Physiology and Development, Sixth Edition**, Sinauer Associates, Inc.,

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

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			
Department				
Coordinator	Marañón Sainz, Emilio			
Lecturers	Marañón Sainz, Emilio Mouriño Carballido, Beatriz Teira Gonzalez, Eva Maria			
E-mail	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	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	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 N2 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. CO2 fluxes between ocean and atmosphere. The biological pump and the solubility pump. Global C cycle: current unbalances.
Unit 7. The calcium carbonate cycle.	CaCO3 oceanic budget. Carbonate saturation. Production, export and redissolution of CaCO3. 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.	Biomass, production and growth of phytoplankton. Observation in oceanography: formulation and testing of hypotheses. Ecological and biogeochemical role of iron. Distribution patterns of diatoms and coccolithophores. Biogeochemistry of coastal eutrophication.
Practical session program.	Data analysis of phytoplankton cell size, abundance and metabolism. Graphical representation of xyz distributions. Open-ocean nitrogen budgets. Modelling the global carbon cycle using computer models. Case analysis.

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	Using data and scientific articles, specific topics are exlored in detail. Subjects tackled include, amongst others, the ecology and biogeochemical role of diatoms and coccolithophores, the ecological and biogeochemical importance of iron, and ocean acidification.
Problem solving	Practical cases are solved using real data presented numerically and graphically.
Practices through ICT	Numerical modelling of the carbon biogeochemical cycle. Analysis of data on the size-scaling of phytoplankton abundance, biomass and metabolism.

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	Students write a short assay in which they provide a critical synthesis of a scientific article. The clarity and correctness of the writing, as well as the rigour in the use and application of scientific concepts, are particularly valued. The mark obtained in June is maintained for the July call. Upon consultation with the course's coordinator, students may resubmit this work for the July call.	20	B1 C10 D1 D2
Problem solving	Students solve practical cases similar to those used during the practical sessions. The mark obtained the June call is maintained for the July call. Upon consultation with the course's coordinator, students may resubmit this work for the July call.	20	B1 C10 D1 B4 C11 D2
Objective questions exam	Intermediate test with closed answers (true/false, multiple choice) that assess the acquisition of knowledge and skills covered during lectures and seminars during the first half of the course.	20	A1 B1 C10 B4
Problem and/or exercise solving	Final written test includes short questions and practical cases. The test is designed to assess the acquisition of knowledge and skills covered during the lectures, seminars and practical sessions.	40	A1 B1 C10 B4 C11

Other comments on the Evaluation

The date, time and place of exams will be published in the official web 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.

The mark obtained in the two tasks (synthesis of a scientific article and case resolution) is kept for the 2nd opportunity call. However, the marks obtained in the intermediate test and in the final written test are NOT kept for the 2nd opportunity call. Therefore, all students who make use of the second call must take the final exam, which represents 60% of the total mark for the course. It is possible, after consulting with the coordinator, to deliver the two tasks again for consideration in the second call.

All enrolled students must deliver the two tasks, because the marks obtained in earlier academic years are not kept.

Students must behave honestly and responsibly. Any form of copying or plagiarism, intended to alter the level of acquired knowledge and abilities, in exams, evaluations, reports or any other kind of student work is completely unacceptable. Fraudulent behaviour may result in the failing of the course for a whole academic year. An internal dossier of these activities will be kept and, in cases of reoffending, the University Rectorate will be asked to open a disciplinary enquiry

Sources of information

Basic Bibliography

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

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

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

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

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

Gasol JM, Kircvhman (Eds.), **Microbial ecology of the oceans**, 3a, Wiley-Blackwell, 2018

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	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 A3 A4		C3 C4	D1 D2
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 A3 A4	B1	C4	D1 D2
The student should understand and distinguish the advantages and disadvantages of the several wind, wave and tide related energy systems available	A2 A3		C3 C4	D1 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 A4		C4	D1 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, heigh 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 mar. Newton Equilibrium tide theory. Dynamyc 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	PPractices 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 objetives and purpose of the seminar. The students will have a guide on the TEMA platform describing all que 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 tasas to do, explain the different instruments and technic, and monitors the students' use of such instruments
Tests	**Description**
Objective questions exam	A multiple option test to calíbrate 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 (and evaluated)	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, 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 during two academic courses (the current one 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

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Pond, S y Pickard,GL, **Introductory Dynamicall oceanography**, 3, Pergamon Press, 1991

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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 oceanografia Fisica**, 1, Anthia., 2008

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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 Nombela Castaño, Miguel Angel Pérez Arlucea, Marta María			
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 environmets.
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 oceanographyc 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 B4	C13 C14	D5
4. To know the basic techniques of compositional analysis and physical properties of sedimentary cores	A2 A3	B2 B4	C13 C14	D5
5. To know and apply the techniques of geochemical characterization in sediments.	A2	B2 B4	C13 C14	D1 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.- Electromacnetic and radiometric surveying and its application to marine research.
THEMATIC UNIT IX-: SAMPLING SEDIMENTS AND ROCKS METHODS IN SHELF AND DEEP SEA ENVIRONMENTS. GEOTHECNICS TECHNICS	THEME 11.- Sampler methods for Particulate Suspended Matter and bottom sediment samples at deep environments. THEME 12.- Deep sea coring technics. methods. Ocean Drilling Projects. THEME 13.- Geophisical observation into the corers.
THEMATIC UNIT X-: OCEANOGRAPHY INFRAESTRUCTURES	THEME 14.: Sampler platforms in geological oceanography. THEME 15: New technology in submarine observatoties.
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 neccesary 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 is MANDATORY.

Mentored work	In groups of two or three 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 is 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 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 "cruisse report". Some of the collected data will be worked out in practical sessions. The activity is 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 is MANDATORY. The correct implementation of the exercises proposed in these practices will be evaluated.	15	A2 B2 C13 D1 A3 B4 C14
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 activuty is MANDATORY	15	A2 B5 C13 D1 A3 C14 A4
Seminars	Seminar attendance is MANDATORY. The correct implementation of the exercises proposed in these seminars will be evaluated.	10	A2 B2 C13 D1 A3 B4 C14
Field practice	Attendance at the sea survey is MANDATORY. The correct implementation of the exercises proposed in these practices will be evaluated.	10	A2 B2 C13 D5 A3 B4 B5
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 throughoutthe course.	10	A2 B2 C13 D1 A3 B4 C14 D5 A4 B5
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 B2 C13 D1 A3 B4 C14 D5 A4 B5

Other comments on the Evaluation

Continuous assesment option

It will be **necessary to obtain a mínimum of 5 points (out of 10)** in all the Methodologies/Tests to carry out the weighting and pass the subject.

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 studies excursion, attendance at them is mandatory to be eligible for this evaluation option. **Failure to attend any of this activities, with no justified cause invalidates this possibility, as well as the opportunity for extraordinary evaluation (2nd opportunity).**

Second opportunity assesment (July)

Exams of each of the Items NOT passed in the 1st opportunity evaluation.

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

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

Basin Analysis/V10G061V01406
Applied marine geology/V10G061V01403

Subjects that are recommended to be taken simultaneously

Physical oceanography II/V10G061V01307

Subjects that it is recommended to have taken before

Geology: Geology 1/V10G061V01103
Geology: Geology 2/V10G061V01108
Coastal and marine sedimentary habitats/V10G061V01207
Sedimentology/V10G061V01205
Geological oceanography I/V10G061V01303

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	Moldes Moreira, Diego Nieto Palmeiro, Óscar			
Lecturers	Calle González, Inmaculada de la 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 studing 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 pollutants in the water column, sediments and marine organisms.	Sampling methods. Methods for sample preparation and determination in the water column. Extraction, purification and determination methods of pollutants in sediments and marine organisms.
Analysis of marine biotoxines.	Chemical structure of marine biotoxines. Toxicity of marine biotoxines. 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 will make some lab practices regarding the analysis of environmental pollutants and will present the corresponding report.
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	

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 assesed.	2.5	A5	B4	D2
Studies excursion	The students will visit a wastewater treatment facility. After that, a brief questionaire 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 quizs 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 B1 C6 D1 A4 B4 C7 D5 A5 C8
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 B1 C6 D1 A4 B4 C7 A5 C8
Report of practices, practicum and external practices	The students will present an original report of the results obtained in the lab practices	10	A3 C6 D1 A4 C7 D2 A5 C8
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 B1 C7 D1 A5 B4

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/

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 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

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

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

García Estévez J.M., Olabarría C., Pérez S., Rolán Álvarez E., Rosón G., **Métodos y Técnicas en Investigación Marina**, Tecnos-Anaya, 2011

Gianguzza A., **Marine chemistry: an environmental analytical chemistry approach**, Springer, 2012

Complementary Bibliography

Clark, Robert B, **Marine Pollution**, Oxford University Press, 2001

Mackenzie L. Davis, **Water and Wastewater Engineering. Design Principles and Practice**, McGraw-Hill, 2010

José A. Ibáñez Mengual, **Desalación de aguas**, Instituto Euromediterráneo del Agua, 2009

Se-Kwon Kim, **Springer Handbook of Marine Biotechnology**, Springer London Ltd., 2014

A. Aminot, M. Chaussepied, **Manuel des Analyses Chimiques en Millieu Marin**, Centre National pour l'Explorations des Oceanes. B, 1983

OECD, **Marine Biotechnology Enabling Solutions for Ocean Productivity and Sustainability**, OECDiLibrary, 2013

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

Chemical oceanography I/V10G061V01204
Chemical oceanography II/V10G061V01209
Chemistry applied to the marine environment I/V10G061V01304

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	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
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.
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	C11	D5
Dominate the aquaculture auxiliary techniques (phytoplankton and zooplancton) 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
Recognise and analyse problems and propose solution strategies	A2 A3	B3 B4	C11	D1 D5
Identify and control problems of environmental impact and marine pollution caused by marine aquaculture	A2 A3 A5		C8	D1 D5
Design, control and management of culture centres and recovery of marine endangered Species	A2 A5	B3 B4	C11	D5
Known the operational details of marine companies, recognise specific problems and propose solutions	A3			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.
ZOOPLANCTON 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. Cetaria 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 studients 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 practics will be used to explain the techniques of cultivation and laboratory culture. To take full advantage of these practices, the student will wrote 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 its 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 wuill 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 required to approve.	10	A2 A3 A5	B4	D1 D5
Laboratory practical	Laboratory practics are considered an essential part of the subject. Practics will be evaluatted by the attendance and assistance of students to them. Laboratory practics are an obligatory activity.	5	A5	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 A5	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 A3 A5	B3 B4	D1 D5

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 calification 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/

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., **Acuicultura. Texto introductorio**, 2016, ACRIBIA S.A., 2016

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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 contamination

Subject	Marine contamination			
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 Delgado Núñez, Cristina			
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 A3 A4 A5	B2 B3 B4	C8 C11	D1 D2 D5
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 A3 A4 A5	B2 B3 B4	C8 C11	D1 D2 D5
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 A3 A4 A5	B2 B3 B4	C8 C11	D1 D2 D5

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 annoxia. 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 campounds (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: Sorces, distribution, bioaccumulation and biomagnification. Toxicity. Methylmercury. 8. Trace metals II. Copper, lead, cadmium. Sources, concentrations in marine compartments, toxicity. Trobutyltin (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. Lisosomal 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 ausence. Biological indices in communities.
Manage¡ing 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 questionary and a practical case available through TEMA. 2. handing over the questionary 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 ellaborated and handed over to the teacher by the date of the final exame. Attendance is mandatory.

Personalized assistance	
Methodologies	**Description**
Lecturing	Power point presentations in the classroom; personal assitance 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	Questionaire ellaboration 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 exame. Two tests will be designed: one with 30% along the course and another final with 40% coinciding with the call for 1st opportunity.	70	A2 A3 A4 A5	B2 B3 B4	C8 C11	D1 D2 D5
Seminars	Mandatory presence in the seminars. Delivery of the corresponding individual questionnaires	15	A2 A3 A4 A5	B2 B3 B4	C8 C11	D1 D2 D5
Laboratory practical	Mandatory presence in the practices and an individual report	15	A2 A3 A4 A5	B2 B3 B4	C8 C11	D1 D2 D5

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, manteining 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
Clark, R,B., **Marine Pollution**, 5ª ed., Clarendon Press. Oxford, 2001
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			
Department				
Coordinator	Roson Porto, Gabriel			
Lecturers	Roson Porto, Gabriel Souto Torres, Carlos 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	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 develope 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 @alumnos.uvigo.es.
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 @alumnos.uvigo.es.
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 @alumnos.uvigo.es.
Tests	**Description**

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 @alumnos.uvigo.es.
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 @alumnos.uvigo.es.

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), 40% of an intermediate test (ie), and a 20% from the seminars test (st), according to the formula:

N=0.4*ot+0.2*ie+0.4*st

The grade in the official test must be at least 5 (from 0 to 10).

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%). The students must assist to the seminars, and do the reports again, the following, year if they don t pass the subject.

The seminars and partial test qualification s will be saved for the second opportunity.

Final oficial test (3 hours, 40%).

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:

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

Sources of information

Basic Bibliography

Gabriel Rosón, **Las Ecuaciones del océano: Teoría y problemas resueltos.**, 9788481588477, Universidade de Vigo, Servicio de Publicaciones, 2020

CUSHMAN-ROISIN, B., **Introduction to Geophysical Fluid Dynamics. Physical and Numerical Aspects**, 9780120887590, Ray Henderson & Deirde Cavanaugh. U.S.A., ACADEMIC PRESS, 2009

POND, S., G.L.PICKARD, **Introductory Dynamical Oceanography**, 9780750624961, Pergamon Press. Oxford, Butterworth-Heinemann, 1983

Periáñez, Raúl, **Fundamentos de oceanografía dinámica**, 8447212351, 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	Gago Duport, Luís Carlos			
Lecturers	Alejo Flores, Irene Diz Ferreiro, Paula Francés Pedraz, Guillermo Gago Duport, Luís Carlos Gil Lozano, Carolina Pérez Arlucea, Marta María			
E-mail	duport@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 environmets.
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 antrophic 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	
1. Geological risks associated with the marine and coastal environment. (6 hours).	Introduction 1.1. Definition and types of geological risks. 1.2. Coastal and submarine risks linked to internal geodynamics. 1.3. Coastal and submarine risks linked to external geodynamics. 1.4. Sea level changes.
2. Seawater as a source of resources and environmental control. (4 hours).	2.1. Physicochemical and compositional characteristics of seawater. 2.2. Urey's equation: the terrestrial thermostat and the stability of the ocean's pH. 2.3 Processes for obtaining salts: sequential evaporation of seawater. Desalination and brine recovery plants. 2.4. Practical example: Recovery of lithium from seawater: reality or utopia?
3. Genesis, exploration and exploitation of marine geological resources (8 hours).	3.1 Fossil hydrocarbons: oil, gas and gas hydrates. 3.2 Submarine mining: manganese nodules and crusts. Metallic polisulfides. 3.3 Exploration of the ocean floor: geohabitats. 3.4 Exploration of the oceanic subsoil in IODP expeditions.
Seminars.	Seminar I. Stratigraphic control in oil exploration wells (6 hours). Seminar II. Geological capture of atmospheric CO2. (2 hours). Seminar III. Techniques for mineralogical and geochemical analysis of marine sediments. (2 hours). Seminar IV. Practical case: aquifer salinization models on the coast of Almería (4 hours).
Field trips.	Two field trips to analyse flood risk and anthropic effects along different Galician coastal areas (16 hours).
Laboratory practices.	Laboratory practices: Crystallization processes applied to the formation of marine mineral resources. (4 hours.).

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.	5	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.	35	A1 A3 A5	B1	C12 C14	
Problem and/or exercise solving	Reports of the seminars	35	A2 A3	B1 B4	C12	D1
Report of practices, practicum and external practices	Report of the practices	5	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

Other comments on the Evaluation

- Attendance at practices, seminars and field trips is mandatory.

- In case of non-attendance at any of the seminars, the corresponding report cannot be submitted.

-A number of absences of more than 20% in seminars will interrupt the c**ontinuous evaluation proces**s.

-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).

-**In the global evaluation**, 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).

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 35% of the remaining grade.

Second chance evaluation

The exam will have the same characteristics and fulfill the same requirements as **the global assessment of the first opportunity**

Exam dates and classes can be consulted on the website of the Faculty of Marine Sciences.

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
Beatley, T., **An Introduction to coastal zone management**, 2º ed, Island Press, 2002
Burns, R. (Ed.), **Marine Minerals. Reviews in Mineralogy, vol 6,**, Mineralogical Society of America, 1979
Craig, J.R., Vaughan, D.J. & Skinner, B.J., **Recursos de la Tierra y el Medio Ambiente**, 4º ed., Pearson Education, 2012
Hsu, Chang Samuel., and Paul R. Robinson, **Handbook of Petroleum Technology**, 2ª ed., Springer International, 2017
Chester, Roy,, **Marine Geochemistry,**, 2ª ed., Oxford: Blackwell Science, 2000
Earney, P.C.E., **Marine Mineral Resources**, Taylor and Francis, 2012
Complementary Bibliography
Couper, A, **The Times Atlas and Encyclopaedia of The Sea**, Times Book Ltd, 1989
Cronan, D.S., **Handbook of Marine Mineral Deposits,**, CRC Press,, 1999
Seibold, E.; Berger, W.H., **The sea floor. An introduction to marine geology,**, 2ª ed., Springer, 2017
Keller, E.A., Blodgett, R.H, **Riesgos Naturales: Procesos de la Tierra como riesgos, desastres y catástrofes,**, Pearson Educación, 2007

Recommendations
Subjects that continue the syllabus
Basin Analysis/V10G061V01406
Geographic analysis methods/V10G061V01409
Subjects that are recommended to be taken simultaneously
Marine and coastal management/V10G061V01404
Subjects that it is recommended to have taken before
Coastal and marine sedimentary habitats/V10G061V01207
Geological oceanography I/V10G061V01303
Geological oceanography II/V10G061V01308

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 environmets.
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	Training and Learning Results			
Knowledge and critical assessment of the sources of information for coastal and sea planning and management	A2 A3	B1 B4		D1 D3
Elaborate land use/cover maps	A4	B4 B5	C13 C14	
Capacity to understand the application of the corresponding sectorial legislations	A3 A4	B1 B4 B5		D3 D5
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 schedulled sesions.
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 aproach 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

	Description	Qualification	Training and Learning Results			
Lecturing	The evaluation will consist of a written exam. To be approved, the student need to obtain a minimum of 4.5 points on the condition that the global average reaches 5 points.	40	A2 A3	B1		D1 D3 D5
Seminars	Assistance is compulsory. To be approved, the student need to obtain a minimum of 4.5 points on the condition that the global average reaches 5 points.	30	A3 A4	B4	C13 C14	D1 D3 D5
Studies excursion	Delivery of a memory of field/questionnaire	10	A3	B1	C13 C14	D1 D3 D5

Practices through ICT	Assistance is compulsory. 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, memoires, etc. the same day at the end of the practice.	20	A4	B5	D1 D3 D5

Other comments on the Evaluation

Date, timeand 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 consider 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.

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 opcio**, 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				
Fisheries				
Subject	Fisheries			
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	Training and Learning Results		
Understand the population processes that affect the dynamics of living resources		C11	D1 D5
Understand the basic methods of fisheries resource assessment	A1	C11	D1
Understand and apply basic methods of fitting mathematical models for parameter estimation, population dynamics and assessment of marine living resources	A1	C11	D1 D5
Develop skills to use basic fisheries computer programs	A1	C11	

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	It will available mainly in the tutoring schedule, except for unforeseen circumstances. It is recommended that the student contact the teacher about when to carry out the tutoring. Tutoring hours: Thursday, from 11:00 to 13:00 h and from 16:00 to 18:00 h and Friday, from 11:00 to 13:00 h. Outside of these hours according to availability of the teacher.
Laboratory practical	It will available mainly in the tutoring schedule, except for unforeseen circumstances. It is recommended that the student contact the teacher about when to carry out the tutoring. Tutoring hours: Thursday, from 11:00 to 13:00 h and from 16:00 to 18:00 h and Friday, from 11:00 to 13:00 h. Outside of these hours according to availability of the teacher.
Practices through ICT	It will available mainly in the tutoring schedule, except for unforeseen circumstances. It is recommended that the student contact the teacher about when to carry out the tutoring. Tutoring hours: Thursday, from 11:00 to 13:00 h and from 16:00 to 18:00 h and Friday, from 11:00 to 13:00 h. Outside of these hours according to availability of the teacher.
Problem solving	It will available mainly in the tutoring schedule, except for unforeseen circumstances. It is recommended that the student contact the teacher about when to carry out the tutoring. Tutoring hours: Thursday, from 11:00 to 13:00 h and from 16:00 to 18:00 h and Friday, from 11:00 to 13:00 h. Outside of these hours according to availability of the teacher.

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 ofthe 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), 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).

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

King, M., **Fisheries biology, assessment and management**, Blackwell Publishing, 2007
Sparre, P. y Venema, S. C., **Introduccón a la evaluación de recursos pesqueros tropicales. Part 1**, FAO, 1997
Jennings, S.; Kaiser, M. J. and Reynolds, J. D., **Marine Fisheries Ecology**, Blackwell Science, 2001

Complementary Bibliography

Hilborn, R. and Hilborn, U., **Overfishing. What everyone needs to know**, Oxford University Press, 2012

Recommendations

Subjects that it is recommended to have taken before

Statistics/V10G061V01107
Marine Ecology/V10G061V01206

Other comments

To carry out the exams the student must have a calculator able to perform linear regression.

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	#EnglishFriendly Spanish			
Department				
Coordinator	García Gil, María Soledad			
Lecturers	Diz Ferreiro, Paula García Gil, María Soledad Pérez Arlucea, Marta María			
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
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.
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 environmets.
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	Training and Learning Results			
Transmit information of form written, verbal and graphic for audiences of diverse types	A4 A5	B1 B5	C14	D1
Caracterice and mapping of marine bottoms, marine sub-bottoms and coastal areas-continental	A3	B4 B5	C13	D1 D5
Interpretation of paleoceanographic proxies	A3 A4	B1 B5	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 adquire 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 classroon 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 contents of the master sessions will be practiced with different exercises (recognition of sedimentary basins types in different marine contexts, stratigraphic surfaces. (Assistance and reports are mandatories, 30% 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	B4	C14	D1
Seminars	Reports of Seminars	40	A5	B1 B5	C14	D1 D5
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	B4	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.

Global assesment option

The same percentages indicated above will be maintained. However, given the experimental nature of the seminars and practicals, non-attendace 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

Coastal and marine sedimentary habitats/V10G061V01207
Sedimentology/V10G061V01205
Geological oceanography II/V10G061V01308

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 Galician			
Department				
Coordinator	Domínguez Martín, José Jorge			
Lecturers	Domínguez Martín, José Jorge Kim , Sin-Yeon			
E-mail	jdguez@uvigo.es			
Web	http://jdguez.webs.uvigo.es/			
General description	This is a special Zoology which studies the main fish and shelfish 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	Training and Learning Results			
Ability to apply knowledge in practice	A1 A2 A3 A4 A5	B2 B4 B5	C9 C10 C11	D1 D2
Research skills.	A1 A2 A3 A4 A5	B2 B4 B5	C9 C10 C11	D1 D2
Identification of fish and shellfish. Knowledge of the external and internal morphology of fish and shellfish. Knowledge of the distribution, habitat and lifestyles of fish and shellfish. Knowledge of reproduction and life cycles of fish and shellfish. Management of fishery resources and shellfish. Biological bases necessary for the study of Fisheries and Aquaculture.	A1 A2 A3 A4 A5	B2 B4 B5	C9 C10 C11	D1 D2

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. Moult 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 to 2. 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.

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**, 14, McGraw-Hill, 2009

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	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 extraordinary evaluation (2nd opportunity).**

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:(Dirs), **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.gal 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 A3	B1 B2	C1 C4	D1 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 A5	B3 B4 B5		

Contents

Topic

1.-INTRODUCTION To THE Objective TELEDETECTION 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.	1.1.- Teledetection in Oceanography 1.2.- Brief history of the space observation of the oceans 1.3.- Possibilities for the oceanography 1.4.- Temporary and space scales of the phenomena of interest.
2.- PHYSICAL PRINCIPLES OF THE Objective TELEDETECTION In this unit pretends that the student know the principles of the physics of the electromagnetic radiation, his interaction with the atmosphere and the ocean, as well as the spectral characteristics of the covers.	Contents 2.1.- Radiation and electromagnetic spectrum. 2.2.- Terms and units of measure. 2.3.- Principles of the electromagnetic radiation. 2.4.- *Caractrísticas Spectral of the covers. 2.5.- Interaction of the atmosphere with the radiation. 2.5.1.- Absorption. 2.5.2.- Dispersion. 2.5.3.- Broadcast.
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 steps required from the capture of an image by a sensor until his application and utilisation by part of an user. Finally they describe the most used satellites.	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. Photography *aerea and *Drones
4.- *ANALISIS And DIGITAL TREATMENT OF Objective IMAGES: In this unit establish the principles of visual and digital interpretation as well as the processing of the information with the object to delete errors (correction), improve some appearance of the information obtained (enhance) or obtain other parameters from the data of radiance (transformations). Finally it will enter to the student in the digital classification and the integration of information in systems of geographic information.	Contents: 4.1. Visual analysis 4.1.1. Criteria of Interpretation 4.2. Digital treatment 4.2.1. Digital image 4.2.2. Corrections 4.2.3. It enhance 4.2.4. Transformations
5.- APPLICATIONS - Colour of the Ocean - Temperature - Poured and Pollution - Red Tides and Phytoplankton - Oceanic Circulation - polar Thaw - Studies of Choral - fluvial Feathers	Aims: In this last unit enumerate the applications of the teledetection in meteorology and study of the oceans. In each one of these applications makes a description of the physical principles that make it 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

*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 theworks scheduled . His main aim is to clear the concepts that have been explained inthe 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 practices is it of study directed. They are of mandatory assistance.	15	A2 A3 A4	B2 B3 B4	C4	D2
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 A4	B1 B3	C1 C4	D1 D2
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	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 B5	C4	D1

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 Lactures 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.

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**, Taylo & 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	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 ROMS model.	Introduction. Model input structure. Bathymetry, forcing and boundary condition.
Examples with ROMS.	Run and analysis of simple examples.
Nesting with ROMS.	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 consecution of different goals (preparation of the input data, run of the model, preparation of graphics with the results, etc...) will be evaluated following a previously informed rubric and/or a test.	20		B3	D2
Seminars	Evaluarase a destreza en desenrrolo de distinto código computacional (integración numérica de ecuaciones diferenciais sinxelas, código de visualización, etc). The hability to develop of computational code will be tested (numercial integration of simple differential equations, visualization tools, etc).	40	A5		D1 D2
Presentation	The previous qualification will be given depending on a final presentation.	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.

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 *podrÃ*n suppose suspend the subject during a complete course. CarryÃ 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			
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 fihseries.	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. Amoebae. Apicomplexa. Ciliates. II.3. Microsporidia. II.4. Myxosporidia. II.5. Protozoa of bivalve molluscs: Perkinsus, Haplosporidia, Marteilia.
BLOCK III. HELMINTHS AND ARTHROPODS	III.1. Plathelminths: Monogenea. Digenea. Cestoda. Turbellaria. III.2. Nemathelminths: 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	20	30	50
Laboratory practical	20	50	70
Seminars	10	20	30
*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.

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.

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 (20%) and Microbiology (20%).	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 (20%) and Microbiology (20%). 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 (Parasitology 10%; Microbiology 10%).	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.

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

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
Loker, E.S. & Hofkin, B.V., **Parasitology: A Conceptual Approach**, 2015
Austin, B., **Infectious Disease in Aquaculture**, 2012
LeBoffe, M.J. & Pierce, B.E., **Microbiology: Lab Theory and Appplication**, 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 Spanish Galician			
Department				
Coordinator	Presa Martínez, Pablo			
Lecturers	Presa Martínez, Pablo			
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. 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, physical-chemical, oceanographic and biological (Biochemical, Physiology, Genetics, Ecology, etc.) disciplines. The genetic "approach" is crucial in the management of the 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 as a central paper 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	Training and Learning Results			
Cognitive (knowledge): comprehension of the concepts and the basic processes of genetic variability, genetic differentiation and evolutionm 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 tp 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. Evaluation of the level of genetic knowledge of the students. Analysis of the program. Taking of decisions on the process of learning and the system of evaluation of the course. Review of basic genetic concepts.
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. Genetic improvement in aquaculture.
CHAPTER II. Population genotyping.	Strategies of genotyping for populations. Types of molecular polymorphisms. Register and tabulation of the polymorphism.
CHAPTER III. Populational genetic structure.	The ideal population and the populational equilibrium. Systematic factors of change: mutation, migration, selection. Factors of random change or dispersive: 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.	Amplificacion Of DNA, migration by electroforesis 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.	Populational genotyping, tabulation of data. 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	12	12	24
Problem and/or exercise solving	0	14	14
Report of practices, practicum and external practices	0	6	6
Presentation	1	10	11
Objective questions exam	2	16	18
Debate	2	2	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 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 syncronously or asyncronously, 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, for its conceptual apprehension; consists on problems, multiple questions or practical cases with simple mathematical applications.	20	A3	B2 B3	C9 C11	D2
Report of practices, practicum and external practices	Preparation of a report of the practice made, with illustrations of the proofs, statitistical tests performed and the conclusions.	20	A1	B4	C10	D1
Presentation	Presentation and defence in class 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
Objective questions exam	Written exercise of short practical questions comprising the main phenomena studied in the course.	30	A1 A2 A3	B1 B2	C1 C11	D1
Debate	Active participation in classes, seminars and practices, with reasoning and scientific and ethical position on the exploitation of living marine resources.	10	A1 A3	B1	C10	D5

Other comments on the Evaluation

Continuous evaluation option (regular): the contents taught in the master classes and in the experimental and computer practices, will be evaluated respectively through the daily resolution of homework (electronic correction), the execution and attitude towards the practices (performance face-to-face), the final report of the practices (memory correction) and the oral defense of the practical case (on the established day of the last problems seminar). In addition, an exam of objective questions is proposed for all students with a weight of 30% of the final grade.

Global assessment option: for those students who were unable to follow the subject daily in person for personal or work reasons, an extraordinary written test will be given, coinciding on the date and place with the regular continuous assessment written exam. Given the experimental nature of the practices, attendance at them is mandatory to be eligible for this evaluation option.

Extraordinary evaluation option (2nd opportunity): it is carried out on the second date of July of the academic year and its requirements do not differ from the continuous evaluation or the global evaluation, that is, it is necessary to previously carry out the practices and they are maintained. the marks of the continuous evaluation obtained during the course, except those of the written exam of the first call.

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

Hedrick, P.W., **Genetics of Populations**, 4th, Jones & Bartlet Publ, 2011

Avise, J., **Molecular Markers: Natural Hist ory and Evolution**, 2nd, Sinauer Associates Inc.,U.S., 1994

A. Moya y A. Fontdevila, **Introducción a la genética de poblaciones**, New edition, Sintesis Editorial, 2018

Matthew Hahn, **Molecular Population Genetics**, 1st, Oxford University Press Inc, 2018

Andy Beaumont , Pierre Boudry, Kathryn Hoare, **Biotechnology and Genetics in Fisheries and Aquaculture**, 2nd, John Wiley and Sons Ltd, 2010

Complementary Bibliography

Recommendations

Other comments

The students immatriculated 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. It is advisable 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
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	Training and Learning Results			
Learn to use programs of Treatment of Images of Satellite in marine applications. 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.	A2 A3 A4 A5	B1 B2 B3 B4 B5	C1 C4	D1 D2

Contents	
Topic	
1.-INTRODUCTION To THE TELEDETECTION Objective 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.	1.1.- Teledetection in Oceanography 1.2.- Brief history of the space observation of the oceans 1.3.- Possibilities for the oceanography 1.4.- Temporary and space scales of the phenomena of interest.

2.- PHYSICAL PRINCIPLES OF THE TELEDETECTION In this unit pretends that the student know the principles of the physics of the electromagnetic radiation, his interaction with the atmosphere and the ocean, as well as the spectral characteristics of the covers.	Objective Contents 2.1.- Radiation and electromagnetic spectrum. 2.2.- Terms and units of measure. 2.3.- Principles of the electromagnetic radiation. 2.4.- *Caractrísticas Spectral of the covers. 2.5.- Interaction of the atmosphere with the radiation. 2.5.1.- Absorption. 2.5.2.- Dispersion. 2.5.3.- Broadcast.
3.- ELEMENTS OF A SYSTEM OF 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 steps required from the capture of an image by a sensor until his application and utilisation by part of an user. Finally they describe the most used satellites.	Objective 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. Photography *aerea and *Drones
4.- *ANALISIS And DIGITAL TREATMENT OF IMAGES: In this unit establish the principles of visual and digital interpretation as well as the processing of the information with the object to delete errors (correction), improve some appearance of the information obtained (enhance) or obtain other parameters from the data of radiance (transformations). Finally it will enter to the student in the digital classification and the integration of information in systems of geographic information.	Objective Contents: 4.1. Visual analysis 4.1.1. Criteria of Interpretation 4.2. Digital treatment 4.2.1. Digital image 4.2.2. Corrections 4.2.3. It enhance 4.2.4. Transformations
5.- APPLICATIONS - Colour of the Ocean - Temperature - Poured and Pollution - Red Tides and Phytoplankton - Oceanic Circulation - polar Thaw - Studies of Choral - fluvial Feathers	Aims: In this last unit enumerate the applications of the teledetection in meteorology and study of the oceans. In each one of these applications makes a description of the physical principles that make it 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

*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 theworks scheduled . His main aim is to clear the concepts that have been explained inthe 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 B2 C4 D2 A3 B3 A4 B4
Seminars	It will make a follow-up *individualizado of technicians and contents for the development of the works scheduled. The seminars are of compulsory assistance.	10	A2 B2 C1 D1 A3 B3 C4 D2
Lecturing	The lesson *magistral 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 B1 C1 D1 A3 B3 C4 D2 A4
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. This work and his presentation can be substituted by a theoretical and practical proof in assessment of the professor.	30	A2 B2 C4 D1 A4 B3 A5 B4 B5
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 B2 C4 D1 A5 B3 B4
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 B1 C4 D1 A3 B4 A4 B5

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 *obigatorio 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 *obliatorias 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.&*nbsp; 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 *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 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**, Taylo & 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	Souza Troncoso, Jesús			
Lecturers	Souza Troncoso, Jesús			
E-mail	troncoso@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.
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 environmets.
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			
The practices are diverse and depending on the company where they are carried out, one or another competence will be achieved.	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

Contents

Topic	
The contents of the external academic practices have to otain 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.

Planning

	Class hours	Hours outside the classroom	Total hours
Practicum, External practices and clinical practices	150	0	150

*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 formative project in that it concretises the realisation of each external academic practice will have to fix the educational aims and the activities to develop. The aims will establish considering the basic capacities, generic and/or specific that it has to be obtained by the student.

Personalized assistance

Methodologies	Description
Practicum, External practices and clinical practices	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

Practicum, External practices and clinical practices	The advisor of the collaborator entity will realise and will send to the academic advisor of the university a final report, to the conclusion of the practices, that will collect the number of hours realised by the student and in which it will be able to value the different appearances referred so much to the generic competitions how to the specific, foreseen in the corresponding formative project. The student will elaborate and will do delivery to the academic tutor of the University a final memory (1-2 pages), to the conclusion of the practices with the seen well of the tutor of the company. The academic advisor will evaluate the practices developed, according to the reports of the student and of the advisor of the Company, filling the corresponding report of assessment with the final note.	100

Other comments on the Evaluation

All the procedure can find in the BOE number 297 (10/11/2010) and in the guideline of External Practices of the Marine Sciences Faculty.

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 evaluation will be carried out taking into account all the Tutors' reports and the student's personal report.

Sources of information

Basic Bibliography

Complementary Bibliography

Recommendations

Other comments

It is very important to follow the instructions of the Tutor of the Company, realise all the activities that are requested to the student.
Adopt an attitude of collaboration in all the tasks entrusted from the start of the practice.

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 Spanish Galician English			
Department				
Coordinator	Francés Pedraz, Guillermo			
Lecturers	Francés Pedraz, Guillermo			
E-mail	gfrances@uvigo.gal			
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 environmets.
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.

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

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.

Planning

	Class hours	Hours outside the classroom	Total hours
Presentation	1	10	11
Lecturing	2	2	4
Mentored work	0	282	282
Learning-Service	0	0	0
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
Learning-Service	Developing the TFG following the Learning-Service methodology is possible if tutors provide this this possibility. In this case, the dedication is 8 contact hours and 282 hours of personal work. This methodology replaces the classic tutored work.

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.
Learning-Service	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

Assessment

Description	Qualification	Training and Learning Results

Essay	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% Evaluation of the written memory and oral presentation by the tribunal. Value: 70% 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.	100	A1 A2 A3 A4 A5	B1 B2 B3 B4 B5	C1	D1 D2 D3 D4 D5

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

Complementary Bibliography

Recommendations

Other comments

As in all subjects, personal effort is essential, as well as attending to the instructions of the tutor and delivering the report in the deanery within the deadlines set by the Academic Committee of TFG.

It is recommended to read carefully the regulations related to the elaboration and defense of TFG of the Center and all the related documentation that can be found in
http://mar.uvigo.es/index.php/es/alumnado-actual/trabajo-fin-de-grado