



(\*)Facultade de Ciencias do Mar

## Grado en Ciencias del Mar

### Subjects

#### 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

IDENTIFYING DATA				
Biochemistry				
Subject	Biochemistry			
Code	V10G061V01201			
Study programme	Grado en Ciencias del Mar			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	2nd	1st
Teaching language	#EnglishFriendly Spanish			
Department				
Coordinator	San Juan Serrano, María Fuencisla			
Lecturers	San Juan Serrano, María Fuencisla			
E-mail	fsanjuan@uvigo.es			
Web				
General description	Basic concepts on the structure and function of biomoléculas, integration and regulation of their metabolism and transmission and expression of the genetic information.			
	English Friendly subject: International students may request from the teachers: a) resources and bibliographic references in English, b) tutoring sessions in English, c) exams and assessments in English.			

### Training and Learning Results

Code	
A2	Students can apply their knowledge and understanding in a manner that indicates a professional approach to their work or vocation, and have competences typically demonstrated through devising and sustaining arguments and solving problems within their field of study
A3	Students have the ability to gather and interpret relevant data (usually within their field of study) to inform judgments that include reflection on relevant social, scientific or ethical issues
A4	Students can communicate information, ideas, problems and solutions to both specialist and non-specialist audiences
B1	Know and use vocabulary, concepts, principles and theories related to oceanography and apply everything learned in a professional and/or research environment.
B3	Recognize and implement good practices in measurement and experimentation, and work responsibly and safely both in field surveys and in the laboratory.
B4	Manage, process and interpret the data and information obtained both in the field and in the laboratory.
C9	Acquire basic knowledge about the structural and functional organization and the evolution of marine organisms.
C11	Apply the knowledge and techniques acquired to the characterization and sustainable use of living resources and marine ecosystems.
D1	Develop the search, analysis and synthesis of information skills oriented to the identification and resolution of problems.
D2	Acquire the ability to learn autonomously, continuously and collaboratively, organizing and planning tasks over time.

### Expected results from this subject

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

### Contents

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

Planning			
	Class hours	Hours outside the classroom	Total hours
Lecturing	41.5	74.7	116.2
Seminars	4	9	13
Laboratory practical	6	1.5	7.5
Objective questions exam	3	0	3
Problem and/or exercise solving	0	8.3	8.3
Report of practices, practicum and external practices	0	2	2
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

<b>Methodologies</b>	
	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 terminología 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, procesamiento 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 **the global assesment and the 2nd opportunity to recover the content and the % corresponding to said activities.**

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

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 actuaciones and, in case of reincidencia, it will ask the wool Reitoria to abertura of a file discipline .

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## 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 Pastor J.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

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## Recommendations

### Subjects that continue the syllabus

Physiology of marine organisms/V10G061V01305

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### 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				
<b>Marine botany</b>				
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

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 features 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 Xanthophyceae 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

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### **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**,

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### **Recommendations**

#### **Subjects that continue the syllabus**

Marine Ecology/V10G061V01206

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#### **Subjects that it is recommended to have taken before**

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

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### **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

Expected results from this subject	Training and Learning Results			
1.- Know the fundamental principles of the Thermodynamic and know applied to realize global analyses of thermodynamic systems of interest in Sciences of the Sea. Comprise and know use the relations and *diagramas *termodinámicos that describe the different properties of the substances. Know the cycles *termodinámicos basic of thermal machine and *refrigeración and his main applications in Sciences of the Sea. Know collaborate in the work with other people of communicative and constructive form in the manufacture of experiments *termodinámicos.	A5	B1 B3	C1 C4 C5	D2
2.- Resolve problems of theory of fields and equations of the physical-mathematical chords with the paper of the fields in Sciences of the Sea. Argue the resolution of problems by means of it logical scientist and the scientific methodology.	A5	B1 B3	C1 C4 C5	D1 D2
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 *tarear 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
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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: <a href="http://mar.uvigo.es/index.php/en/alumnado-actual-2/examenes-3">http://mar.uvigo.es/index.php/en/alumnado-actual-2/examenes-3</a>	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.

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**Sources of information**

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**Basic Bibliography**

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

R. A. Serway y J.W. Jewett, **Física para Ciencias e Ingeniería**, Thomson, 9ªEd., 2014

**Complementary Bibliography**

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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

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**Recommendations**

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**Subjects that it is recommended to have taken before**

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Physics: Physics I/V10G061V01102

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**Other comments**

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

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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

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	<p>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.</p> <p>After each practical lesson, students must do a questionnaire.</p> <p>Once it is finished, students will have to answer some questions related to the work developed.</p>
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### Personalized assistance

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

### Assessment

	Description	Qualification	Training and Learning Results			
Problem solving	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.	20	A2 A4 A5	B1 B4	C6	D1 D2
	Attendance at the seminars is mandatory.					
Laboratory practical	<p>In this section will be valued:</p> <ul style="list-style-type: none"> <li>- The work carried out by the students in the laboratory.</li> <li>- The questionnaire done at the end of each practical lessons.</li> <li>- 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.</li> </ul> <p>Attendance at laboratory experiments is mandatory.</p> <p>To overcome the subject the student should reach at least 50% of the maximum possible score for this activity.</p>	20	A2 A4 A5	B3 B4	C7	D1 D2
Essay questions exam	<p>Written tests to evaluate skills acquired throughout the course.</p> <p>It will be valued:</p> <ul style="list-style-type: none"> <li>- A midterm exam, no eliminatory (20%)</li> <li>- The final exam (40%)</li> </ul> <p>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.</p>	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 minimum, the final grade will be the one obtained for "Question exam" (60%).

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

**In July**



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

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

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

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

### **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.

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### **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

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### **Recommendations**

#### **Subjects that continue the syllabus**

Chemical oceanography II/V10G061V01209

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#### **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	<a href="http://193.146.32.240/tema1112/claroline/course/index.php">http://193.146.32.240/tema1112/claroline/course/index.php</a>			
General description	<p>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.</p> <p>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).</p> <p>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.</p> <p>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.</p> <p>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.</p>			

<b>Training and Learning Results</b>	
Code	
A5	Students have developed those learning skills that are necessary for them to continue to undertake further study with a high degree of autonomy
B1	Know and use vocabulary, concepts, principles and theories related to oceanography and apply everything learned in a professional and/or research environment.
B2	Plan and execute surveys in the field and laboratory work, applying basic tools and techniques for sampling, data acquisition and analysis in the water column, sea bottom and marine substratum.
B3	Recognize and implement good practices in measurement and experimentation, and work responsibly and safely both in field surveys and in the laboratory.
B4	Manage, process and interpret the data and information obtained both in the field and in the laboratory.
C1	know at a general level the fundamental principles of sciences: Mathematics, Physics, Chemistry, Biology and Geology.
C12	Acquire knowledge about processes and products related to internal and external geological cycles.

- C13 Acquire the basic sedimentological, geochemical and geophysical techniques and methodologies used in identification, use and sustainability of the natural resources of coastal and marine environments.
- C14 Know basic concepts and events of global change obtained from geological records.
- D1 Develop the search, analysis and synthesis of information skills oriented to the identification and resolution of problems.
- D2 Acquire the ability to learn autonomously, continuously and collaboratively, organizing and planning tasks over time.

### Expected results from this subject

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

### Contents

#### Topic

#### Topic 0. Presentation of the subject

- 0.1. Aims of the course;
- 0.2. List of lectures and topics addressed by the course;
- 0.3. List of Laboratory seminars and practical;
- 0.4. Fieldwork;
- 0.5. Tests;
- 0.6. Tutorials;
- 0.7. Assessment;
- 0.8. Etiquette.

Topic 1. Basic concepts	<ul style="list-style-type: none"> <li>1.1. Sediments and sedimentary rocks and their relevance to other disciplines;</li> <li>1.2. The geological cycling of sediments and rocks;</li> <li>1.3. Sediment source, routing, and sink;</li> <li>1.4. Sediment residence time;</li> <li>1.5. Interplay between tectonics, climate, biology, geochemistry, and the formation and deposition of sediments.</li> </ul>
Topic 2. Methods	<ul style="list-style-type: none"> <li>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;</li> <li>2.2. Sampling campaigns: strategy and planning;</li> <li>2.3. Characterization of sediments based on: (i) physical; (ii) chemical; and (iii) other properties;</li> <li>2.4. Examples and case studies.</li> </ul>
Topic 3. Rock weathering and the transport of solid and solute load into the ocean	<ul style="list-style-type: none"> <li>3.1. Water-rock interaction: chemical and physical breakdown of rocks at the Earth's surface;</li> <li>3.2. Mechanisms, rates, and extent of weathering and its interactions with climate and tectonics;</li> <li>3.3. Weathering products and the transport of solid and solute load into the ocean;</li> <li>3.4. Impacts of weathering on ocean chemistry.</li> </ul>
Topic 4. Siliciclastic sediments I: general fluid flow characteristics	<ul style="list-style-type: none"> <li>4.1. Transport environments;</li> <li>4.2. Physical properties of fluids;</li> <li>4.3. Relevant concepts of fluid dynamics, such as the laminar and turbulent flows, the boundary layer, and the bottom effects;</li> <li>4.4. Types of flow: (i) unidirectional; (ii) oscillatory; (iii) gravitational; and (iv) liquefied.</li> </ul>
Topic 5. Siliciclastic sediments II: sediment transport and bedforms	<ul style="list-style-type: none"> <li>5.1. Forces acting on a sediment particle: the Bernoulli effect;</li> <li>5.2. Sedimentologically significant types of flows: the Reynolds Number;</li> <li>5.3. Entrainment and transport: shear stress; boundary layer; and viscous sublayer;</li> <li>5.4. Deposition: the Stokes' law. Transport modes: the Hjulstrom's and Shields' curves;</li> <li>5.5. Bedforms under unidirectional flows: (i) terminology; (ii) sequence of formation; and (iii) stability;</li> <li>5.6. Cross-stratification: (i) types; (ii) bedforms under oscillatory flows; (iii) stability; and (iv) relationships with the flow regime;</li> <li>5.7. Other bedforms.</li> </ul>
Topic 6. Siliciclastic sediments III: description and classification	<ul style="list-style-type: none"> <li>6.1. Description: texture and structure;</li> <li>6.2. Classification according to the grain size;</li> <li>6.3. Shape;</li> <li>6.4. Origin and composition;</li> <li>6.5. Classification according to the sediment composition;</li> <li>6.6. Concepts of textural and compositional maturity;</li> <li>6.7. Diagenesis of siliciclastic sediments and lithification into siliciclastic sedimentary rocks.</li> </ul>
Topic 7. Siliciclastic sediments IV: grain-size distribution and fabric of siliciclastic sediments	<ul style="list-style-type: none"> <li>7.1. Grain-size analysis and statistics: theory and practical examples;</li> <li>7.2. Fabric and texture;</li> <li>7.3. Porosity and permeability;</li> <li>7.4. Structures nonrelated to flows: biological; postsedimentaries; diagenetic;</li> <li>7.5. Bedform interpretation: temporal and spatial scales of the siliciclastic sedimentary processes.</li> </ul>
Topic 8. Chemical and biochemical sediments I: ocean chemistry and (bio)chemical sedimentation	<ul style="list-style-type: none"> <li>8.1. Processes that control ocean chemistry and its evolution through time;</li> <li>8.2. Relationship between (bio)chemical sediments, climate, and weathering;</li> <li>8.3. Ocean carbonate chemistry: carbonate species and carbonate precipitation in seawater;</li> <li>8.4. Carbonate minerals;</li> <li>8.5. Carbonate saturation, lysocline, and carbonate compensation depth and their evolution through time in connection with weathering and sea-level changes.</li> </ul>

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.
Studies excursion	Attendance is mandatory (80% lectures). 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.
Laboratory practical	Attendance is mandatory. 5 hours of laboratory practical, using a petrographic microscope as a fundamental tool to perform petrographic investigation of sediments and sedimentary rocks.
Mentored work	Attendance is mandatory. 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  $\geq 5.00$ , while individual assignments must be each  $\geq 4.00$ .

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.

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### 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., **CO<sub>2</sub> 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)**,

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### 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

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### 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.

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<b>IDENTIFYING DATA</b>				
<b>Marine Ecology</b>				
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	<a href="http://https://mar.uvigo.es/">http://https://mar.uvigo.es/</a>			
General description	<p>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.</p> <p>English Friendly subject: International students may request from the teachers:</p> <p>a) resources and bibliographic references in English, b) tutoring sessions in English, c) exams and assessments in English.</p>			

### 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 B2 C11 D1  
A3 B4 D2  
A4  
A5

To use the basic bibliography related to the ecological concepts

A2 B1 C10 D1  
A3 B2 C11  
A4  
A5

## 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	<p>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</p> <p>The contents of these seminars will be:</p> <p>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.</p> <p>In the seminars 2, 3 and 4 will be necessary the utilisation of the statistical programs *R and *RStudio.</p>
Laboratory practical	<p>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.</p> <p>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.</p> <p>Seminars will tackle the necessary practical contents for the preparation of the work.</p> <p>The adequate organisation and development of the experimental work, requires to strictly respect the following recommendations:</p> <ol style="list-style-type: none"> <li>1. Members of each group should belong to the same group of seminars.</li> <li>2. Laboratory work should be by all members of the group.</li> <li>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.</li> </ol>

#### 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	<p>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.</p> <p>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).</p> <p>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.</p>	15	A2 B4 D1 A3 D2 A4 A5
Project	<p>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.</p> <p>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.</p> <p>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%.</p> <p>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.</p> <p>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.</p>	30	A2 B1 C10 D1 A3 B2 C11 D2 A4 B4 A5

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 D1 C11 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 D1 C11 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 opportunity

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

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

## Sources of information

### Basic Bibliography

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

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

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

### Complementary Bibliography

## Recommendations

### Subjects that continue the syllabus

Biological oceanography I/V10G061V01301

Biological oceanography II/V10G061V01306

<b>IDENTIFYING DATA</b>				
<b>Coastal and marine sedimentary habitats</b>				
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	<a href="http://http://webs.uvigo.es/c10/webc10/ficha.php?id=4">http://http://webs.uvigo.es/c10/webc10/ficha.php?id=4</a>			
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.			

<b>Training and Learning Results</b>	
Code	
A2	Students can apply their knowledge and understanding in a manner that indicates a professional approach to their work or vocation, and have competences typically demonstrated through devising and sustaining arguments and solving problems within their field of study
A3	Students have the ability to gather and interpret relevant data (usually within their field of study) to inform judgments that include reflection on relevant social, scientific or ethical issues
A4	Students can communicate information, ideas, problems and solutions to both specialist and non-specialist audiences
B1	Know and use vocabulary, concepts, principles and theories related to oceanography and apply everything learned in a professional and/or research environment.
B2	Plan and execute surveys in the field and laboratory work, applying basic tools and techniques for sampling, data acquisition and analysis in the water column, sea bottom and marine substratum.
B4	Manage, process and interpret the data and information obtained both in the field and in the laboratory.
C12	Acquire knowledge about processes and products related to internal and external geological cycles.
C13	Acquire the basic sedimentological, geochemical and geophysical techniques and methodologies used in identification, use and sustainability of the natural resources of coastal and marine environments.
D1	Develop the search, analysis and synthesis of information skills oriented to the identification and resolution of problems.
D5	Sustainability and environmental commitment. Equitable, responsible and efficient use of resources.

<b>Expected results from this subject</b>				
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

<b>Contents</b>	
Topic	

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

## Planning

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

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

## Methodologies

	Description
Lecturing	Theoretical 50 minutes lessons. (40% of total mark). Up to 1 extra point for participation and discussion on classroom)
Case studies	It comprises the cartography, characterisation and evolution of sedimentary environments explored from the Google Earth. (Attendance and reports, 10% of the subject mark)
Studies excursion	It comprises two field-trips: 1. Arousa Island 2. Corrubedo  (Attendance and reports, 20% of mark)
Seminars	Seminar 1. 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 tutorial according to the teacher schedule: Monday, Wednesday and Friday: 12:00-14:00h , that will be able to be modified in function of the educational needs.
Studies excursion	Students that wish it will be able to attend to personalized tutorials to resolve doubts, mainly in the indicated schedules. To optimize time, it is necessary that the student to contact with the lecturer previously. The tutorials will be able to be individual or in group in accordance with the schedules of the lecturer: Prof. Soledad García Gil (Tuesday, Wednesday and Thursday: 12:00-14:00 h) that would be modified according to educational needs.
Case studies	Students that wish it will be able to attend to personalized tutorials to resolve doubts, mainly in the indicated schedules. To optimize time, it is necessary that the student to contact with the lecturer previously. The tutorials will be able to be individual or in group in accordance with the schedules of the lecturer: Prof. Soledad García Gil (Tuesday, Wednesday and Thursday: 12:00-14:00 h) that would be modified according to educational needs.
Seminars	Students that wish it will be able to attend to personalized tutorials to resolve doubts, mainly in the indicated schedules. To optimize time, it is necessary that the student to contact with the lecturer previously. The tutorials will be able to be individual or in group in accordance with the schedules of the lecturer: Prof. Soledad García Gil (Tuesday, Wednesday and Thursday: 12:00-14:00 h) that would be modified according to educational needs.

## Assessment

	Description	Qualification	Training and Learning Results			
Case studies	Report (memory) of the results obtained in the classroom of computing.	10	A2	B4	C12 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 opportunity** 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.

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### 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

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### Recommendations

#### Subjects that continue the syllabus

Geological oceanography I/V10G061V01303

Geological oceanography II/V10G061V01308

Basin Analysis/V10G061V01406

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#### 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	Bodelón González, Gustavo			
Lecturers	Bodelón González, Gustavo			
E-mail	gbodelon@uvigo.gal			
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

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

### Contents

Topic	
Lesson 1. Microorganisms on the marine ambient	1.1. Purpose and field of study of marine microbiology 1.2. Microorganisms on the biological scale. 1.3. Role of microbiota in marine ecosystems. 1.4. Perspectives of marine microbiology
Lesson 2. Structure and function of prokaryotic microorganisms and acellular agents	2.1. Structure and function of prokaryotic microorganisms 2.2. Structure and function of acellular agents

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

### Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	30	68	98
Laboratory practical	18	28	46
Seminars	4	2	6

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

### Methodologies

	Description
Lecturing	The teacher structures and/or explains the objectives and contents of each topic and responds to the questions posed by the students. At final for each topic, the students will have at their disposal at Fatic 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
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Lecturing	Four partial tests, eliminatory along the semester of multiple choice, and/or development questions:  Test 1: 14%. Test 2: 14%. Test 3: 14%. Test 4: 14%.  Failed 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/essay 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

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

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

#### Complementary Bibliography

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

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

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

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

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**Recommendations**

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**Subjects that continue the syllabus**

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Marine microbiology and parasitology/V10G061V01411

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**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	<a href="http://http://depc07.webs.uvigo.es/">http://http://depc07.webs.uvigo.es/</a>			
General description	This subject presents the chemical methodology applied to the determination of the compounds of greatest interest in Chemical Oceanography, from sample taking to obtaining the final result.			
	English Friendly subject: International students may request from the teachers: a) resources and bibliographic references in English, b) tutoring sessions in English, c) exams and assessments in English.			

**Training and Learning Results**

Code				
A2	Students can apply their knowledge and understanding in a manner that indicates a professional approach to their work or vocation, and have competences typically demonstrated through devising and sustaining arguments and solving problems within their field of study			
A4	Students can communicate information, ideas, problems and solutions to both specialist and non-specialist audiences			
B1	Know and use vocabulary, concepts, principles and theories related to oceanography and apply everything learned in a professional and/or research environment.			
B2	Plan and execute surveys in the field and laboratory work, applying basic tools and techniques for sampling, data acquisition and analysis in the water column, sea bottom and marine substratum.			
B3	Recognize and implement good practices in measurement and experimentation, and work responsibly and safely both in field surveys and in the laboratory.			
B4	Manage, process and interpret the data and information obtained both in the field and in the laboratory.			
C6	Acquire the fundamentals and terminology of chemical processes.			
C7	Apply to the marine and coastal environment the principles and methods used in Chemistry.			
D1	Develop the search, analysis and synthesis of information skills oriented to the identification and resolution of problems.			
D2	Acquire the ability to learn autonomously, continuously and collaboratively, organizing and planning tasks over time.			

**Expected results from this subject**

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

Prepare the reagents and the necessary material to carry out an oceanographic campaign.	A2 A4	B1 B2 B3	C6 C7	D1 D2
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	<p>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:</p> <ul style="list-style-type: none"> <li>- Chlorosity and chlorinity.</li> <li>- Total alkalinity.</li> <li>- Dissolved oxygen.</li> <li>- Phosphate in seawater.</li> <li>- Metals in seawater by atomic spectroscopy.</li> </ul> <p>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.</p> <p>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.</p> <p>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.</p>
Seminars	<p>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.</p> <p>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.</p> <p>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.</p>

### 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 website. 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 <a href="https://campusremotouvigo.gal">campusremotouvigo.gal</a> . 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 website. 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 <a href="https://campusremotouvigo.gal">campusremotouvigo.gal</a> . Likewise, any doubts that arise to the student can be formulated through the forums that are enabled for this on the Moovi platform.
Introductory activities	The student who wishes it will be able to attend personalized tutorials to solve doubts, mainly in the schedules at the University website. 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 <a href="https://campusremotouvigo.gal">campusremotouvigo.gal</a> . Likewise, any doubts that arise to the student can be formulated through the forums that are enabled for this on the Moovi platform.
Lecturing	The student who wishes it will be able to attend personalized tutorials to solve doubts, mainly in the schedules at the University website. 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 <a href="https://campusremotouvigo.gal">campusremotouvigo.gal</a> . 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 website. 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 <a href="https://campusremotouvigo.gal">campusremotouvigo.gal</a> . 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
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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 seminars 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).**

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#### Recommendations

##### Subjects that continue the syllabus

Chemistry applied to the marine environment II/V10G061V01309

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##### Subjects that it is recommended to have taken before

Chemistry: Chemistry I/V10G061V01105

Chemistry: Chemistry 2/V10G061V01110

Chemical oceanography I/V10G061V01204

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#### 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.

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IDENTIFYING DATA				
<b>Marine zoology</b>				
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	<a href="http://https://mar.uvigo.es/">http://https://mar.uvigo.es/</a>			
General description	<p>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.</p> <p>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.</p> <p>International students may request from the teachers:</p> <p>a) resources and bibliographic references in English, b) mentoring sessions in English, c) exams and assessments in English.</p>			

### Training and Learning Results

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

### Expected results from this subject

Expected results from this subject	Training and Learning Results			
Handle vocabulary, codes and inherent concepts to the marine zoology	A2	C1		
Know and comprise the essential facts, concepts, principles and theories related with the marine zoology.	A2			
Know the basic techniques of sampling of the fauna in the column of water, and diverse types of fund	A2 A5			
Basic knowledge of the methodology of investigation in marine zoology	A2	B1 B2		
Capacity to identify and understand the problems related with the marine zoology	A3	B1	C1 C9	D1
Know work in campaigns and in laboratory of responsible way and sure, promoting the tasks in team	A2	B2		D1 D2
Transmit information of form written, verbal and graphic for audiences of diverse types	A2 A4			

Capacity of analysis and synthesis	A2 A3	B4		D1
Capacity of organisation and planning		B2 B4		D1 D2
Oral communication and writing in the official tongues of the University	A4			
Capacity to work in one instrument	A5			D2
Capacity to learn of autonomous and continuous form	A5			D2
Capacity to apply the knowledges in practice	A2 A4	B4		D1
Skills of investigation	A2 A3 A4 A5	B1 B2 B4	C1 C9 C10	D1 D2

## Contents

### Topic

LESSON 1: INTRODUCTION	Definition and objectives of the subject. General characteristics of the metazoa: definition and models of organisation
LESSON 2: PHYLUM PORIFERA. PHYLUM PLACOZOA.	PORIFERA: general characteristics, cell types and skeleton. Types of organisation. Reproduction and development. Systematic summary. PLACOZOA: Form and function.
LESSON 3: PHYLUM CNIDARIA	General characteristics. Polymorphism: The polyp and the medusa. Cell types. Reproduction. Systematic summary. Hydrozoa, Scyphozoa, Staurozoa, Cubozoa and Anthozoa: form and function.
LESSON 4: PHYLUM CTENOPHORA	General characteristics. (Corporal organisation) Form and function. Reproduction. Systematic summary
LESSON 5: The BILATERIA: INTRODUCTION. PHYLUM 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 PHYLUM	Phyla Gnathostomulida, Rotifera, Acanthocephala, Cyclophora, 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, Solenogastrea, 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. PHYLUM ECHIURA and SIPUNCULA	The Siboglinidae: general characteristics; form and function; reproduction and development. Phylum Echiura: Form and function. Phylum Sipuncula: Form and function.
LESSON 14: ECDISOZOA: INTRODUCTION and LOWER PHYLUM	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	<p>Lesson 1.- PORIFERA. The skeleton of Sponges: methods of extraction and preparation of spicules; microscopical study.</p> <p>Lesson 2.- CNIDARIA. The polyp and the medusa: morphology. Observation of representatives of Hydrozoa, Scyphozoa and Anthozoa.</p> <p>Lesson 3.-. MOLLUSCA I. External morphology of the main groups: Polyplacophora, Scaphopoda, Bivalvia, Gastropoda and Cephalopoda; identification with keys of several species.</p> <p>Lesson 4.- MOLLUSCA II. Internal anatomie: dissection of a Bivalvia: Mytilus galloprovincialis.</p> <p>Lesson 5.- POLYCHAETA. External morphology: Errantia and Sedentaria polychaetes; identification with keys of some species.</p> <p>Lesson 6.- ARTHROPODA I. Crustacea: External morphology; internal anatomie: and dissection of a Malacostraca: Nephrops norvegicus; observation and identification of brachiurans.</p> <p>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.</p> <p>Lesson 8.- ECHINODERMATA I. External morphology of the main groups. Identification with keys of several species.</p> <p>Lesson 8.- ECHINODERMATA II. External morphology and internal anatomie: dissection of a Echinoidea: Paracentrotus lividus.</p> <p>Lesson 10.- Chordata. Observation of Tunicata and Cephalochordata; external morphology, identification and dissection of a Osteichthyes.</p>

<b>Planning</b>			
	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.

<b>Methodologies</b>	
	Description
Laboratory practical	Attendance is compulsory; in order for the laboratory sessions to be evaluated, attendance to at least 80% of them is required. Attendance to at least 80% of the internship will be required in order for the internship to be evaluated.
	Study of the external and internal anatomy of the main groups using common microscopical techniques in Zoology
Seminars	During the first seminar there will be an exposition of a topic considered of relevance in the training in Marine Zoology and directly related to the practical work that must be done. Also, the methodology to do the collaborative work will be explained. Possible doubts will be solved. In the second seminar, the students will present the results achieved in the collaborative work. Attendance is compulsory
Collaborative Learning	Collaborative learning through a mainly practical work in small groups. The works will include the following phases: sampling through photographic transects, identification of the fauna in the photographs and their adaptations to their habitat, and writing the results. The other collaborative work is related to the labels of fish and shellfish in the markets and fish auctions. Students have to take pictures of fish and shellfish and to their labels. Then they have to compare the information of the labels with the required information by the regulations. Finally, students have to study the biology of these fish and shellfish and its relationship with the fishery.
Lecturing	This method refers to the explanation of the topics to the students. The teacher clarifies the syllabus content to the students. Although teachers are more active than students the teacher will ask questions to keep the students attentive.

<b>Personalized assistance</b>	
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

<b>Assessment</b>			
	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 D1 C10	
Seminars	Assistance and participation of the students in the two seminars and the presentation of the works done by students will be evaluated. Also their participation in the subsequent discussion will be evaluated.	5	A2 A3 A4 A5	B1 B2 B4	D1 D2
Collaborative Learning	The ability to work together autonomously as well as the writing document of the results obtained (2 points, 20%).  To pass this methodology, students have to get a minimum mark of 0,8 points in the assignments.	20	A2 A3 A4 A5	B1 B2 B4	D1 D2
Lecturing	Continuous assessment: four mid term multiple choice tests (10 minutes) will be done during the semester. These tests will not get rid of themes. Each one will be score up to 0.5 points (2 points in total, 20%)  Final exam: a major written exam will be done with short answer questions (3 points, 30%)  Both results will be added. To pass this methodology, students have to get a minimum mark of 2 points.	50	A2 A5	B1 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/examenos/>

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.

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#### Sources of information

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##### Complementary Bibliography

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#### Recommendations

##### Subjects that continue the syllabus

Biological oceanography I/V10G061V01301

Biological oceanography II/V10G061V01306

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##### Subjects that it is recommended to have taken before

Biology: Biology 2/V10G061V01106