



(*)Facultade de Ciencias do Mar

(*)Grao en Ciencias do Mar

Subjects

Year 2nd

Code	Name	Quadmester	Total Cr.
V10G060V01301	Bioquímica	1st	6
V10G060V01302	Botánica mariña	1st	6
V10G060V01303	Estatística	1st	6
V10G060V01304	Oceanografía química I	1st	6
V10G060V01305	Sedimentoloxía	1st	6

Year 3rd

Code	Name	Quadmester	Total Cr.
V10G060V01318	Prácticas externas	2nd	6

Year 2nd

Code	Name	Quadmester	Total Cr.
V10G060V01401	Ecoloxía mariña	2nd	6
V10G060V01402	Medios sedimentarios costeiros e mariños	2nd	6
V10G060V01403	Oceanografía química II	2nd	6
V10G060V01404	Principios de microbioloxía mariña	2nd	6
V10G060V01405	Zooloxía mariña	2nd	6

Year 3rd

Code	Name	Quadmester	Total Cr.
V10G060V01501	Fisioloxía de organismos mariños	1st	6
V10G060V01502	Oceanografía biolóxica I	1st	6
V10G060V01503	Oceanografía física I	1st	6
V10G060V01504	Oceanografía xeolóxica I	1st	6
V10G060V01505	Química aplicada ao medio mariño I	1st	6
V10G060V01601	Oceanografía biolóxica II	2nd	6
V10G060V01602	Oceanografía física II	2nd	6
V10G060V01603	Oceanografía xeolóxica II	2nd	6

V10G060V01604	Química aplicada ao medio mariño II	2nd	6
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Year 4th

Code	Name	Quadmester	Total Cr.
V10G060V01701	Contaminación mariña	1st	6
V10G060V01702	Dinámica oceánica	1st	6
V10G060V01703	Pesqueiras	1st	6
V10G060V01704	Xestión mariña e litoral	1st	6
V10G060V01801	Acuicultura	2nd	6

Year 3rd

Code	Name	Quadmester	Total Cr.
V10G060V01901	Análise de conchas	2nd	6
V10G060V01902	Bioloxía de peixes e mariscos	2nd	6
V10G060V01903	Economía e lexislación	2nd	6
V10G060V01904	Métodos en análise xeográfica	2nd	6
V10G060V01905	Modelización	2nd	6
V10G060V01906	Parasitoloxía e microbioloxía mariña	2nd	6
V10G060V01907	Recursos xenéticos mariños	2nd	6
V10G060V01908	Teledetección oceanográfica	2nd	6

Year 4th

Code	Name	Quadmester	Total Cr.
V10G060V01909	Xeoloxía mariña aplicada	1st	6
V10G060V01991	Traballo de Fin de Grao	2nd	12

IDENTIFYING DATA				
Biochemistry				
Subject	Biochemistry			
Code	V10G060V01301			
Study programme	(*)Grao en Ciencias do Mar			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	2nd	1st
Teaching language	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.			

Competencies		
Code		Typology
CB1	Students have demonstrated knowledge and understanding in a field of study that builds upon their general secondary education, and is typically at a level that, whilst supported by advanced textbooks, includes some aspects that will be informed by knowledge of the forefront of their field of study	• know
CB2	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	• Know How
CB3	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	• know • Know How
CB4	Students can communicate information, ideas, problems and solutions to both specialist and non-specialist audiences	• know • Know How
CB5	Students have developed those learning skills that are necessary for them to continue to undertake further study with a high degree of autonomy	• know • Know How
CE1	To know the vocabulary, codes and concepts inherent to the oceanographic scientific field	• know
CE2	To know and understand the essential facts, concepts, principles and theories related to oceanography	• know
CE4	To know the basic techniques to sample the water column, organisms, sediments and sea bottom, as well as the surveying methods for dynamic and structural variables	• know • Know How
CE5	Basic knowledge of research methodology in oceanography	• know • Know How
CE6	Ability to identify and understand the problems in the field of oceanography	• know • Know How
CE12	To be able to operate the instrumental techniques applied to sea	• Know How
CE13	To acquire, evaluate, process and interpret oceanographic data within the theories currently in use	
CE15	To recognize and implement good scientific practice in measurement and experimentation, both in the field and in the laboratory	• know • Know How
CE16	To plan, design and implement applied research from the recognition stage to the final evaluation of results and discoveries	• know • Know How
CE17	Ability to survey in the field and to work in the laboratory responsibly and safely, encouraging team work	• Know How • Know be
CE18	To transmit writing, verbal and graphical information for audiences of various types	• know • Know How
CE26	To plan, direct and write technical reports on marine issues	• Know How
CE28	To teach marine science at different levels	• Know How
CT1	Analysis and synthesis ability	• know • Know How
CT8	Teamwork ability	• Know How • Know be

Learning outcomes	
Learning outcomes	Competences
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.	CB1 CB5 CE2 CE5 CE28 CT1

Approach of the biological phenomena in molecular terms, relating the structure of each biomolecules family with the biological function that exert	CB2 CB3 CE2 CE5 CE28 CT1
Acquisition and appropriate utilisation of concepts and biochemical terminology	CB4 CE1 CE18 CE26 CE28 CT1
Resolution of questions of quantitative biochemistry	CB1 CB2 CE15 CE16 CE28 CT1
Familiarisation with use of basic instrumental and equipment of a biochemical laboratory	CB2 CB5 CE4 CE5 CE12 CE15 CE17 CE28 CT1 CT8
Knowledge and application of simple techniques of separation and quantification of biomolecules	CB1 CB2 CB5 CE4 CE5 CE12 CE15 CE17 CE28 CT1 CT8
Development of scientific thinking style	CB2 CB3 CB5 CE6 CE13 CE16 CT1 CT8

Contents

Topic	
Inorganic components from living organisms:	Importance of no covalent interactions. Role of the water in the biological processes. Interactions of the macromolecules in solution.
Nucleic acids	Composition of nucleosides and nucleotides. Deoxyribonucleic acid. Ribonucleic acids.
Amino acids and proteins:	Classification and properties of the amino acids. Peptidic bond Peptides and proteins: structure, function and classification.
Carbohydratess:	General characteristics and classification. Monosaccharides, oligosaccharides and polysaccharides. Structure, importance and function.
Lipids:	General characteristics and biological importance. Classification: fatty acids; simple lipids; complex lipids; isoprenoid lipids; eicosanoids.

Enzymes:	Concept, active site, and classification. Enzymatic catalysis. Kinetic enzymatic. allosteric Enzymes.
Introduction to Metabolism:	Metabolic pathways. Anabolism and catabolism. Energy from biological processes. Metabolism regulation.
Carbohydrate metabolism:	Anaerobic processes of energy generation. Oxidative processes: citric acid cycle and route of the pentose phosphate cycle. Biological oxidations: electron transport chain and oxidative phosphorylation. Carbohydrate biosynthesis.
Lipid metabolism:	Beta oxidation of fatty acids. Fatty acids biosynthesis. 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: Separation, identification and quantification of biomolecules	Extraction and quantification of protein
Practice: Enzymology	Enzyme activity measure. 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
Practices report	0	2	2

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

Methodologies

	Description
Lecturing	The professor will give fundamental notions needed to understand and prepare the contents of the matter.
Seminars	The seminars will be carry out collaborative way. Students will prepare some of the contents of program and some related subject of interest.
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.

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	Evaluated Competences
Lecturing	Assistance no available	0	
Seminars	In the realization of the seminars values the capacity to relate and apply the concepts purchased, to identify and understand problems, the appropriate utilization of the terminoloxía biochemical, his capacity to transmit the information. How transversal competitions value the initiative, the capacity of autonomous learning, the work in team, the capacity of organization, the critical capacity and the skill in the research of information and handle of the computer.	20	CB1 CB2 CB3 CB4 CB5 CE1 CE2 CE6 CE18 CE26 CE28 CT1 CT8
Laboratory practical	To the finalizar the practices will realize an examination or will deliver a report to value the knowledge and handle of the technicians instrumentais used, the application of the theoretical knowledges to the practice, the capacity of analysis, procesamento and interpretation of the results obtained.	20	CB1 CB2 CB3 CB4 CB5 CE1 CE4 CE5 CE12 CE13 CE15 CE16 CE17 CE18 CE26 CT1 CT8

Objective questions exam	Test: It assesses, in a general way, the knowledge acquired of the course program Short answer: It assesses the knowledge acquired, the ability to relate them and the proper use of concepts and biochemical terminology.	50	CB1 CB2 CB3 CB4 CB5 CE1 CE2 CE18 CT1
Problem and/or exercise solving	To finalize the theoretical exhibition of each subject or group of subjects related, the students will resolve of individual form the problems or exercises proposed by the professor.	10	CB1 CB2 CB3 CB4 CB5 CE6 CT1

Other comments on the Evaluation

The student will have to complement the sua ficha in the platform FAITIC, approaching photograph in which was recognizable. This requirement is indispensable for the realization of the practices, the seminars and the distinct probas.

Advise to the students that use a direction of and-mail of the University of Vigo when they direct to the professor by this road and that do it always with the owed identification (name and surnames, course and titulación) and indicating the subject.

Advise the assistance to the kinds magistral.

Resolution of problems and / or exercises: The half note of the problems / exercises has to be equal or upper to 5 (on 10) to be had in account in the final evaluation.

Seminars: the realization of the seminars is compulsory for the superación of the subject. The half note of the seminars will have to be equal or main than 5 (on 10) so that it was had in account in the final note.

Practical: the realization of the practices and of the examination and/or report of the same compulsory sound for the superación of the subject. The note of the practices will have to be equal or main than 5 (on 10) so that it was had in account in the final note.

The final examination will consist in a proof of test and short answer of all the subjects impartidos in the kinds magistral and seminars. To surpass the subject to note of the final examination has to be equal or upper to 5 (on 10). Date, time and place of exams will be published in the official web of Marine Sciences

Faculty: <http://mar.uvigo.es/index.php/en/alumnado-actual-2/examenes-3>

To the student that have to present to the evaluation of July by not surpassing test them type test and of short answer, him conservará the note of the probas surpassed during the course.

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 .

Sources of information

Basic Bibliography

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

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

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

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

Complementary Bibliography

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

Herrera E., Bioquímica Básica, 1ª Ed, 2014, Elsevier

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

McKee T. y McKee J.R., Bioquímica. La base molecular de la vida, 5ª Edición, 2015, McGraw-Hill/Interamericana

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

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

Recommendations

Subjects that continue the syllabus

Physiology of marine organisms/V10G060V01501

Subjects that it is recommended to have taken before

Fish and shellfish biology/V10G060V01902

Chemistry applied to the marine environment I/V10G060V01505

Chemistry applied to the marine environment II/V10G060V01604

IDENTIFYING DATA				
Marine botany				
Subject	Marine botany			
Code	V10G060V01302			
Study programme	(*)Grao en Ciencias do Mar			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	2nd	1st
Teaching language	Spanish English			
Department				
Coordinator	Castro Cerceda, María Luísa Sánchez Fernández, José María			
Lecturers	Castro Cerceda, María Luísa Muñoz Sobrino, Castor Sánchez Fernández, José María			
E-mail	lcastro@uvigo.es jmsbot@uvigo.es			
Web				
General description	Study of the main marine plant groups, classification, life habits and interactions with other groups and the environment			

Competencies	
Code	Typology
CB2 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	• Know How
CB3 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	• Know How
CB4 Students can communicate information, ideas, problems and solutions to both specialist and non-specialist audiences	• Know How
CB5 Students have developed those learning skills that are necessary for them to continue to undertake further study with a high degree of autonomy	• Know How
CT1 Analysis and synthesis ability	• Know How
CT2 Organization and planning skills	• Know How
CT3 Written and oral communication in the official languages of the University	• Know be
CT5 Information technology skills (search and data analysis)	• Know How

Learning outcomes	
Learning outcomes	Competences
To know the origin and evolution of the marine plants and the features of the main groups	CB2 CB3 CB4 CB5 CT3 CT5
To acquire the skills to collect, prepare, analyze, identify and preserve plant samples	CT1 CT2
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	CB3 CB4 CB5 CT1 CT2 CT3 CT5

Contents	
Topic	
1. Introduction to Botany	1.1. Definition of Botany 1.2. Groups of plants 1.3. Relationship with the degree
2. Plant reproduction	2.1. Asexual reproduction 2.2. Sexual reproduction
3. Procariotic algae	3.1. Main feautres of Cyanophyta 3.2. Main features of Prochlorophyta

4. Introduction to the eukaryotic algae	4.1. Origin of the main lines of photosynthetic organisms 4.2. Phylum Gaucophyta 4.3. Phylum Euglenophyta
5. Unicellular phyla; main features	5.1. Phylum Cryptophyta 5.2. Phylum Haptophyta 5.3. Phylum Pyrrophyta
6. Phylum Ochrophyta (Heterokontophyta) I	Main features
7. Phylum Ochrophyta (Heterokontophyta) II	7.1. Class Xantophyceae 7.2. Class Bacillariophyceae
8. Phylum Ochrophyta (Heterokontophyta) III	8.1. Class Phaeophyceae. Main features
9. Phylum Ochrophyta (Heterokontophyta) III	9.1. Main features of Bangiophyceae 9.2. Main features of Floridophyceae
10. Phylum Chlorophyta I	10.1. Main features of Prasinophyceae 10.2. Main features of Chlorophyceae 10.3. Main features of Bryopsidophyceae 10.4. Main features of Ulvophyceae 10.5. Main features of Zygnematophyceae
11. Ecology and ethnobotany of algae	11.1. Introduction to the study of the marine algae communities 11.2. Uses of the algae
12. Introduction to the flowering plants	12.1. Main features and life cycle 12.2. Adaptations to the coastal environment
13. Coastal vegetation	13.1. Introduction
14. Fungi and lichens	14.1. Main features

Planning

	Class hours	Hours outside the classroom	Total hours
Laboratory practical	9	9	18
Field practice	4	10	14
Seminars	3	3	6
Mentored work	0	23	23
Lecturing	25	25	50
Essay	7	14	21
Practices report	1	5	6
Problem and/or exercise solving	2	10	12

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

Methodologies

	Description
Laboratory practical	Study and identification of the main groups of algae
Field practice	"In situ" study of the main algal communities and coastal vegetation of the Atlantic Coast of Galicia
Seminars	Discussion of the work of each group; questions and doubt solution
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	Classroom lesson with support on audiovisual material, trying to make them as participatory as possible
Laboratory practical	Study of the morphology, systems of reproduction and identification of the main groups of seaweeds. Use of laboratory material, mainly optical equipment (stereo microscope and microscope)
Field practice	Study of the main communities of coastal plants, and their adaptations to live under marine influence
Seminars	By groups, work on two aspects related with the development of the course: in the first place how to develop a scientific/technical report, and second methods of phylogenetic reconstruction, which are used during all the course as a link that relates the biological groups. Students willin so will be able to solve doubts during OFFICE HOURS on Mondays and Tuesday at 10-13h; It is recommended to book an appointment by email beforehand.
Mentored work	Students will be guided by the professor during the development of the work

Assessment

Description	Qualification	Evaluated	Competences
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Essay	Public presentation of the groups' reports	15	CB2 CB3 CB4 CB5 CT3 CT5
Practices report	Evaluation of the reports on the field and laboratory sessions	20	CB5 CT3
Problem and/or exercise solving	assessment of the theoretical part of the course	65	

Other comments on the Evaluation

IT IS NECESSARY to reach half of the note in each one of the three evaluations in order to pass the course.

Those activities that were not evaluated during the regular course will have to be evaluated before the second final exam in July. The grades of those parts passed in June can be kept for the "second chance" in July, but NOT further.

The participation in any of the activities implies that the final qualification will be different from "not presented".

The dates of the exams are approved by the Faculty (<http://mar.uvigo.es/index.php/gl/alumnado-actual/examenes-3>)

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

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

Sources of information

Basic Bibliography

Izco, J. (Ed.), Botánica, 2, McGraw-Hill/Interamericana, 2004

Graham, J.E., Wilcox, L.W., Graham, L.E., Algae, 2, Benjamin Cummings, 2008

Lee, R.E., Phycology, 4, Cambridge University Press, 2008

Complementary Bibliography

van den Hoek, C., Algae, 1, Cambridge University Press, 1996

Dawes, C.J., Marine Botany, 2, Wiley, 1998

Varios, Artículos en Revistas,

Recommendations

Subjects that continue the syllabus

Marine Ecology/V10G060V01401

Marine and coastal management/V10G060V01704

IDENTIFYING DATA				
Statistics				
Subject	Statistics			
Code	V10G060V01303			
Study programme	(*)Grao en Ciencias do Mar			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	2nd	1st
Teaching language	Spanish			
Department				
Coordinator	Lorenzo Picado, Leticia			
Lecturers				
E-mail				
Web	http://https://fatic.uvigo.es/index.php/es/			
General description	Subject destined to the knowledge and use of the fundamental statistical techniques for the treatment of and analysis of experimental data.			

Competencies		
Code		Typology
CB1	Students have demonstrated knowledge and understanding in a field of study that builds upon their general secondary education, and is typically at a level that, whilst supported by advanced textbooks, includes some aspects that will be informed by knowledge of the forefront of their field of study	• know • Know How
CB2	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	• know • Know How
CB3	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	• Know How
CE14	To recognize and analyze new problems and to propose problem-solving strategies	• Know How
CE16	To plan, design and implement applied research from the recognition stage to the final evaluation of results and discoveries	• Know How
CE29	Skill in the practical use of models and in the incorporation of new data for their validation, improvement and development	• Know How
CT1	Analysis and synthesis ability	• Know How
CT4	Basic computing skills related to the field of study	• Know How
CT5	Information technology skills (search and data analysis)	• Know How
CT6	Problem management and solving skills	• Know How
CT7	Decision making	• Know How
CT15	Ability to apply knowledge in practice	• Know How

Learning outcomes	
Learning outcomes	Competences
Be able to identify the statistical aspects within an empirical problem and draw conclusions from the existing information applying the concepts studied in the subject. Know, apply and correctly interpret the descriptive techniques and calculation of basic probabilities and assess their interest as a fundamental tool in data analysis.	CB1 CB2 CB3 CE16 CT1 CT5 CT15
Know the importance of information and be able to assess and classify it in each decision area. Know how to correctly apply and interpret the basic descriptive techniques for the analysis of unidimensional and bidimensional variables.	CB2 CB3 CE14 CT5 CT15
Understand the concept of hypothesis testing.	CB3 CE16 CE29 CT6 CT7
Understand the principles of multivariate analysis.	CB3 CE16 CE29 CT6 CT15

Effectively solve problems and issues of each of the lessons using the appropriate quantitative method.	CE29 CT6 CT7 CT15
Introduce the students in the manage of computer packages related to statistics: excel, R. And so favor a positive attitude towards the quantitative methods, in general, and statistics, in particular, as well as their computer manipulation.	CB3 CE16 CE29 CT4 CT6 CT15
Understand the importance of statistical analysis when taking decisions and learn when to apply each technique and interpret the results obtained.	CB3 CE14 CE16 CE29 CT1 CT7 CT15
To awaken the taste for the use and study of statistics, seeing it as a tool that allows us to learn more about our own field of knowledge and to start carrying out our own research.	CB3 CE16 CT15

Contents

Topic	
1. Exploratory data analysis	Measures of central tendency, dispersion and form. Graphic representations. Linear and non-linear transformations. Atypical data and their detection. Mean and variance in subpopulations. Descriptive introduction to the ANOVA.
2. Calculation of probabilities and main distributions of probability	Random experiment. Rule of addition. Conditioned probability. Main probability theorems. Independence of events. Diagnostic tests. Discrete and continuous variables. Mean and variance. Discrete models: binomial, multinomial, hypergeometric and poisson. Continuous models: normal, log-normal, exponential, chi-square, t-Student and F-Snedecor.
3. Introduction to hypothesis testing. Frequency tables: means and tests.	Definition of a test. Type I and type II errors, level of significance, p-value, power and sample size. Types of tests. Normality test Frequency tables. Association measures for nominal, ordinal and quantitative variables. Measures of prediction and agreement. Chi-square test of goodness of fit, independence and homogeneity.
4. Regression.	The simple linear model. Scatter plot. Line of regression. Correlation coefficient and goodness of fit. ANOVA of the regression and residue analysis. Non-linear regression: logarithmic, potential and exponential models. Introduction to multiple linear regression.
5. Statistical inference techniques for comparison of groups	Comparisons between 2 independent or related groups. Previous variance test: "F" test. Tests to compare two means: "t" tests. Comparison of more than 2 groups: ANOVA and multiple comparison test. Study of the assumptions of alternative nonparametric techniques.

Planning

	Class hours	Hours outside the classroom	Total hours
Seminars	7	14	21
Laboratory practical	15	7.5	22.5
Autonomous problem solving	0	27.5	27.5
Lecturing	30	30	60
Problem and/or exercise solving	2	2	4
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
Seminars	Resolution of practical exercises of the subjects. In some cases, Excel will be used.
Laboratory practical	Data processing using the free software R.
Autonomous problem solving	Resolution of exercises in the problem sets.
Lecturing	Exposition of the main statistical techniques described in the syllabus of the subject.

Personalized assistance

Methodologies	Description
Autonomous problem solving	In the hours of tutoring and seminars. The student who wishes can go to personalized tutoring to answer questions, mainly in the hours indicated. The student may set a different schedule by previously contacting the professor.
Laboratory practical	In the tutorials and seminars.
Seminars	In the tutorials and seminars.

Assessment

	Description	Qualification	Evaluated	Competences
Laboratory practical	The result of the analysis of data made during the practices will be uploaded to the faitic platform will be evaluated.	10		CB3 CT6 CT15
Seminars	The students will be evaluated by solving an exercise in the classroom in an autonomous way.	10		CE14 CT6 CT7 CT15
Problem and/or exercise solving	There will be two midterm exams during the course that will take place during the theory classes. Midterm 1 (10%): lessons 1 and 2. Midterm 2 (10%): lessons 3 and 4.	20		CB3 CT6 CT15
Essay questions exam	Final exam of the subject	60		CB3 CE14 CT1 CT6 CT7 CT15

Other comments on the Evaluation

It is possible to pass the subject through continuous evaluation. The continuous assessment note is obtained as the weighted average of the following qualifications:

- Average grade of laboratory practice reports. (25%)
- Average grade of the exercises solved in the seminars. (25%)
- Average grade of the midterm exams. (50%)

If the subject is not passed through continuous assessment, the grade of continuous evaluation will represent 40% of the final grade, with the remaining 60% being the final exam grade in the official exams.

The grade in the extraordinary call is computed exactly in the same way as in the ordinary call. Counting the continuous evaluation (seminars, practices and partials) 40% and the final exam 60%.

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

Faculty: <http://mar.uvigo.es/index.php/en/alumnado-actual-2/examenes-3>

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

MIRÁS CALVO, M.A. / SÁNCHEZ RODRÍGUEZ, M.E., Técnicas estadísticas con hoja de cálculo y R : azar y variabilidad en las ciencias naturales, 1, Servizo de Publicacións da Universidade de Vigo, 2018,
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SOKAL, R. / ROHLF, F., Biometría, 4, Blume, 2012, Madrid

STEEL, R. / TORRIE, J., Bioestadística. Principios y procedimientos, 4, McGraw-Hill, 1995, Bogotá

SUSAN MILTON, J., Estadística para Biología y Ciencias de la Salud, 3, McGraw-Hill Interamericana, 2007, Madrid

Complementary Bibliography

FOWLER F. / COHEN, L. / JARVIS, P., Practical Statistics for Field Biology, 2, John Wiley & Sons, 2013, Chichester

Recommendations

IDENTIFYING DATA**Chemical oceanography I**

Subject	Chemical oceanography I			
Code	V10G060V01304			
Study programme	(*)Grao en Ciencias do Mar			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	2nd	1st
Teaching language	Spanish			
Department				
Coordinator	Prieto Jiménez, Inmaculada			
Lecturers	Marín Caba, Laura Prieto Jiménez, Inmaculada			
E-mail	iprieto@uvigo.es			
Web				
General description	"Chemical Oceanography I" aims to explain processes that take place in seawater from a physicochemical point of view. For this, the behavior of systems in different media and interfaces is studied.			

Competencies

Code		Typology
CB1	Students have demonstrated knowledge and understanding in a field of study that builds upon their general secondary education, and is typically at a level that, whilst supported by advanced textbooks, includes some aspects that will be informed by knowledge of the forefront of their field of study	• know
CB2	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	• Know How
CB3	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	• Know How
CB4	Students can communicate information, ideas, problems and solutions to both specialist and non-specialist audiences	• Know How
CB5	Students have developed those learning skills that are necessary for them to continue to undertake further study with a high degree of autonomy	• Know How • Know be
CE1	To know the vocabulary, codes and concepts inherent to the oceanographic scientific field	• know
CE2	To know and understand the essential facts, concepts, principles and theories related to oceanography	• know • Know How
CE6	Ability to identify and understand the problems in the field of oceanography	• know • Know How
CE15	To recognize and implement good scientific practice in measurement and experimentation, both in the field and in the laboratory	• Know How
CE17	Ability to survey in the field and to work in the laboratory responsibly and safely, encouraging team work	• Know How
CE18	To transmit writing, verbal and graphical information for audiences of various types	• Know How
CT2	Organization and planning skills	• Know How
CT3	Written and oral communication in the official languages of the University	
CT8	Teamwork ability	• Know How

Learning outcomes

Learning outcomes	Competences
Describe the composition and behavior of materials present in seawater.	CB1 CE1 CE2 CE6 CT3
Explain the main properties of water, electrolyte solutions and seawater from a physicochemical point of view.	CB1 CE1 CE2 CE6 CT3

Recognize and interpret the transport phenomena of solutes.	CB2 CB3 CE1 CE2 CE6 CE15 CT2 CT3 CT8
Distinguish the types of estuaries based on water circulation and identify their characteristics.	CB2 CB3 CB5 CE1 CE2 CE6 CE18 CT3
Use quantitative models to study the water circulation and calculate residence times in estuaries.	CB2 CB3 CE1 CE2 CE6 CT3
Explain the characteristics of the air-sea interface, the processes that take place and the factors that control them.	CB2 CB3 CB4 CE1 CE2 CE6 CT3
Describe the gas solubility in the seawater and apply the models to estimate gas exchange across the air-sea interface.	CB2 CB3 CE1 CE2 CE6
Explain the characteristics of the seawater-solid interface, the processes that occur in it and identify the factors that determine them.	CB2 CB3 CE1 CE2 CT3
Interpret the properties and behavior of particulate matter and colloids present in seawater.	CB2 CB3 CE1 CE2 CE6 CE15 CE17 CE18 CT2 CT3 CT8
Use appropriate experimental techniques to study the adsorption processes and apply the models at the solid-solution interface.	CB2 CB3 CB5 CE1 CE2 CE6 CE15 CE17 CE18 CT2 CT3 CT8

Explain the characteristics and composition of interstitial waters.

CB1
CB3
CB4
CB5
CE1
CE2
CT3

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. - 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.
Laboratory experiment 4	Study of properties of colloidal systems.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	23	35	58
Problem solving	14	28	42
Laboratory practical	15	20	35
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 Tema platform.
Problem solving	Activity where it is exposed some aspects related to the development of the topics covered in the subject, also solving problems, exercises and / or issues. In addition, the students must work on proposed exercises and issues, according to the guidelines established by the professor in the classes or seminars of the subject.

Laboratory practical The students will perform different experiments in the laboratory over several sessions. In order to be able to have previous knowledge of the practices to be carried out, students will have the corresponding material on the Tema platform.

After working in the laboratory, students must prepare a report, which must include the results obtained, discussion and conclusions related to the practice.

Once it is finished, students will have to answer some questions related to the work developed.

Personalized assistance

Methodologies	Description
Lecturing	Sessions in which the faculty will resolve the questions and queries of the students related to the study and / or subjects related to the subject and the activities developed during the course. The students who want to be able to go to personalized tutorials, specially in the schedule indicated below. Hours: Tuesday, wednesday and thursday, from 15:30 to 17:30 h. This schedule may vary on time, depending on other teaching and / or research duties that the faculty must attend, so it would be convenient for the student to contact in advance.
Laboratory practical	Idem
Problem solving	Idem
Tests	Description
Essay questions exam	Idem

Assessment

	Description	Qualification	Evaluated	Competences
Laboratory practical	In this section will be valued: - The work carried out by the students in the laboratory. - The report on the laboratory experiments carried out by the students. - Test about the work developed. Attendance at laboratory experiments is mandatory. To overcome the subject the student should reach at least 50% of the maximum possible score for this activity.	20		CB2 CB3 CB4 CE1 CE2 CE6 CE15 CE17 CE18 CT2 CT3 CT8
Problem solving	The problems, exercises and/or questions proposed will be evaluated, according to the guidelines established by the professor in the classes or in the seminars of the subject. Attendance at the seminars is mandatory. The student should achieve at least 40% of the maximum score to consider this section in the overall rating.	20		CB2 CB3 CB4 CE1 CE2 CE6 CE18 CT2 CT3

Essay questions exam	Written tests to evaluate skills acquired throughout the course, which may include open questions, questions and problems about contents of the course. The students must develop, relate, organize and present the knowledge and skills they have on the subject.	60	CB1 CB2 CB3 CB4 CB5 CE1 CE2 CE6 CE18 CT2 CT3
	It will be valued:		
	- A midterm exam (20%)		
	- The final exam (40%)		
	To pass the subject a minimum grade of 3,5 points (of 10) must be achieved in both tests.		

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 at the end of the semester will be the sum of all the sections that make up the evaluation, provided that the required minimums are exceeded. If this is not the case, the qualification will be that of "Question exam".

The final grade, if higher than 7 points, can be normalized so that the highest grade can be up to 10 points.

In July

In the call for the subject in July, the evaluation system will be similar.

In July, students who have not passed the subject in January call may retrieve the section corresponding to the written tests (60%). To pass the subject a minimum grade of 3.5 points (of 10) must be achieved, maintaining the grades obtained by the students through the problems and/or issues solving during the course and the laboratory experiments.

The final grade will be the sum of all the sections, as long as the required minimums are exceeded. If it is not the case, the qualification that will appear in the record will be that of the weighted final test.

In the case that this qualification in the July is lower than that obtained in the evaluation at the end of the term, the qualification that will appear will be the latter.

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

<http://mar.uvigo.es/index.php/en/alumnado-actual-2/examenes-3>

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

Sources of information

Basic Bibliography

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

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

Complementary Bibliography

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

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

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

Recommendations

Subjects that continue the syllabus

Chemical oceanography II/V10G060V01403

IDENTIFYING DATA**Sedimentology**

Subject	Sedimentology			
Code	V10G060V01305			
Study programme	(*)Grao en Ciencias do Mar			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	2nd	1st
Teaching language	Spanish English			
Department				
Coordinator	Rey García, Daniel Marino , Gianluca			
Lecturers	Alejo Flores, Irene Diz Ferreiro, Paula García Gil, María Soledad González Villanueva, Rita López Pérez, Ángel Enrique Marino , Gianluca Rey García, Daniel			
E-mail	gianluca.marino@uvigo.es danirey@uvigo.es			
Web	http://193.146.32.240/tema1112/claroline/course/index.php			

General description Sedimentology is a building block of Marine Geology. Studying this subject is essential to: (i) achieve a comprehensive understanding of how the marine (sedimentary) basins operate and evolve through time; and (ii) unravel the complex interactions between the sediments and the climatic and/or tectonic processes that contribute to shape the Earth's surface. Sedimentology pertains to the study of the marine sediments and of the processes that govern their formation, such as erosion, transport, deposition, and diagenesis.

The course contributes essential insights into the methods and analytical technics that are most commonly used in the study and recognition of the different types of sediments and sedimentary rocks. These are key for the analysis of the sedimentary facies and sequences, for their paleoenvironmental interpretation (e.g., palaeoclimatology, palaeoceanography), and for deciphering the sedimentary record and help the prospection and exploration of natural resources (e.g., petroleum, ore deposits).

The course also sheds light on the importance of the marine sediments and on their relationship with the physical, chemical, biological, and hydrodynamic processes that shape the Earth's surface and control the dynamics of the ocean basins on a range of timescales. It is therefore essential to identify those processes that arise from anthropogenic activity versus those that exclusively reflect natural processes.

Through the knowledge of the sedimentary record, the sedimentology course contributes critical knowledge of the past processes, ongoing evolution, and expected future trends of the marine environment due to changes in the natural and/or anthropogenic forcing. This is central to the understanding and management of the environment that surrounds us, such as the marine and costal 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.

Competencies

Code	Typology
CB2 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	• know • Know How
CB5 Students have developed those learning skills that are necessary for them to continue to undertake further study with a high degree of autonomy	• know • Know How
CE1 To know the vocabulary, codes and concepts inherent to the oceanographic scientific field	• know
CE2 To know and understand the essential facts, concepts, principles and theories related to oceanography	• know
CE5 Basic knowledge of research methodology in oceanography	• know • Know How
CE6 Ability to identify and understand the problems in the field of oceanography	• know
CE12 To be able to operate the instrumental techniques applied to sea	• Know How
CE13 To acquire, evaluate, process and interpret oceanographic data within the theories currently in use	• Know How
CE15 To recognize and implement good scientific practice in measurement and experimentation, both in the field and in the laboratory	• Know How
CE16 To plan, design and implement applied research from the recognition stage to the final evaluation of results and discoveries	• Know How
CE17 Ability to survey in the field and to work in the laboratory responsibly and safely, encouraging team work	• Know How

Learning outcomes

Learning outcomes	Competences
1. Recognise and identify the different types of sediments	CB5 CE1 CE5 CE12 CE15 CE17 CE18 CT16
2. Characterise texture and mineralogy in sediments	CB5 CE1 CE5 CE12 CE15 CE17 CE18 CT16
3. Recognise and identify the sedimentary structures	CB5 CE1 CE5 CE12 CE15 CE17 CE18 CT16
4. Identify the relationship(s) between sedimentary structures and depositional processes	CB5 CE2 CE6 CE13 CE15 CT6 CT16
5. Master the sedimentary processes of erosion, transport, and deposition	CB5 CE5 CE12 CE15 CE17 CE18 CT16
6. Characterise the exchange of (geo)chemical properties between seawater and sediments	CB5 CE1 CE5 CE12 CE13 CE15 CE17 CE18 CT16
7. Identify post-depositional alterations in sediments	CB5 CE1 CE6 CE12 CE13 CE15 CE18 CT16

8. Interpret the sedimentological data	CB5 CE1 CE2 CE6 CE12 CE13 CE15 CE18 CT6 CT16
9. Develop an understanding of the factors that control sedimentation in the marine environment	CB5 CE2 CE6 CE13 CE17 CE18 CT6 CT16
10. Comprehend the concepts of facies, depositional environment, and sedimentary sequence	CB5 CE1 CE2 CE6 CE13 CE18 CT6 CT16
11. Use the sedimentological analysis to decipher the dynamics and evolutive trends of the sedimentary environment(s)	CB5 CE2 CE6 CE13 CE18 CT6 CT16
12. Become skilled in applying the analytical and investigative methods to perform sedimentological work in the marine environment	CB2 CB5 CE1 CE5 CE6 CE12 CE13 CE16 CE17 CE18 CT16
13. Apply the knowledge developed during the course to address (sedimentological) problems in the marine environment	CB2 CB5 CE2 CE5 CE6 CE12 CE16 CE17 CE18 CT6 CT16

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 practicals; 0.4. Fieldwork; 0.5. Tests; 0.6. Tutorials; 0.7. Assessment.

Topic 1. Basic concepts	<ul style="list-style-type: none"> 1.1. Sediments and sedimentary rocks and their relevance to other disciplines; 1.2. The geological cycling of sediments and rocks; 1.3. Sediment source, routing, and sink; 1.4. Sediment residence time; 1.5. Interplay between tectonics, climate, and the formation and deposition of sediments.
Topic 2. Methods	<ul style="list-style-type: none"> 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; 2.2. Sampling campaigns: strategy and planning; 2.3. Characterization of sediments: (i) physical; (ii) chemical; and (iii) other properties; 2.4. Examples and case studies.
Topic 3. Rock weathering and the transport of solid and solute load into the ocean	<ul style="list-style-type: none"> 3.1. Water-rock interaction: chemical and physical breakdown of rocks at the Earth's surface; 3.2. Mechanisms, rates, and extent of weathering and its interactions with climate and tectonics; 3.3. Weathering products and the transport of solid and solute load into the ocean; 3.3. Impacts of weathering on ocean chemistry.
Topic 4. Siliciclastic sediments I: general fluid flow characteristics	<ul style="list-style-type: none"> 4.1. Transport environments; 4.2. Physical properties of fluids; 4.3. Relevant concepts of fluid dynamics, such as the laminar and turbulent flows, the boundary layer, and the bottom effects; 4.4. Types of flow: (i) unidirectional; (ii) oscillatory; (iii) gravitational; and (iv) liquefied.
Topic 5. Siliciclastic sediments II: sediment transport and bedforms	<ul style="list-style-type: none"> 5.1. Initiation of motion: (i) critical shear stress; (ii) sediment size and density, and (iii) biological activity; 5.2. Cohesive sediments; 5.3. Sediment transport: modes and transport rate; 5.4. Sedimentation of particles: static fluid (Stokes Law) and natural flows (drag coefficient); 5.5. Bedforms under unidirectional flows: (i) terminology; (ii) sequence of formation; and (iii) stability; 5.6. Cross-stratification: (i) types; (ii) bedforms under oscillatory flows; (iii) stability; and (iv) relationships with the flow regime; 5.7. Other bedforms.
Topic 6. Siliciclastic sediments III: description and classification	<ul style="list-style-type: none"> 6.1. Description: texture and structure; 6.2. Classification according to the grain size; 6.3. Shape; 6.4. Origin and composition; 6.5. Classification according to the sediment composition; 6.6. Concepts of textural and compositional maturity; 6.7. Siliciclastic sediments, climate, and tectonics; 6.8. Diagenesis of siliciclastic sediments and lithification into siliciclastic sedimentary rocks.
Topic 7. Siliciclastic sediments IV: grain-size distribution and fabric of siliciclastic sediments	<ul style="list-style-type: none"> 7.1. Grain-size analysis and statistics; 7.2. Fabric and texture; 7.3. Porosity and permeability; 7.4. Bedforms; 7.5. Sedimentary structures; 7.6. Temporal and spatial scales of the siliciclastic sedimentary processes.
Topic 8. Chemical and biochemical sediments I: ocean chemistry and (bio)chemical sedimentation	<ul style="list-style-type: none"> 8.1. Processes that control ocean chemistry and its evolution through time; 8.2. Relationship between (bio)chemical sediments, climate, and weathering; 8.3. Ocean carbonate chemistry: carbonate species and carbonate precipitation in seawater; 8.4. Carbonate minerals; 8.5. Carbonate saturation, lysocline, and carbonate compensation depth.
Topic 9. Chemical and biochemical sediments II: description and classification of carbonate sediments	<ul style="list-style-type: none"> 9.1. Allochemical carbonate constituents; 9.2. Ortochemical 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. Physical processes that control carbonate production and facies distribution in the ocean; 10.3. Chemical processes that control carbonate production and facies distribution in the ocean; 10.4. 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. Sedimentary facies	12.1. Facies: concept and types; 12.2. Facies association; 12.3. Cyclicity, rhythms, and their origin; 12.4. Correlations.
Seminars	Seminar 1. grain size (part 1) and shape; Seminar 2. grain size (part 2) and composition; Seminar 3. sediment transport.
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	40	65
Studies excursion	14	10	24
Laboratory practical	6	0	6
Presentation	0.25	1.75	2
Mentored work	0	15	15
Seminars	7	15	22
Seminars	0	9	9
Essay questions exam	0	3	3
Problem and/or exercise solving	0	1	1
Objective questions exam	0	1	1
Practices report	0	2	2

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

Methodologies

	Description
Lecturing	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	It includes the 2 fieldtrips of 7 hours each, which are aimed at carrying out direct observations on specific sedimentary environments and evaluate their main sedimentological features.
Laboratory practical	5 hours of laboratory practical, using a petrographic microscope as a fundamental tool to perform petrographic investigation of sediments and sedimentary rocks.
Presentation	Short presentations on topics related to those addressed during the lectures, seminars, and/or fieldtrips.
Mentored work	Reports to be presented after seminars, laboratory practicals, and fieldtrips.
Seminars	Seminars of 2:20 hours each in the laboratory, during which main analytical techniques and approaches are illustrated and applied.
Seminars	Activities associated to the practical and/or theoretical works.

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.
Seminars	Questions and doubts that may arise during seminars 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	Evaluated Competences
Lecturing	Written exam that consists mostly of short questions. In addition, the 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.	60	CB2 CB5 CE1 CE2 CE5 CE6 CE18 CT6
Laboratory practical	Written report and/or questionnaires related to the activity that was developed during seminars and laboratory practicals.	20	CB2 CE1 CE5 CE12 CE13 CE15 CE16 CE17 CT6 CT16
Studies excursion	Reports and/or questionnaires related to the information acquired during the fieldtrips.	15	CB2 CE1 CE5 CE12 CE13 CE15 CE16 CE17 CT16
Presentation	Assessment of the oral presentation skills.	5	CB2 CB5 CE1 CE2 CE6 CE18 CT16

Other comments on the Evaluation

Attendance at fieldtrips, seminars, and laboratory practicals is 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 fieldtrips will preclude admission to the final exam.

It is required to reach at least a mark of 40% in each component of the course (i.e., practical, fieldstrip, seminar, and final exam) for the final mark to be computed and pass the exam.

If none of the students reaches a mark of 90% in the final qualification, scheduling of an additional test will be considered to improve the mark. No more than 4 top students with a final mark better than 75% mark will be eligible for such a test.

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/index.php/en/alumnado-actual-2/examenes-3>

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

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

Sources of information

Basic Bibliography

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

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

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

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Recommendations

Subjects that continue the syllabus

Coastal and marine sedimentary habitats/V10G060V01402

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.

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 TEMA 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 24:00 of the day that is indicated in the TEMA platform. No submission will be accepted nor evaluated beyond the submission deadline.

AUTHORSHIP

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

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

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

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

THE PLATFORM TEMA IS THE FORMAL METHOD OF COMMUNICATION

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

HONORABILITY

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

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

IDENTIFYING DATA**Internships**

Subject	Internships			
Code	V10G060V01318			
Study programme	(*)Grao en Ciencias do Mar			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Optional	3rd	2nd
Teaching language	Spanish			
Department				
Coordinator	Souza Troncoso, Jesús			
Lecturers	Souza Troncoso, Jesús			
E-mail	troncoso@uvigo.es			
Web				
General description	The external academic practices constitute an activity of formative nature realised by the university students and supervised by the Universities, whose aim is to allow to the same reinforce and complement the knowledges obtained in his academic training, favouring the acquisition of capacities in view to prepare them for the exercise of professional activities (BOE 297, 10 December 2010).			

Competencies

Code		Typology
CB2	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	• know • Know How
CE14	To recognize and analyze new problems and to propose problem-solving strategies	• Know How
CE17	Ability to survey in the field and to work in the laboratory responsibly and safely, encouraging team work	• Know How
CE27	To understand the operation details of enterprises linked to the marine environment, and to recognize their specific problems and solutions	• Know How
CT8	Teamwork ability	• Know How
CT12	Ability to adapt to new situations	• Know be
CT15	Ability to apply knowledge in practice	• Know How

Learning outcomes

Learning outcomes	Competences
New	CB2 CE14 CE17 CE27 CT8 CT12 CT15

Contents

Topic	
The contents of the external academic practices have to obtain the following objectives:	a) Contribute to the integral training of the students complementing his theoretical and practical learning. b) Facilitate the knowledge of the methodology of work adapted to the professional reality in that the students will have to operate, contrasting and applying the knowledges obtained. c) Stimulate the development of technical capacities, methodological, personal and participatory. d) Obtain a practical experience that facilitate the insertion in the market of work and improve his future employability. e) Favour the values of the innovation, the creativity and the ventures.

Planning

	Class hours	Hours outside the classroom	Total hours
External practices	150	0	150

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

Methodologies

Description

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

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

Assessment

	Description	Qualification	Evaluated Competences
External practices	The advisor of the collaborator entity will realise and will send to the academic advisor of the university a final report, to the conclusion of the practices, that will collect the number of hours realised by the student and in which it will be able to value the different appearances referred so much to the generic competitions how to the specific, foreseen in the corresponding formative project.	100	CB2 CE14 CE17 CE27 CT8
	The student will elaborate and will do delivery to the academic tutor of the University a final memory (1-2 pages), to the conclusion of the practices with the seen well of the tutor of the company.		CT12 CT15
	The academic advisor will evaluate the practices developed, according to the reports of the student and of the advisor of the Company, filling the corresponding report of assessment with the final note.		

Other comments on the Evaluation

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

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

Sources of information

Basic Bibliography

Complementary Bibliography

Recommendations

Other comments

It is very important to follow the instructions of the Tutor of the Company, realise all the activities that are requested to the student.

Adopt an attitude of collaboration in all the tasks entrusted from the start of the practice.

IDENTIFYING DATA**Marine Ecology**

Subject	Marine Ecology			
Code	V10G060V01401			
Study programme	(*)Grao en Ciencias do Mar			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	2nd	2nd
Teaching language	Spanish			
Department				
Coordinator	Fernández Suárez, Emilio Manuel			
Lecturers	Fernández Suárez, Emilio Manuel Olabarria Uzquiano, Celia			
E-mail	esuarez@uvigo.es			
Web				
General description	Marine ecology is the first subject entirely focussed on Ecology in the Marine Science studies at the University of Vigo. The subject describes the main metabolic pathways in the biosphere, analyze how energy flows drive cycles of matter, introduces models of population dynamics and the interactions between populations and finally assesses the factors controlling the structure and functioning of marine ecosystems. The effect of anthropogenic perturbations on the functioning of marine ecosystems is introduced horizontally in the different units.			

Competencies

Code	Typology
CB1 Students have demonstrated knowledge and understanding in a field of study that builds upon their general secondary education, and is typically at a level that, whilst supported by advanced textbooks, includes some aspects that will be informed by knowledge of the forefront of their field of study	• know
CB2 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	• know • Know How
CB3 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	• know • Know How
CB4 Students can communicate information, ideas, problems and solutions to both specialist and non-specialist audiences	• Know How
CB5 Students have developed those learning skills that are necessary for them to continue to undertake further study with a high degree of autonomy	• know
CE2 To know and understand the essential facts, concepts, principles and theories related to oceanography	• know
CE5 Basic knowledge of research methodology in oceanography	• know • Know How
CE6 Ability to identify and understand the problems in the field of oceanography	• know
CE10 To know the problems and the basic principles of sustainability in relation to the use and exploitation of the marine environment	• know
CE13 To acquire, evaluate, process and interpret oceanographic data within the theories currently in use	• Know How
CE15 To recognize and implement good scientific practice in measurement and experimentation, both in the field and in the laboratory	• Know How
CE16 To plan, design and implement applied research from the recognition stage to the final evaluation of results and discoveries	• Know How
CE17 Ability to survey in the field and to work in the laboratory responsibly and safely, encouraging team work	• Know How
CE18 To transmit writing, verbal and graphical information for audiences of various types	• Know How
CE37 Technical advice or assistance on issues related to the marine and coastal environment	• know • Know How
CT1 Analysis and synthesis ability	
CT6 Problem management and solving skills	• Know How

Learning outcomes

Learning outcomes	Competences
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Capacity to understand and analyse the basic processes of the interactions between organisms.	CB1 CB2 CB3 CB4 CB5 CE2 CE6 CE10 CT1 CT6
Capacity to understand the bases of diversity and the the factors controlling organization and structure of the ecosystems	CB1 CB2 CB3 CB4 CB5 CE2 CE6 CE10 CE18 CT1 CT6
To design, analyze, interpret and present experimental results	CB1 CB2 CB3 CB4 CB5 CE2 CE5 CE6 CE10 CE13 CE15 CE16 CE17 CE18 CE37 CT1 CT6
To use software typically used in Marine Ecology	CB1 CB2 CB3 CB4 CB5 CE5 CE13 CE16 CT1
To use the basic bibliography related to the ecological concepts	CB1 CB2 CB3 CB4 CB5 CE2 CE5 CE6 CE16 CE37 CT1

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 dynamics	Diversity, biodiversity and species richness. Colonization and extinction: Island population dynamics. Implications on habitat reduction and fragmentation. Equitativity: Models of distribution of abundance. Diversity indexes. Diversity in space: diversity spectra and gradients. Topology of the food webs. 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.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	30	60	90
Seminars	7	14	21
Laboratory practical	9	24	33
Problem and/or exercise solving	1	0	1
Project	3	0	3
Essay questions exam	2	0	2

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

Methodologies

	Description
Lecturing	Lectures will be used to develop the fundamental contents of the matter
Seminars	<p>The seminars will address contents of more complex assimilation, that require the utilisation of computer programs and capacities of data analysis which will be later used by the students in the experimental work</p> <p>The contents of these seminars will be:</p> <p>Seminar 1: experimental and technical sampling design. Data analysis I: analysis of variance in Ecology. Practical case.</p> <p>Seminar 2: Discussion on the experimental approach of the practical work. Data analysis II. Multivariate analysis in Ecology: similarity analysis, MDS. Practical case.</p> <p>Seminar 3: Presentation of scientific results. Models in Ecology: use of the Stella software. Practical case</p>

Laboratory practical	<p>The experimental work consists in the design, sampling, experimentation, processing of samples, data analysis, preparation and discussion of results and, finally, presentation of the results by the students. They will develop, therefore, all the phases of an investigation. The experimental work will be carried out in an autonomous way in 4 people groups supervised by the professors.</p> <p>The seminar sessions will tackle the necessary practical contents for the experimental design and data treatment of the practical work. The students will have to his disposal the Ecology laboratory in the allocated dates.</p> <p>The results of the will be present in format poster.</p>
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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	Seminars will be evaluated by means of a specific examination of the contents presented in the seminar sessions. The qualification of this examination will represent 10% of the total qualification.
Project	The qualification of the experimental work will be based on the quality of the design, preparation and presentation of results. Each group will present a poster during 10 minutes in a public session. The students will evaluate the presentations of their colleagues, whose qualifications will allow to award prizes to the three best projects. The qualification of the experimental work will represent 25 % of the total. The groups obtaining the first prize, second prize and third prize in accordance with the rates issued by their colleagues will increase the qualification by 10 %, 7 % and 5 %, respectively.
Essay questions exam	Along the course, short exams will be developed. The qualification of these exams will represent 5% of the final qualification. A final exam will be held at the end of the course. This exam will represent 60 % of the total qualification. To pass the subject a minimum qualification of 4 points (over10) in the final exam will be required.

Assessment

Description	Qualification	Evaluated	Competences
Problem and/or exercise solving	Seminars. They will be evaluated by means of a specific examination of the contents of the seminars. The qualification of this examination will represent 10% of the total qualification.	10	CB1 CB2 CB3 CB4 CB5 CE5 CE6 CE13 CE16 CE17 CT1 CT6

Project	The qualification of the experimental work will be based on the quality of the experimental design, and on the preparation and presentation of results. The professors will provide a document that will fix the criteria of evaluation. Each group will present the investigation in a poster and as an 10 minutes oral presentation in a public session. The qualifications assigned by the the students will allow to award prizes to the three better projects. The qualification of the experimental work will represent 25 % of the total qualification. The groups that obtain the first prize, second prize and third prize in accordance with the qualification issued by students, will increase the qualification by 10 %, 7 % and 5 %, respectively.	25	CB1 CB2 CB3 CB4 CB5 CE5 CE6 CE13 CE15 CE16 CE17 CE18 CT1 CT6
Essay questions exam	Along the course, short exams will be carried out. They will represent 5% of the final qualification. At the end of the course a global exam of the subject will be performed that will represent 60 % of the total qualification. To pass the exam a minimum qualification of 4 points on 10 will be required in the global exam.	65	CB1 CB2 CB3 CB4 CB5 CE2 CE6 CE10 CT1 CT6

Other comments on the Evaluation

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

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

<http://mar.uvigo.es/index.php/en/alumnado-actual-2/examenes-3>

Sources of information

Basic Bibliography

Rodríguez, J, Ecología, Pirámide, 2016, Madrid

Begon, M, Ecology, Blackwell, 2006, Massachussets

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

Complementary Bibliography

Recommendations

Subjects that continue the syllabus

Biological oceanography I/V10G060V01502

Biological oceanography II/V10G060V01601

Marine contamination/V10G060V01701

Fisheries/V10G060V01703

IDENTIFYING DATA**Coastal and marine sedimentary habitats**

Subject	Coastal and marine sedimentary habitats			
Code	V10G060V01402			
Study programme	(*)Grao en Ciencias do Mar			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	2nd	2nd
Teaching language	Spanish			
Department				
Coordinator	García Gil, María Soledad			
Lecturers	Francés Pedraz, Guillermo García Gil, María Soledad Pérez Arlucea, Marta María			
E-mail	sgil@uvigo.es			
Web	http://http://webs.uvigo.es/c10/webc10/ficha.php?id=4			
General description	This subject is directed to the acquisition of knowledge and competences on the marine sedimentary environments, from the coastal to the oceanic basins. It includes morphological features and classification of sedimentary environments and processes. It also considers aspects of environmental and economic management. It has a theoretical character-practical including two field trips for the observation and analysis of sedimentary environments.			

Competencies

Code		Typology
CB1	Students have demonstrated knowledge and understanding in a field of study that builds upon their general secondary education, and is typically at a level that, whilst supported by advanced textbooks, includes some aspects that will be informed by knowledge of the forefront of their field of study	• know
CB2	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	• Know How
CB3	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	• Know How
CB4	Students can communicate information, ideas, problems and solutions to both specialist and non-specialist audiences	• Know How
CB5	Students have developed those learning skills that are necessary for them to continue to undertake further study with a high degree of autonomy	• Know be
CE1	To know the vocabulary, codes and concepts inherent to the oceanographic scientific field	• know
CE2	To know and understand the essential facts, concepts, principles and theories related to oceanography	• know
CE5	Basic knowledge of research methodology in oceanography	• know
CE6	Ability to identify and understand the problems in the field of oceanography	• know
CE13	To acquire, evaluate, process and interpret oceanographic data within the theories currently in use	• Know How
CE14	To recognize and analyze new problems and to propose problem-solving strategies	• Know How
CE15	To recognize and implement good scientific practice in measurement and experimentation, both in the field and in the laboratory	• Know How
CE16	To plan, design and implement applied research from the recognition stage to the final evaluation of results and discoveries	• Know How
CE17	Ability to survey in the field and to work in the laboratory responsibly and safely, encouraging team work	• Know How
CE18	To transmit writing, verbal and graphical information for audiences of various types	• Know How
CE19	To map and characterize the seabed and the underground in marine and coastal areas	• Know How
CE26	To plan, direct and write technical reports on marine issues	• Know How
CT1	Analysis and synthesis ability	• Know How
CT15	Ability to apply knowledge in practice	• Know How

Learning outcomes

Learning outcomes	Competences
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Elaborate and interpret stratigraphic sections and perform correlations	CB3 CE1 CE2 CE13 CE17 CE18 CE19 CT1 CT15
Relate the coastal processes with the architecture of the coastal sedimentary environments	CB1 CB2 CB3 CB5 CE1 CE2 CE5 CE6 CE13 CE16 CE26 CT1 CT15
Distinguish the different types of deep sediments	CB1 CB5 CE1 CE2 CE5 CE6 CE13 CE15 CE16 CE17 CE19 CE26 CT1 CT15
Relate the ressedimentation processes with the turbiditic systems	CB2 CB3 CE1 CE2 CE5 CE6 CE15 CE16 CE17 CE19 CT1 CT15
Understand the sedimentary effects of the deep oceanic circulation	CB2 CB3 CE1 CE2 CE5 CE6 CE13 CE15 CE16 CE19 CT1 CT15

Understand the pelagic sediments as the result of a global biogeochemical system.	CB1 CB2 CB3 CE1 CE2 CE5 CE6 CE13 CE14 CE16 CE17 CE18 CT1 CT15
Identify the different types of coastal sedimentary environments in function of their sedimentary record.	CB1 CB3 CB5 CE1 CE2 CE6 CE14 CE18 CT1 CT15
Understand the coastal and marine environments space-temporal evolution	CB1 CB2 CB3 CB4 CB5 CE1 CE2 CE5 CE6 CE14 CE19 CE26 CT1 CT15

Contents

Topic	
Subject 1. Introduction to the sedimentary environments	Introduction to the Stratigraphy and the sedimentary environments Evolution of the sedimentary environments in the context of the sequential Stratigraphy
Subject 2. Introduction to the processes of transport and sedimentation in sedimentary environments	Transport and sedimentation by currents, tides, waves and wind Characteristics and related sedimentary structures. Mass transport, sediments flows and turbidity currents. Associated sedimentary structures.
Subject 3. Beaches and systems island- barrier-lagoon	Factors that influence in the coastal morphology. Coastal dynamics and sedimentary processes. Beaches: types, subenvironments and dynamics. Barriers: types and morphology.
Subject 4. Deltas	Deltaic processes. Classification of deltas and subenvironments Processes of deformation. Temporal and spatial variability of the deltaic systems.
Subject 5. Estuaries, rias and intertidal flats	Introduction to these transitional environments. Differences and classification. Physical processes. Biogeochemical processes. Zonation and sedimentology. Evolution and stratigraphic implications fo these transitional enviroments.
Subject 6. The continental shelf	Continental shelves and epicontinental seas: geomorphological classification. Processes in the continental shelf. Siliciclastic and carbonatic continental shelves.

Subject 7. Sedimentary oceanic processes	Contribution of sediments to the ocean. Atmospheric and oceanic processes of control of the sedimentation. Upwelling and downwelling. Biogeochemical processes in the oceanic sedimentation
Subject 8. Sedimentary processes in the slope and in the oceanic basins	Dynamics of the dense flows Types of deposits, classification and morphology The turbidites. Types and deposits
Subject 9. Contourites and depositional contourite systems	Classification and factors that define a turbiditic system. Deep oceanic circulation. Erosional and depositional contouritic features. Dynamic and evolution of the contouritic systems. Economic interest of the contouritic deposits.
Subject 10. Pelagic and hemipelagic sedimentation.	Distribution of the pelagic and hemipelagic sediments in the ocean bottoms. Oceanic sedimentary processes and distribution of pelagic and hemipelagic sediments. Types of deposits.
Subject 11. Synthesis:	Sedimentary evolution of marine and coastal environments.

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
Case studies	Mapping and evolution of sedimentary environments explored from the Google Earth.
Studies excursion	It comprises two field-trips: 1. Arousa Island 2. Corrubedo
Seminars	Seminar 1. Sedimentary Structures Seminar 2. Stratigraphic sections Seminar 3. Videos of marine sedimentary environments.

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	Evaluated	Competences
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Studies excursion	Reports of the exits of field. It will evaluate the assistance to the field.	10	CB3 CB4 CE5 CE6 CE13 CE16 CE17 CE18 CT1 CT15
Case studies	Report (memory) of the results obtained in the classroom of computing.	5	CB2 CE19
Seminars	Preparation of a work of synthesis and results for each one of the seminars	15	CB4 CE1 CE2 CE5 CE18 CE19 CT1 CT15
Objective questions exam	Examination with short answer questions on the topics developed during master classes	70	CB4 CE1 CE2 CE5 CE18 CT1 CT15

Other comments on the Evaluation

To surpass the matter, will be necessary to surpass 45% of all the proofs and have an average of approved (50%). The assistance to the theoretical, practical and seminars, as well as the exits to the field are compulsory and they will consider in the percentage of qualification. It will be allowed 20% of absence, but justified. 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, what supposes a fail in the first announcement. To surpass the matter in the second announcement the students will have to do an examination of each one of the parts of the matter that had not surpassed.

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

It is required a responsible and honest behavior from students.

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

Sources of information

Basic Bibliography

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

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

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

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

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

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

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, London, UK

Thurman, H.V. y Trujillo, A.P., Essentials of Oceanography (11 Edition), 11st, Pearson, 2011, London, UK

Tucker, M. y Wright, P., Carbonate Sedimentology, 1st, Blackwell Science, 1990, Oxford

Weimer, P. y Link, M.H., Seismic facies and sedimentary processes of submarine fans and turbidite systems, 1st, Springer-Verlag, 1991, New York

Complementary Bibliography

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

Rebesco, M., Camerlenghi, A., Contourites. Developments in Sedimentology, 1st, Elsevier, 2008, Amsterdam

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, USA

Wefer, G.; Billet, D.; Hebbeln, D.; Jorgensen, Bo B.; y otros, Ocean Margin Systems, 1st, Springer-Verlag, 2003, Berlin

Recommendations

Subjects that continue the syllabus

Basin Analysis/V10G060V01901

Geological oceanography I/V10G060V01504

Geological oceanography II/V10G060V01603

Applied marine geology/V10G060V01909

Subjects that it is recommended to have taken before

Sedimentology/V10G060V01305

IDENTIFYING DATA**Chemical oceanography II**

Subject	Chemical oceanography II			
Code	V10G060V01403			
Study programme	(*)Grao en Ciencias do Mar			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	2nd	2nd
Teaching language	Spanish			
Department				
Coordinator	Nieto Palmeiro, Óscar			
Lecturers	Estévez Bastos, Pablo Leao Martins, Jose Manuel Nieto Palmeiro, Óscar Pena Pereira, Francisco Javier			
E-mail	palmeiro@uvigo.es			
Web	http://http://depc07.webs.uvigo.es/			
General description	In this matter presents the chemical methodology applied to the determination of the compounds of greater interest in the Chemical Oceanography, from the taking of sample until the obtaining of the final result.			

Competencies

Code		Typology
CB2	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	• know • Know How • Know be
CB4	Students can communicate information, ideas, problems and solutions to both specialist and non-specialist audiences	• know • Know How • Know be
CB5	Students have developed those learning skills that are necessary for them to continue to undertake further study with a high degree of autonomy	• know • Know How • Know be
CE1	To know the vocabulary, codes and concepts inherent to the oceanographic scientific field	• know
CE2	To know and understand the essential facts, concepts, principles and theories related to oceanography	• know
CE4	To know the basic techniques to sample the water column, organisms, sediments and sea bottom, as well as the surveying methods for dynamic and structural variables	• know • Know How • Know be
CE5	Basic knowledge of research methodology in oceanography	• know • Know How • Know be
CE6	Ability to identify and understand the problems in the field of oceanography	• know • Know How • Know be
CE12	To be able to operate the instrumental techniques applied to sea	• know • Know How • Know be
CE13	To acquire, evaluate, process and interpret oceanographic data within the theories currently in use	• know • Know How • Know be
CE14	To recognize and analyze new problems and to propose problem-solving strategies	• know • Know How • Know be
CE15	To recognize and implement good scientific practice in measurement and experimentation, both in the field and in the laboratory	• know • Know How • Know be
CE16	To plan, design and implement applied research from the recognition stage to the final evaluation of results and discoveries	• know • Know How • Know be
CE17	Ability to survey in the field and to work in the laboratory responsibly and safely, encouraging team work	• know • Know How • Know be
CE18	To transmit writing, verbal and graphical information for audiences of various types	• know • Know How • Know be
CT3	Written and oral communication in the official languages of the University	

CT6 Problem management and solving skills	<ul style="list-style-type: none"> • Know How • Know be
CT11 Ability to learn independently and continuously	
CT15 Ability to apply knowledge in practice	<ul style="list-style-type: none"> • Know How • Know be

Learning outcomes

Learning outcomes	Competences
Enumerate the physical parameters-chemical more notable in the water of sea to realise oceanographic studies.	CB2 CB5 CE1 CE2 CE6 CE18 CT3 CT11
Describe the foundations and the applications of the technicians of chemical analysis more usually used in the laboratory.	CB4 CB5 CE1 CE2 CE4 CE5 CE12 CE15 CE18 CT3 CT6 CT15
Know choose and use the material for the taking of sample of the water of mar.	CB2 CB4 CB5 CE2 CE4 CE5 CE12 CE13 CE15 CE16 CE17 CT3 CT6 CT15
Apply the technicians of chemical analysis to the compounds of greater interest in the Chemical Oceanography.	CB2 CB4 CB5 CE2 CE5 CE12 CE13 CE15 CE16 CE17 CT6 CT15
Apply the experimental conditions more adapted for the determination of a chemical compound in function of the chemical reactivity.	CB2 CB5 CE5 CE6 CE12 CE13 CE14 CE15 CE16 CT3 CT6 CT15

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.	CB2 CB4 CB5 CE2 CE13 CE15 CE18 CT15
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Prepare the reagents and the necessary material to carry out an oceanographic campaign.	CB2 CB4 CB5 CE1 CE2 CE4 CE5 CE12 CE13 CE15 CE16 CE17 CE18 CT3 CT6 CT15
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Contents

Topic	
Analytical methodology (I): previous operations	Sampling. Preparation of the sample. Measurement and analytical chemistry references. Analytical measurement techniques.
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. Quality assurance in the analytical measurement.
Determination of salinity in seawater other major compounds	Determination of the salinity: chlorinity and chlorosity. Determination of major anions and cations.
Alcalinity of seawater	Buffering capacity and alcalinity. Determination of the total alcalinity in seawater.
Dissolved oxygen	Determination of dissolved oxygen in seawater. Relation between dissolved oxygen and other physico-chemical parameters.
Nutrients: species of N, P, Si	Determination of nitrates, nitrites and ammonium in the half marine. Methods of determination of phosphates: relation of the concentrations N/P. Determination of the concentration of silicate.
Organic matter in the oceans	Determination of humic substances and photosynthetic pigments.
Trace metals	Total determination of trace elements in the marine environment.

Planning

	Class hours	Hours outside the classroom	Total hours
Introductory activities	0.5	0	0.5
Lecturing	18.5	40	58.5
Problem solving	6	20	26
Laboratory practical	20	0	20
Mentored work	7	0	7
Presentation	0.5	0.5	1
Essay questions exam	1.5	0	1.5
Problem and/or exercise solving	1.5	0	1.5
Practices report	0	20	20
Essay	0	14	14

*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 will present them to the students the syllabus to develop during the semester, as well as the aims, competitions and criteria of evaluation. Likewise it will explain them the form to develop the subject along the semester, will create the groups that will make the integrated methodologies.
Lecturing	During the teaching of each subject, the students will have in the platform TEMA, before the session of classroom, of ones aim on the syllabus to treat in the session of classroom. The professor will expose the syllabus in the classroom and will make a series of questions to promote the critical thought during the session of classroom. You aim them they will leave to be available in the platform TEMA a week after having finalised the teaching of the matter.
Problem solving	During the sessions in the classroom devoted to "Resolution of problems", the students will learn to calculate concentrations of compounds of oceanographic interest in seawater from data that obtained usually at the laboratory. The billed of these problems will find in the platform TEMA with some possible answers that will help to the students to autoevaluate.
Laboratory practical	The students will make practices of laboratory on determinations of characteristic chemical parameters of the water of sea as well as of compound chemists of interest in chemical oceanography. The reports of practical have to be delivered in the time stipulated, be original and will be evaluated by the professor of agreement to some criteria of evaluation published in the platform TEMA. They do not have obligation to make these practices those students that made them during the course 2018-19 and obtained an upper qualification to 5 points.
Mentored work	The students will make an original project related with an exit in ship to make a study of chemical oceanography. The project will be evaluated by the professor of agreement to some criteria of evaluation published in the platform TEMA. They do not have obligation to make this work those students that made it during the course 2018-19 and obtained an upper qualification to 5 points.
Presentation	The students will do a brief presentation in public on the project made in the Supervised Work which will be evaluated by the professor and his mates of agreement to some criteria of evaluation published in the platform TEMA. They do not have obligation to make this presentation those students that made it during the course 2018-19 and obtained an upper qualification to 5 points.

Personalized assistance

Methodologies	Description
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. Any doubt that arise to the student can consult any doubt through the forums enabled for this purpose in the platform TEMA.
Mentored work	Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation. Any doubt that arise to the student can consult any doubt through the forums enabled for this purpose in the platform TEMA.
Introductory activities	Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation. Any doubt that arise to the student can consult any doubt through the forums enabled for this purpose in the platform TEMA.
Presentation	Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation. Any doubt that arise to the student can consult any doubt through the forums enabled for this purpose in the platform TEMA.
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. Any doubt that arise to the student can consult any doubt through the forums enabled for this purpose in the platform TEMA.
Problem solving	Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation. Any doubt that arise to the student can consult any doubt through the forums enabled for this purpose in the platform TEMA.

Assessment

Description	Qualification	Evaluated	Competences
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Laboratory practical	The practices of laboratory are compulsory for all the students and will evaluate in accordance with the work realised during the sessions of laboratory and the memory of practices realised of agreement to some criteria of quality published in the platform TEMA.	5	CB2 CB5 CE2 CE5 CE12 CE13 CE15 CE16 CE18 CT3 CT6 CT15
Presentation	The presentation of the project realised during the tutored works will be evaluated by the professor of agreement to some criteria established previously published in the platform TEMA.	7.5	CE1 CE2 CE4 CE5 CE6 CE12 CE15 CE16 CE18 CT3 CT15
Problem and/or exercise solving	When finalising each block of subjects, will realise an examination written with an exercise on the calculation of the concentration using a method of chemical analysis. It will evaluate the result obtained, as well as the clarity and the reasoning used to arrive to this. The final examination will consist in the resolution of three problems of this type.	25	CB2 CB5 CE2 CE4 CE6 CE12 CE13 CE15 CE16 CE18 CT3 CT6 CT11 CT15

Practices report	The work of laboratory and the memory of practices will be evaluated by the professor of agreement to some previously established criteria that will be published in the platform TEMA. In case that the work was not original (was copy of another work or of the network), the professor will not evaluate said work.	20	CB2 CB4 CB5 CE1 CE2 CE4 CE5 CE6 CE12 CE13 CE15 CE16 CE17 CE18 CT3 CT6 CT15
Essay	The report presented in the tutored works will be evaluated by the professor of agreement to some previously established criteria that will be published in the platform TEMA. In case that the work was not original (was copy of another work or of the network), the professor will not evaluate said work.	17.5	CB2 CB4 CB5 CE1 CE2 CE4 CE5 CE6 CE14 CE15 CE16 CE17 CE18 CT3 CT6 CT15
Essay questions exam	In the final examinations, the pupils will have to answer to a series of questions where the aptitude to summarize will be evaluated, outlining and describing in a succinct way the analytical procedures for the determination of the compounds of major interest for the accomplishment of an oceanographic study or some analytical process. The examination will consist of 5 questions of this type.	25	CB2 CB4 CB5 CE1 CE4 CE5 CE12 CE15 CE18 CT3

Other comments on the Evaluation

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

<http://mar.uvigo.es/index.php/en/alumnado-actual-2/examenes-3>

The subject consists of four big principal blocks and the qualification of each one of them is weighted by 25 % on the final note:

1.-Long answer tests. To consider this one to be passed, the students will have to obtain a qualification equal or superior to 5 points.

2.-Resolution of problems and / or exercises. To consider this one to be passed, the students will have to obtain a qualification equal or superior to 5 points.

3.-Works of seminars. They consist on Tutored Works and Presentations. To consider this one to be passed, the students will have to obtain a qualification equal or superior to 5 points.

4.- Practical of laboratory. They consist on Laboratory Practises and Reports / memories of practises. To consider this one to be passed, the students will have to obtain a qualification equal or superior to 5 points.

. It will evaluate the work realised in the laboratory (5%) and the corresponding report of practices (20%) following some criteria that will be published in the platform TEMA.

To approve the subject will be necessary to surpass with a total of 5 points on 10 in all and each one of these blocks.

In case that the minimal qualification was not achieved in the blocks 1.-and / or 2.-, they will have to perform again the examination in the summons of July.

In case that the minimal qualification was not achieved in the blocks 3.-and / or 4.-, the works will have to be sent again by the pertinent corrections in the term that the corresponding teacher will consider oportune.

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

The not properly justified absence to one of the sessions of seminars or practical, blocks 3.- and 4.-, it supposes the no evaluation of the block that correspond, having to repeat in the following course.

It is required that the students curse this subject with a responsible and honest behaviour.

It is considered inadmissible any form of fraud (i.e. copies and/or plagiarism) directed to fake the level of knowledge or skill reached by a/to student/to in any type of exam, report or work designed with this purpose. This fraudulent behaviour will be sanctioned with the firmness and rigour that establishes the valid legislation.

In case of not surpassing the subject, only will validate for the following year the following proofs in case to have them surpassed:

- Presentations/exhibitions
- Practical of laboratory
- Inform/memories of practices
- Works and projects

Sources of information

Basic Bibliography

Grasshof K., Kremling K., Ehrhardt M. (Eds.), *Methods of Seawater Analysis*, 3, Wiley, 1999

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Harris D.C., *An lisis Qu mico Cuantitativo*, Revert , 2007

Millero F.J., Sohn M.L., *Chemical Oceanography*, CRC Press, 1992

Complementary Bibliography

Aminot A., Chaussepied M. (Eds.), *Manuel des Analyses Chimiques en Milieu Marin*, CNEXO, 1983

Parsons T.R., Maita Y., Lalli C.M., *A Manual of Chemical and Biological Methods of Seawater Analysis*, Pergamon Press, 1984

Skoog D.A., West D.M., Holler F.J., (Crouch S.R.), *Fundamentos de Qu mica An lica*, McGraw-Hill o Revert ,

Beiras R., P rez S. (Eds.), *Manual de m todos b sicos en contaminaci n acu tica*, Universidade de Vigo, 2013

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

Chester R., *Marine Geochemistry*, 2, Blackwell Science, 2000

Bearmean G. (ed.), *Sewater: its composition, properties and behaviour*, 2, The Open University. Pergamon Press, 2002

Horwitz W., Latimer G.W., *Official methods of analysis of AOAC International*, 18, AOAC International, cop., 2006

Miller J.N., Miller J.C., *Estad stica y Quimiometr a para Qu mica An lica*, Prentice-Hall, 2002

Burriel F., Lucena F., Arribas S., Hern ndez J., *Qu mica An lica Cualitativa*, 14, Paraninfo, 1992

Recommendations

Subjects that continue the syllabus

Chemistry applied to the marine environment II/V10G060V01604

Subjects that it is recommended to have taken before

Chemical oceanography I/V10G060V01304

Other comments

It is assumed that the students, at the beginning of the subject, have the following knowledge in Chemistry:

- Formulation and chemical nomenclature
- Calculation of concentrations
- Balance of basic chemical reactions and stoichiometric ratios.

Likewise, it is also assumed that the students have capability to learn by themselves the use of a scientific calculator, especially regarding the calculation of basic statistical parameters as well as the adjust by least squares of a linear plot.

IDENTIFYING DATA				
Principles of marine microbiology				
Subject	Principles of marine microbiology			
Code	V10G060V01404			
Study programme	(*)Grao en Ciencias do Mar			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	2nd	2nd
Teaching language	Spanish			
Department				
Coordinator	Longo González, Elisa			
Lecturers	Longo González, Elisa			
E-mail	elongo@uvigo.es			
Web				
General description	Basic introduction to marine microorganisms and their place in the living world. We study the used methods in marine microbiology, especially those based on molecular biology . The subject explores the major metabolic pathways by which microbes obtain energy and carbon for cellular growth, with especial attention to physiology and diversity of bacteria and arqueas. Their role in diverse hábitats and in ocean processes are included			

Competencies		Typology
Code		
CB2	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	• Know How
CB3	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	• Know How
CB4	Students can communicate information, ideas, problems and solutions to both specialist and non-specialist audiences	• know • Know How
CE11	To manage the use of littoral and coastal region and their resources in a sustainable way	• know • Know How
CE12	To be able to operate the instrumental techniques applied to sea	• know • Know How
CE13	To acquire, evaluate, process and interpret oceanographic data within the theories currently in use	
CE17	Ability to survey in the field and to work in the laboratory responsibly and safely, encouraging team work	• know • Know How
CE20	To find and evaluate marine resources of various kinds	• know • Know How
CT1	Analysis and synthesis ability	• know • Know How
CT2	Organization and planning skills	• know • Know How
CT6	Problem management and solving skills	• Know How

Learning outcomes		Competences
Learning outcomes		
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. Students can communicate information, ideas, problems and solutions to both specialist and non-specialist audiences		CB2 CB4
Organization and planning skills		CB3
To find and evaluate marine resources of various kinds		CB4
Ability to survey in the field and to work in the laboratory responsibly and safely, encouraging team work		
To be able to operate the instrumental techniques applied to sea		CB2 CE12 CE13 CE17 CE20 CT1 CT6

New	CB2 CB3 CB4 CE11 CE20 CT1
New	CB2 CB3 CB4 CE11 CE20 CT1 CT2 CT6

Contents

Topic	
Topic 1.- Estructure and funtion of procariote cell	Estructure and size of procariote cell
Topic 2.- Methods in Microbiology. Viable but not culturable cells.	Methods in culture cultured and non cultured cell
Topic 3.- Sampling methods and microbiological techniques	Determination of the size of microbial poblations and molecular techniques
Topic 4.- Microbial metabolism and physiological diversity. Distribution and diversity of marine bacteria	Phototrofism, organotrofism and litotrofism. bacteria of marine habitats
Topic 5.- Distribution and diversity of marine arqueas	Arqueas of marine habitats
Topic 6.-Biogeoquemical cicles.	Carbón, nitogen and other biogemical cicles
Topic 7.- Interaction of microorganisms and others organisms	Simbiosis, methabiosis and other relationships

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	30	30	60
Laboratory practical	17	8.16	25.16
Collaborative Learning	0.5	0	0.5
Seminars	1.5	0	1.5
Essay questions exam	0.6	27	27.6
Objective questions exam	0.9	20.6397	21.5397
Problem and/or exercise solving	0.6	10.2	10.8
Essay questions exam	0.3	0	0.3
Objective questions exam	0.3	0	0.3
Problem and/or exercise solving	0.3	0	0.3
Objective questions exam	0.5	0	0.5
Essay	1.5	0	1.5

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

Methodologies

	Description
Lecturing	<p>The practices following the protocols previously exposed platform topic (which the student has to take to the lab) will be mandatory. Will be a test in the laboratory, on the last day of practices, which counted 15% in the final grade of the course. Also the valuation shall take into account the skills and the student skills in the laboratory that can be up to 5% of the note.</p> <p>Content of the practices of the subject: Practice 1. Preparation of media Practice 2. Methods of growing of microorganisms and obtention of pure culture Practice 3. Bacterial count Practice 4.-study of ayeast grwth curve Practice 5-bioluminescent bacteria Practice 6.-bacterial identification Practice 7.-conservation of microorganisms</p>
Laboratory practical	It is Explained the fluorescence staining technique. The protocol is displayed in a video and preparations will be shown. We will discuss their use and application. At the end there will be a type test to assess students understanding. The note of the seminar will be maximum 4% of final note and only scored students attending.

Collaborative Learning	(*O profesor-a organiza, asesora e supervisa as actividades integradas de aprendizaxe colaborativo a desenvolver en grupos de tres ou catro alumnos-as. Ao final se avaliarán os resultados obtidos mediante unha proba escrita.
Seminars	Students will develop a brief compression in team and individual work on bacterial movement. Groups will be formed. After the group work and discussion a summary/group of no more than 1 page will be delivered to computer. The group will propose a test question. The evaluation will be about: teamwork; Exhibition spokesman; Contributions to the general discussion; Questions; Overview. This activity will only score students attending and the maximum score is 5% of the final grade

Personalized assistance

Methodologies	Description
Laboratory practical	Students will be served in a personalized manner the hours of tutoring from the teacher, who is 10-13 h, Monday and Tuesday, attention individual provided that is not another priority activity. The student who wish, can go to personalized tutoring to solve doubts, mainly at the times indicated. To optimize time, it is necessary that the student contact the teacher in advance.
Seminars	Students will be served in a personalized manner the hours of tutoring from the teacher, who is 10-13 h, Monday and Tuesday, attention individual provided that is not another priority activity. The student who wish, can go to personalized tutoring to solve doubts, mainly at the times indicated. To optimize time, it is necessary that the student contact the teacher in advance
Lecturing	
Collaborative Learning	

Assessment

	Description	Qualification	Evaluated Competences
Objective questions exam	(*LECCIÓN MAXISTRAL. Os contidos teóricos expostos na aula durante o curso avaliaranse mediante tres tipos de probas, a realizar no exame final. A primeira proba incluírá preguntas obxectivas. Indícase na columna adxunta o peso desta e as seguintes probas, na nota final da materia	10	CB2 CB3 CB4 CE11 CE12 CE13 CE20 CT2
Essay questions exam	(*LECCIÓN MAXISTRAL. Unha segunda proba incluírá preguntas de desenvolvemento.	30	CB2 CB3 CB4 CE11 CT1
Problem and/or exercise solving	(*LECCIÓN MAXISTRAL. A terceira proba consistirá na resolución de exercicios.	16	CB2 CB3 CT1 CT6
Objective questions exam	(*PRÁCTICAS. Os contidos tratados en laboratorio avaliaranse mediante tres tipos de probas, a realizar ao termo da semana de prácticas. A primeira proba incluírá preguntas obxectivas.	10	CB2 CB3 CE12 CE17 CE20 CT2
Essay questions exam	(*PRÁCTICAS. A segunda proba incluírá preguntas de desenvolvemento.	10	CB2 CB3 CE17 CT2
Problem and/or exercise solving	(*PRÁCTICAS. A terceira proba incluírá resolución de problemas.	12	CB2 CB3 CT6

Objective questions exam	(*)SEMINARIO I. Aprendizaxe Colaborativo. Os contidos traballados avaliaranse ao final do seminario mediante unha única proba de preguntas obxectivas.	6	CB3 CB4 CT1 CT2
Essay	(*)SEMINARIO II. Os contidos traballados avaliaranse mediante un traballo en grupo, a realizar durante o seminario.	6	CB4 CT1 CT2

Other comments on the Evaluation

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

Sources of information

Basic Bibliography

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

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

Complementary Bibliography

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

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

Recommendations

Subjects that continue the syllabus

Marine microbiology and parasitology/V10G060V01906

IDENTIFYING DATA				
Marine zoology				
Subject	Marine zoology			
Code	V10G060V01405			
Study programme	(*)Grao en Ciencias do Mar			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	2nd	2nd
Teaching language	#EnglishFriendly Spanish			
Department				
Coordinator	Ramil Blanco, Francisco José			
Lecturers	Ramil Blanco, Francisco José Vázquez Otero, María Elsa			
E-mail	framil@uvigo.es			
Web				
General description	With this subject intends to give to the student a basic knowledge in Marine Zoology, through the study of the different files that integrate the marine fauna. It will study, in each case, the general plan of organisation, the external morphology, the internal anatomy, the reproduction and the embryonic development and the ranking. Likewise they will include notions envelope his vital activity, habitat and distribution.			

Competencies		Typology
Code		
CB1	Students have demonstrated knowledge and understanding in a field of study that builds upon their general secondary education, and is typically at a level that, whilst supported by advanced textbooks, includes some aspects that will be informed by knowledge of the forefront of their field of study	
CB2	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	• Know How
CB3	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	• Know How
CB4	Students can communicate information, ideas, problems and solutions to both specialist and non-specialist audiences	• Know How
CB5	Students have developed those learning skills that are necessary for them to continue to undertake further study with a high degree of autonomy	• Know How
CE1	To know the vocabulary, codes and concepts inherent to the oceanographic scientific field	• know
CE2	To know and understand the essential facts, concepts, principles and theories related to oceanography	• know
CE4	To know the basic techniques to sample the water column, organisms, sediments and sea bottom, as well as the surveying methods for dynamic and structural variables	• know
CE5	Basic knowledge of research methodology in oceanography	• know
CE6	Ability to identify and understand the problems in the field of oceanography	• Know How
CE17	Ability to survey in the field and to work in the laboratory responsibly and safely, encouraging team work	• Know How
CE18	To transmit writing, verbal and graphical information for audiences of various types	• Know How
CT1	Analysis and synthesis ability	
CT2	Organization and planning skills	
CT3	Written and oral communication in the official languages of the University	
CT8	Teamwork ability	
CT11	Ability to learn independently and continuously	• know
CT15	Ability to apply knowledge in practice	
CT16	Research skills	• Know How

Learning outcomes		Competences
Learning outcomes		
Handle vocabulary, codes and inherent concepts to the marine zoology		CB1 CE1
Know and comprise the essential facts, concepts, principles and theories related with the marine zoology.		CB1 CE2
Know the basic techniques of sampling of the fauna in the column of water, and diverse types of fund		CE4
Basic knowledge of the methodology of investigation in marine zoology		CE5
Capacity to identify and understand the problems related with the marine zoology		CE6
Know work in campaigns and in laboratory of responsible way and sure, promoting the tasks in team		CB2 CE17

Transmit information of form written, verbal and graphic for audiences of diverse types	CB2 CB4 CE18
Capacity of analysis and synthesis	CB3 CT1
Capacity of organisation and planning	CT2
Oral communication and writing in the official tongues of the University	CB4 CT3
Capacity to work in one instrument	CT8
Capacity to learn of autonomous and continuous form	CB5 CT11
Capacity to apply the knowledges in practice	CT15
Skills of investigation	CT16

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 PHYLA	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, Solenogastera, Polyplacophora, Monoplacophora and Scaphopoda)
LESSON 9: PHYLUM MOLLUSCA (II)	Class Gastropoda: general characteristics; coiling; torsion; (corporal organisation) form and function; reproduction and development; systematic summary
LESSON 10: PHYLUM MOLLUSCA (III)	Class Bivalvia: general characteristics; (corporal organisation): form and function; reproduction and development; systematic summary
LESSON 11: PHYLUM MOLLUSCA (IV)	Class Cephalopoda: general characteristics; (corporal organisation): form and function; reproduction and development; systematic summary
LESSON 12: PHYLUM ANNELIDA (I)	General characteristics; metamerism; classification. Class Polychaeta: general characteristics; (corporal organisation): form and function; reproduction and development.
LESSON 13: PHYLUM ANNELIDA (II): The SIBOGLINIDAE. PHYLA ECHIURA and SIPUNCULA	The Siboglinidae: general characteristics; form and function; reproduction and development. Phylum Echiura: Form and function. Phylum Sipuncula: Form and function.
LESSON 14: ECDISOZOA: INTRODUCTION and LOWER PHYLA	Definition and systematic summary . Phyla Nematoda, Kinorhyncha, Priapulida, Loricifera and Tardigrada: form and function.
LESSON 15: PHYLUM ARTHROPODA	General characteristics. (Corporal organisation) Form and function. Classification. Subphylum Cheliceriformes: General characteristics; Classification. Merostomata and Pycnogonida: form and function.

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

Planning			
	Class hours	Hours outside the classroom	Total hours
Laboratory practical	20	20	40
Seminars	2	2	4
Mentored work	3	30	33
Lecturing	27	40.5	67.5
Objective questions exam	0.5	0	0.5
Problem and/or exercise solving	2	0	2
Laboratory practice	1	0	1
Essay	2	0	2

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

Methodologies	
	Description
Laboratory practical	Study of the external and internal morphology of the main groups, using the usual microscopic techniques in Zoology
Seminars	Exposition of relevant subjects in the training in Marine Zoology and directly related with the practical tutorized work, to present doubts and to guide the students in the methodology to follow.
Mentored work	Realization of practical works in small groups. The works will include the following phases: sampling, sorting and identification of the samples; also a writing and exposition of the main results must be done.
Lecturing	Explanation by the professors of the different themes of the contents of 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
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
Mentored work	Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation

Assessment			
	Description	Qualification	Evaluated Competences
Lecturing	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) A major written exam will be done with multiple choice questions and short answer questions (3 points) Both results will be added. To pass this methodology, students have to get a minimum mark of 2 points.	50	CB5 CE1 CE2 CE18 CT1 CT3 CT11
Laboratory practical	The attendance and the work done by the students during the realization of the practices in the laboratory (1 point) A practical exam in the laboratory at the end of the course (1,5 points). To pass this methodology, students have to get a minimum mark of 0,6 points in the practical exam.	25	CB2 CB5 CE1 CE17 CE18 CT1 CT3 CT11 CT15

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	CB2 CB3 CB4 CB5 CE1 CE4 CE5 CE6 CE17 CE18 CT3 CT8 CT11 CT15
Mentored work	The ability to work together autonomously in the laboratory will be evaluated (0,5 points). The contribution of each student to the final work will be evaluated by the qualification of the rest of the students of the group with a rubric (0,5 points). The writing document of the results obtained in the laboratory will be also evaluated (1 point).	20	CE1 CE4 CE5 CE6 CE17 CE18 CT1 CT2 CT3 CT8 CT11 CT15 CT16

Other comments on the Evaluation

The update oficial calendar of the final exams can be found

at: <http://mar.uvigo.es/index.php/en/alumnado-actual-2/examenes-3>

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.

In the July session the student must present only those methodologies not passed.

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.

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

Sources of information

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

Complementary Bibliography

Recommendations

Subjects that continue the syllabus

Fish and shellfish biology/V10G060V01902

Subjects that are recommended to be taken simultaneously

Marine Ecology/V10G060V01401

IDENTIFYING DATA**Physiology of marine organisms**

Subject	Physiology of marine organisms			
Code	V10G060V01501			
Study programme	(*)Grao en Ciencias do Mar			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	3rd	1st
Teaching language	Spanish Galician			
Department				
Coordinator	Pedrol Bonjoch, María Nuria			
Lecturers	Chivite Alcalde, Mauro García Pérez, Pascual Lopez Patiño, Marcos Antonio Pedrol Bonjoch, María Nuria			
E-mail	pedrol@uvigo.es			
Web				
General description	Study of the operation of the marine organisms (animal and vegetal) and of the mechanisms that make possible his adaptation to the half. It will loan special attention the those physiological **appearances mothers related with the integration of the pertinent information of the half marine and the generation of specific answers.			

Competencies

Code	Typology
CB1 Students have demonstrated knowledge and understanding in a field of study that builds upon their general secondary education, and is typically at a level that, whilst supported by advanced textbooks, includes some aspects that will be informed by knowledge of the forefront of their field of study	• know • Know How
CB2 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	• Know be
CB3 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	• Know How
CB5 Students have developed those learning skills that are necessary for them to continue to undertake further study with a high degree of autonomy	• know
CE1 To know the vocabulary, codes and concepts inherent to the oceanographic scientific field	• know
CE4 To know the basic techniques to sample the water column, organisms, sediments and sea bottom, as well as the surveying methods for dynamic and structural variables	• know • Know How
CE5 Basic knowledge of research methodology in oceanography	• know • Know How
CE6 Ability to identify and understand the problems in the field of oceanography	• know
CE12 To be able to operate the instrumental techniques applied to sea	• know • Know How
CE17 Ability to survey in the field and to work in the laboratory responsibly and safely, encouraging team work	• know • Know How • Know be
CT3 Written and oral communication in the official languages of the University	• know • Know How
CT5 Information technology skills (search and data analysis)	• know • Know How
CT6 Problem management and solving skills	• know • Know How

Learning outcomes

Learning outcomes	Competences
PLANT PHYSIOLOGY	CB1
1. To identify and understand key physiological processes in the development of photosynthetic marine organisms.	CB2 CB3 CE1
2. To know the relationships among the photosynthetic marine organisms and the marine environment by means of the study of changing physiological processes	CB1 CB2 CB3 CB5 CE6

3. To handle equipments and techniques to study plant physiology.	CB2 CB3 CE4 CE5 CE12 CT5
4. To understand the scientific methodology and the technologies applied to plant physiology research.	CB1 CB3 CB5 CE1 CE4 CE5 CE12 CT5
5. To gain capacity of analysis and approaching to hypothesis in plant physiology.	CB2 CB3 CE5 CE6 CT3 CT6
6. To know the relationships among the photosynthetic marine organisms and the abiotic and biotic marine environments, by means of the study of their adaptations and the physiological processes of acclimation (functional types, osmoregulation, fotoprotection, biomass partitioning).	CB2 CB3 CB5 CE1 CT3
ANIMAL PHYSIOLOGY:	CB2
7. To know the mechanisms of acquisition and integration of the sensory information in marine animals	CB3 CB5 CE1
8. To know the physiological bases of muscular activity and its implication in aquatic locomotion	CB3 CE1
9. To know in marine animals the mechanisms trough which synthesis, release, transport and the action of hormones synthesised by endocrine glands and the nervous system of marine animals occur.	CB2 CB3 CE1
10. Knowing the corporal fluids and the functioning of cardiovascular systems.	CB3 CE12 CE17 CT6
11. To know the mechanisms of gas exchange between the animals and the water where they live.	CB3 CE1 CT6
12. To know the mechanisms for wastes elimination and of osmotic regulation in distinct groups of marine animals.	CB3 CE1 CT6
13. To know how animals obtain energy through food consumption, and how to use such energy as well.	CB3 CB5 CE1 CT3 CT5
15. To know the general and basic terminology in Animal Physiology.	CB3 CE1
16. To know and to understand the general functioning of different systems in animals adapted to different environmental conditions.	CB2 CB3 CE1 CT5 CT6
17. To understand the general functioning of the animal as a whole, emphasizing in the role played by the integratory and coordinatory systems.	CB2 CB3 CE1 CT5
18. To understand basic aphysiology-related aspects, such as aquaculture.	CB2 CB3 CB5 CE1 CE5 CT6

Topic

PLANT PHYSIOLOGY:	<ol style="list-style-type: none"> 1. Plant Physiology in the ocean. 2. Cell and tissue basic characteristics photosynthetic marine organisms 3. Water relations in photosynthetic marine organisms. Osmoregulation and osmoprotection. 4. Mineral nutrition in marine environments. 5. Photosynthesis: definition and physiological, ecological and evolutionary relevance. 6. The photosynthetic organelles. 7. Light and photosynthetic pigments. 8. The photochemical phase of photosynthesis. 9. The biochemical phase of photosynthesis. 10. Mechanisms of carbon gain and concentration in photosynthetic marine organisms.
ANIMAL PHYSIOLOGY:	<ol style="list-style-type: none"> 1. Physiological bases of excitability 2. The nervous system and the neural communication 3. Physiology of the systems effectors in marine animals: muscular activity and locomotion, chromatophora and bioluminescence 4. Sensory physiology in marine animals: mechanoreception, electroreception, magnetoreception, quimiorreception, fotoreception and vision. 5. Physiology of the neuroendocrine and endocrine systems in marine animals 6. Circulatory fluids and operation of the cardiovascular systems in marine animals 7. Operation of the respiratory systems in marine animals 8. Physiology of excretion and osmorregulation in marine animals 9. Physiology of the digestive systems in marine animals

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	28	70	98
Laboratory practical	10	4	14
Mentored work	0	6	6
Discussion Forum	0	2	2
Seminars	5	15	20
Objective questions exam	0.7	0	0.7
Essay questions exam	1	0	1
Problem and/or exercise solving	0.3	0	0.3
Essay	0	6	6
Debate	0	2	2

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

Methodologies

	Description
Lecturing	2-4 weekly hours until complete the planning. To be developed in the corresponding classroom, with all the enrolled students. Theory sessions will be supported by power point presentations. The educational materials will be at the disposal of the students at TEMA platform.
Laboratory practical	The students will assist 3 sessions of practices in the laboratory: two sessions of 2.5 h each in Animal Physiology, one session of 4 h in Plant Physiology, and another session of 1 h in Plant Physiology. The attendance is compulsory.
Mentored work	PLANT PHYSIOLOGY: short Activities of cooperative learning in the classroom, in spontaneous or random groups. Immediate delivery. They are a complement for the evaluation, not compulsory. Each activity delivered can add up to 0.1 points to the final mark of PLANT PHYSIOLOGY, although they do not penalise if they are not delivered.
Discussion Forum	PLANT PHYSIOLOGY, through the platform TEMA: -virtual Forum of review: scientific Articles and websites of cytology and histology of photosynthetic marine organisms -virtual Forum of innovation and state of the art: scientific Articles and websites of physiological /ecophysiological subjects of photosynthetic marine organisms -virtual Exercises proposing questions for the final exam Each quality contribution to the forum can add up to 0.1 points to the final mark of PLANT PHYSIOLOGY, although they do not penalise if you do not participate.

Seminars	In the module of ANIMAL PHYSIOLOGY seminars will be devoted to the planning and exhibition of subjects elaborated by the distinct groups of students In the module of PLANT PHYSIOLOGY seminars will be devoted to the resolution of problems
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Personalized assistance

Methodologies	Description
Seminars	Resolution of doubts and difficulties to the groups or personal if necessary. During the seminar and in tutorials, monday and friday from 11:00 to 12:00.
Lecturing	Resolution of doubts and difficulties to the the group or personal if necessary. During the session and in tutorials, monday and friday from 11:00 to 12:00. Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation.
Laboratory practical	Resolution of doubts and difficulties to the groups or personal if necessary. During the practices and in tutorials, monday and friday from 11:00 to 12:00.
Mentored work	Resolution of doubts and difficulties to the groups the groups or personal if necessary. In the classroom and in tutorials, monday and friday from 11:00 to 12:00.
Discussion Forum	Feedback through the platform TEMA
Tests	Description
Essay	Resolution of doubts and difficulties to the groups or personal if necessary. In tutorials, monday and friday from 11:00 to 12:00.
Debate	Feedback through the platform TEMA

Assessment

	Description	Qualification	Evaluated	Competences
Seminars	It is compulsory the attendance to the seminars	10		CB1
	In the module of Plant Physiology (10% qualification) the assessment will be by attendance and performance, and the problems will be matter of examination.			CB2 CB3 CE1 CE6
	In the module of Animal Physiology (10% qualification) the students in groups of 2-3 will elaborate a memory and will present in public a work of a listing of subjects proposed.			CT5 CT6
Lecturing	Attendance will be valued	0		CB1
	By means of a final exam comprising the two modules. The weighting per module is 50%. It demands a minimum of 4 each in each module to pass the examination.			CB2 CB3 CB5 CE1 CE4 CE5 CE6
	The final exam will consist on short answer tests, long answer tests, and resolution of exercises.			CT3 CT5 CT6
Laboratory practical	In the module of Plant Physiology (5% of the qualification) the evaluation will be by attendance and questions in the final exam.	10		CB1 CB2
	In the module of Animal Physiology (5% of the qualification) the evaluation will be by attendance			CB3 CB5 CE1 CE4 CE5 CE12 CE17 CT5 CT6
Mentored work	Voluntary for Plant Physiology	0		

Discussion Forum	Voluntary for Plant Physiology	0
Objective questions exam	Mandatory	25
Essay questions exam	Mandatory	35
Problem and/or exercise solving	Mandatory	10
Essay	Mandatory for Animal Physiology	10

Other comments on the Evaluation

To pass the matter demands that the global qualification of each one of the modules (examination, seminars and practical) separately marks no less than 4 points (up to 10).

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.

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

<http://mar.uvigo.es/index.php/en/alumnado-actual-2/examenes-3>

Sources of information

Basic Bibliography

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Lobban CS, Harrison PJ, Seaweed Ecology and Physiology, Cambridge University Press, New York, 1997

Kirk JTO, Light and photosynthesis in aquatic ecosystems, 3rd ed. Cambridge, UK: Cambridge University Press, 2011

Larkum AWD, Robert JO, Duarte CM, Seagrasses: biology, ecology, and conservation, Dordrecht (The Netherlands): Springer, 2006

Taiz L et al., Plant Physiology and Development, Sixth Edition, Sinauer Associates, Inc., 2015

Recommendations

Subjects that continue the syllabus

Marine Ecology/V10G060V01401

Aquaculture/V10G060V01801

Subjects that are recommended to be taken simultaneously

Marine botany/V10G060V01302

Marine zoology/V10G060V01405

Subjects that it is recommended to have taken before

Biochemistry/V10G060V01301

Other comments

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

IDENTIFYING DATA**Biological oceanography I**

Subject	Biological oceanography I			
Code	V10G060V01502			
Study programme	(*)Grao en Ciencias do Mar			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	3rd	1st
Teaching language	Spanish			
Department				
Coordinator	Lastra Valdor, Mariano			
Lecturers	Jabalera Cabrerizo, Marco Lastra Valdor, Mariano			
E-mail	mlastra@uvigo.es			
Web				
General description	This subject deepens in the study of diverse coastal ecosystems, located in the transition continent-ocean as they are the beaches, rocky coast, estuaries, coastal lagoons, dunes, reefs, etc. The fundamental aim is to comprise the characteristics of these ecosystems and know the fauna and flora that inhabit them.			

Competencies

Code		Typology
CB1	Students have demonstrated knowledge and understanding in a field of study that builds upon their general secondary education, and is typically at a level that, whilst supported by advanced textbooks, includes some aspects that will be informed by knowledge of the forefront of their field of study	• know • Know How
CB2	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	• Know How
CB3	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	• Know How
CB4	Students can communicate information, ideas, problems and solutions to both specialist and non-specialist audiences	• Know How • Know be
CB5	Students have developed those learning skills that are necessary for them to continue to undertake further study with a high degree of autonomy	• Know How • Know be
CE1	To know the vocabulary, codes and concepts inherent to the oceanographic scientific field	• know
CE5	Basic knowledge of research methodology in oceanography	• know • Know How
CE6	Ability to identify and understand the problems in the field of oceanography	• know • Know How
CE13	To acquire, evaluate, process and interpret oceanographic data within the theories currently in use	• know • Know How
CE14	To recognize and analyze new problems and to propose problem-solving strategies	• know • Know How
CE15	To recognize and implement good scientific practice in measurement and experimentation, both in the field and in the laboratory	• know • Know How
CE16	To plan, design and implement applied research from the recognition stage to the final evaluation of results and discoveries	• know • Know How
CE17	Ability to survey in the field and to work in the laboratory responsibly and safely, encouraging team work	• know • Know How
CE18	To transmit writing, verbal and graphical information for audiences of various types	• Know How • Know be
CT2	Organization and planning skills	• know • Know How • Know be
CT8	Teamwork ability	• Know How • Know be
CT16	Research skills	• Know How • Know be

Learning outcomes

Learning outcomes	Competences
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Through theoretical contents, practical, exits of field and the work of investigation, at the end of the course the student will have to have purchased the necessary knowledges that allow him interpret the operation of the coastal ecosystems (estuaries, beaches, coastal lagoons, etc), and his interaction with the antropic activities in the open ocean.

CB1
CB2
CB3
CB4
CB5
CE1
CE5
CE6
CE13
CE14
CE15
CE16
CE17
CE18
CT2
CT8
CT16

Contents

Topic	
1. Introduction to the marine habitat	1.1. Types of coastal habitats 1.2. Adequacy of the coastal ecosystems to the typology of habitats of interest 1.3. Conservation of the coastal ecosystems 1.4 Destruction of the coastal habitats
2. Estuaries	2.1. Introduction 2.2. Salinity and substrate 2.3. Vegetation and macrofauna 2.4. The communities of Petersen 2.5. The alimentary chain
3. Rocks	3.1. General appearances 3.2 Adaptations to the physical stress: temperature, waves, burial, .. 3.3. Coasts warmed up, exposed and moderately exposed. 3.4. Subtidal rocks 3.5. Control factors 3.6. The food chain
4. Beaches	4.1. Introduction 4.2. Types of Beaches 4.3. Zonation 4.4. Flora and fauna
5. Coastal lagoons	5.1. General characteristics 5.2. Lagoon organisms 5.3. Ecology of the coastal lagoons 5.4. Primary and secondary production
6. Dune systems	6.1. General characteristics 6.2. Characteristics of ecological importance 6.3. Dune vegetation 6.4. Fauna 6.5. Food chains
7. Mangroves	7.1. Distribution and physical conditions 7.2. Zonation 7.3. Ecological importance
8. Coral reefs	8.1. The paper of the zooxanthellae 8.2. Factors that limit the growth of the reefs 8.3. Geographic distribution and types of coral reefs 8.4. Productivity of the reef 8.5. Biological interactions and mutualism
9. Vertical structure in open ocean and coastal waters: biology of the superficial ocean.	9.1 Zonation of the oceanic region 9.2. Phytoplankton and zooplancton 9.3. Food webs

Planning

	Class hours	Hours outside the classroom	Total hours
Seminars	7	7	14
Laboratory practical	15	0	15
Studies excursion	0	10	10

Lecturing	25	37.5	62.5
Mentored work	0	34.5	34.5
Objective questions exam	1	10	11
Essay	1	2	3

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

Methodologies

Methodologies	Description
Seminars	They will divide the groups in subgroups of 4-5 people. Each subgroup will prepare a work to choose between the subjects offered by the professor at the beginning of the course. Each student will have to involve clearly in all or some of the facets of the work. The works will be directed during the destined hours to the seminars. The oral exhibition will have a length of 20 minutes for the oral presentation and 5 minutes for the round of questions of the professor and of the rest of students. The presentation will come accompanied by an archive in computer support (powerpoint) that will send to the professor in dates fixed previously to the presentation.
Laboratory practical	With the samples taken during the exit to the sea, the students will learn to realise separation, identification and headcounts of pertaining organisms to distinct groups of the benthos. With the table of data obtained will work the statistical section from univariate analysis, bivariate and multivariate.
Studies excursion	They will realise in the subject two field trips: 1) Exit to the estuary of Vigo in the fuselage Mytilus, for the collected of benthic samples with dragas quantitative (Van-Veen). 2) Exit to Aguiño (Ribeira, A Coruña)
Lecturing	They will present and they will argue theoretical contents that they will be evaluated in a final examination.
Mentored work	The works of investigation will be driving in group through the seminars. The students that belong to the same group will have to assist to same group of seminar.

Personalized assistance

Methodologies	Description
Lecturing	Theoretical classes on the subjects of the subject. Its content will be moved to the platform TEMA once that each subject has finalised. Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation. Schedule of tutorials: September 2017: Tuesday and Thursday of 17:00 to 18:00 h. From October 2017: Tuesday and Thursday of 13:00 to 14:00 h.
Laboratory practical	2 groups of laboratory of 20 students roughly.
Seminars	3 groups of seminars, of roughly 15 students, and that will serve to give support to the works of investigation developed by the students.

Assessment

Description	Qualification	Evaluated	Competences
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Lecturing	(*)Exame escrito. Realizaranse preguntas que mostren o nivel de comprensión adquirido polos alumnos ao longo da materia, tanto nas clases teóricas, como prácticas, seminarios e saídas de campo.	65	CB1 CB2 CB3 CB4 CB5 CE1 CE5 CE6 CE13 CE14 CE15 CE16 CE17 CE18 CT2 CT8 CT16
Laboratory practical	(*)Avaliarase a participación nas prácticas, o rigor no traballo de mostraxe e laboratorio, a aptitude para o traballo en equipo e a capacidade para elaborar e interpretar resultados.	10	CB3 CB5 CE1 CE15 CE16 CE17
Seminars	(*)Dividiranse os grupos en subgrupos de 4-5 persoas. Cada grupo preparará un traballo a elixir de entre os propostos polo profesor ao principio do curso. Os traballos se tutorizarán durante as horas destinadas aos seminarios (grupos pequenos 2.5h). A exposición dos traballos terá lugar no mes de Decembro e terán unha duración de 20 minutos para a presentación oral e 5 minutos para a rolda de preguntas do profesor e do resto de alumnos. A presentación virá acompañada por un arquivo en soporte informático (powerpoint) que se enviará ao profesor en datas fixadas previamente á presentación.	25	CB1 CB2 CB3 CB4 CB5 CE1 CE5 CE6 CE13 CE14 CE15 CE16 CE17 CE18 CT2 CT8 CT16

Other comments on the Evaluation

To surpass the subject is necessary to approve each one of the three proofs (test, seminars and practicals).

In the second announcement only will realise an examination written corresponding to the matter given in the test, but will take into account the assistance to seminars and practical during the course.

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

Faculty: <http://mar.uvigo.es/index.php/en/alumnado-actual-2/examenes-3>

Students are strongly 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

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

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

Hogarth Peter J., The Biology of Mangroves, First Edition, Oxford University Press, 1999, USA

Kjerfve B., Coastal Lagoon processes, First Edition, Elsevier science B.V., 1994, Netherlands

Sorokin Y. I., Coral Reef Ecology, Springer, 1995, USA

Barnes R.S.K., An introduction to marine ecology, Second edition, Blackwell Science, 1999, USA

Nordstrom, K.F., Psuty, N. & Carter, B., Coastal dunes, Wiley & sons, 1990, USA

Nybakken, James W., Marine biology : an ecological approach, Fourth edition, Pearson Benjamin Cummings, 2005, USA

Brown, A.C. & McLachlan, Ecology of sandy shores, Elsevier, 1990, Netherlands

Complementary Bibliography

Knox G.A., The ecology of seashores, CRC Press, 2001, USA

D. Bertness et al, Marine community ecology and conservation, Second edition, Sunderland, Massachusetts : Sinauer Associates, 2014, USA

Levinton J.S., Marine Biology: function, biodiversity, ecology, Oxford University Press, 2001, USA

Rupert F.G. Ormond, John D. Gage, and Martin V. Angel, Marine biodiversity : patterns and processes, First Edition, Cambridge University Press, 1997, UK

Raffaelli D.G., Intertidal ecology, Second edition, Chapman & Hall, 1999, UK

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Adam, P., Saltmarsh ecology, Cambridge University press, 2010, UK

Barreiro F., Gómez M., López J., Lastra M. & la Huz R., Coupling between macroalgal inputs and nutrients outcrop in exposed sandy beaches, Hydrobiologia, 700: 73-84, 2013,

Vila-Concejo A. & Kench P.S., Storms in Coral Reefs: Processes and Impacts, Coastal Storms, pp.127-149, 2017,

Ansell, A.D, Gibson, R.N., Barnes, M.,, Oceanography and Marine Biology, An annual review, Aberdeen University Press, 1995,

Shing Yip Lee et al., Ecological role and services of tropical mangrove ecosystems: a reassessment, Global Ecology and Biogeography 23 , 726-743, 2014,

Recommendations

Subjects that continue the syllabus

Biological oceanography II/V10G060V01601

Subjects that are recommended to be taken simultaneously

Coastal and marine sedimentary habitats/V10G060V01402

Ocean Dynamics/V10G060V01702

Subjects that it is recommended to have taken before

Biochemistry/V10G060V01301

Marine botany/V10G060V01302

Marine Ecology/V10G060V01401

Chemical oceanography I/V10G060V01304

Chemical oceanography II/V10G060V01403

Marine zoology/V10G060V01405

IDENTIFYING DATA**Physical oceanography I**

Subject	Physical oceanography I			
Code	V10G060V01503			
Study programme	(*)Grao en Ciencias do Mar			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	3rd	1st
Teaching language	Spanish			
Department				
Coordinator	Roson Porto, Gabriel			
Lecturers	Roson Porto, Gabriel Varela Benvenuto, Ramiro Alberto			
E-mail	groson@uvigo.es			
Web				
General description	Knowledge of the main physical processes in the ocean as well as their relevant climatological causes.			

Competencies

Code		Typology
CB1	Students have demonstrated knowledge and understanding in a field of study that builds upon their general secondary education, and is typically at a level that, whilst supported by advanced textbooks, includes some aspects that will be informed by knowledge of the forefront of their field of study	• know
CB2	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	• know
CB3	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	• know
CE1	To know the vocabulary, codes and concepts inherent to the oceanographic scientific field	• know
CE2	To know and understand the essential facts, concepts, principles and theories related to oceanography	• know
CE5	Basic knowledge of research methodology in oceanography	• know
CE6	Ability to identify and understand the problems in the field of oceanography	• know
CE14	To recognize and analyze new problems and to propose problem-solving strategies	• know
CE16	To plan, design and implement applied research from the recognition stage to the final evaluation of results and discoveries	• know
CE18	To transmit writing, verbal and graphical information for audiences of various types	
CE25	To participate in and advise on research on wave climate	
CT1	Analysis and synthesis ability	• know

Learning outcomes

Learning outcomes	Competences
Basic knowledge of the climatological processes and the meteorological phenomena, with special attention to his influence on the oceanic processes.	CB1 CE1 CE2 CE6 CE14 CE16 CE18 CT1
Descriptive knowledge of the main physical processes in the ocean	CB2 CB3 CE1 CE2 CE5 CE6 CE18 CT1
Descriptive knowledge of the oceanic circulatory systems.	CE1 CE14 CE25

Contents

Topic

I. BASIC CLIMATOLOGY

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

II. HYDROGRPHY AND WATER MASSES

II.1. TEMPERATURE
 II.1.1. Surface distribution.
 II.1.2. Temperature of the water column. Differences among three regions: Mixing layer, seasonal thermocline, main thermocline, deep waters.
 II.1.3. Upwelling. Ekman spiral. Ekman Transport. Types of upwelling. Downwelling.
 II.2. SALINITY
 II.2.1. Conservative and no conservative components. Absolute and practical salinity.
 II.2.2. Surface distribution and it relationship with balance precipitation + runoff - evaporation. Estuaries and estuarine circulation. Coupling estuarine circulation with upwelling and downwelling.
 II.3. MASAS DE AGUA Y DIAGRAMAS TS
 II.3.1. Water masses and water types. Abyssal circulation. Types of density variation in relation with water masses formation. The core method. Identification of water masses circulation.
 II.3.2. Equation of state of Seawater. Isopycnals. Density vertical profiles of by latitudes: The pycnocline. Density gradient and water masses stability.
 II.3.3. TS diagrams. Mixing of water types; caballing. Stability of water masses using TS diagrams.

III. DYNAMICS OF OCEAN CURRENTS

III.1. Surface currents and wind systems. The westward intensification. Eulerian and lagrangian currents.
 III.2. The subtropical and subpolar gyres. Equatorial currents. The Antarctic Circumpolar Current.
 III.3. Dynamic topography and geostrophic currents. Barotropic and baroclinic regimes. Helland-Hansen equation.
 III.4. Origin of the dynamic topography: cyclonic and anticyclonic winds. Convergences and divergences of the surface currents. Relationship with upwelling and downwelling. Ekman Pumping.

IV. REGIONAL OCEANOGRAPHY

IV.1. THE ANTARCTIC OCEAN.
 IV.2. THE ATLANTIC OCEAN.
 IV.3. THE MEDITERRANEAN SEA.
 IV.4. THE PACIFIC OCEAN.
 IV.5. THE INDIAN OCEAN.

Planning

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

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

Methodologies

	Description
Lecturing	Theoretical lessons
Seminars	Research work (obligatory attendance)
Autonomous problem solving	Exam

Personalized assistance

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

Assessment				
	Description	Qualification	Evaluated	Competences
Lecturing	Exams	0		CB1 CB2 CB3 CE1 CE2 CE5 CE6 CE14 CE16 CE18 CE25 CT1
Seminars	Seminars	0		CB1 CB3 CE1 CE5 CE16 CT1
Autonomous problem solving	Exam and seminars	0		CE5 CE25 CT1
Objective questions exam	(*)EXAMEN EN DATA NON ESPECIFICADA	20		CB1
Problem and/or exercise solving	(*)ENTREGAS BOLETÍNS SEMINARIOS	30		CB1 CB2 CE2 CE14 CE25

Other comments on the Evaluation

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

Assesment of classroom lectures:

One no official exam (no free up of contents) during the course in a no previously specified date. (weight 20%)

Official Exam (weight 50%)

Assesment of Seminars:

individual memories of seminars (weight 30%).

Delivery of seminar report must be up to 7 days after the seminar. See delivery calendar at <http://facultadeccdomar.webs.uvigo.es/index.php/es/alumnado-actual/calendario-escolar>.

After that deadline, delivery is not accepted (in this case mark will be 0).

Repeat students are also required to delivery seminar reports .

Students are required to pass (mark ≥ 5) both official exam and seminar reports in order to pass the whole matter.

Both non official exam and seminar reports will be kept for the second opportunity.

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

<http://mar.uvigo.es/index.php/en/alumnado-actual-2/examenes-3>

Sources of information**Basic Bibliography**

SENDIÑA, I Y . PÉREZ MUÑOZURI, V, Fundamentos de meteorología,, Universidad de Santiago de Compostela, Servizo de Publicacións e Intercambio Científico, 2006

R.A. Varela y G. Rosón., Métodos en Oceanografía Física, Editorial Anthias Biblioteca INNOVA, 2008

Complementary Bibliography

PICKARD, G.L. y W. EMERY, Descriptive Physical Oceanography, 6ª edition. Pergamon Press.320 p., 2011

TOMCZAK, M. y J. STUART GODFREY, Regional Oceanography: an introduction, Pergamon. 422 p., <http://www.es.flinders.edu.au/~mattom/regoc/pdfver>, 2003

ANGELA COULING and the Open University course Team., Ocean circulation, Pergamon press, 238 p., 2001

R. STEWART, Introduction to Physical Oceanography, Texas A&M University., <http://www.uv.es/hegigui/Kasper/por%20Robert%20H%2>, 2003

Recommendations**Subjects that continue the syllabus**

Physical oceanography II/V10G060V01602

Other comments

IMPORTANT MARKS:

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

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

The final mark of this matter will be an average of three marks (between 0 and 10): the no official exam (en), the official exam (eo) and the average mark of the seminars, both in first and second opportunity, accordingly with:

$$n = 0,2*en + 0,5*eo + 0,3*se$$

The official exam as well as average mark of the seminars must be passed separately. If not (i.e. if $se < 5$ or $eo < 5$) the following formulae replaces the former one:

$$n = 0,2*en + 0,2*eo + 0,1*se$$

IDENTIFYING DATA**Geological oceanography I**

Subject	Geological oceanography I			
Code	V10G060V01504			
Study programme	(*)Grao en Ciencias do Mar			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	3rd	1st
Teaching language	#EnglishFriendly Spanish			
Department				
Coordinator	Bernabéu Tello, Ana María			
Lecturers	Alejo Flores, Irene Bernabéu Tello, Ana María González Villanueva, Rita Marino , Gianluca			
E-mail	bernabeu@uvigo.es			
Web	http://193.146.32.240/tema1112/claroline/course/index.php			
General description	Geological oceanography (also called marine geology) is one of the broadest fields in the Earth Sciences and contains many subdisciplines, including geophysics, and plate tectonics, petrology and geochemistry, sedimentation processes, and micropaleontology and stratigraphy. Geological Oceanography I will focus on the study of basic earth processes affecting sedimentation in litoral areas, since sediments are the main geological feature of these region. The subject will cover the fundamental techniques to study the topography, structure, sedimentation, and associated geological processes of these areas to discover how they were formed and how ongoing processes (coastal dynamics, climate change, human impact...) may change them in the future. The subject will deal with the peculiarity of combining terrestrial and marine data to study litoral and coastal processes.			

Competencies

Code	Typology
CB2	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
CB5	Students have developed those learning skills that are necessary for them to continue to undertake further study with a high degree of autonomy
CE1	To know the vocabulary, codes and concepts inherent to the oceanographic scientific field
CE2	To know and understand the essential facts, concepts, principles and theories related to oceanography
CE5	Basic knowledge of research methodology in oceanography
CE6	Ability to identify and understand the problems in the field of oceanography
CE13	To acquire, evaluate, process and interpret oceanographic data within the theories currently in use
CE16	To plan, design and implement applied research from the recognition stage to the final evaluation of results and discoveries
CE17	Ability to survey in the field and to work in the laboratory responsibly and safely, encouraging team work
CT6	Problem management and solving skills
CT16	Research skills

Learning outcomes

Learning outcomes	Competences
1. Capacity to plan and execute field surveys in the coastal and litoral realm	CB2 CE1 CE2 CE5 CE6 CE13 CE16 CE17 CT16

2. Capacity to manage the basic techniques of observation, measurement and description of marine geological materials in these environments	CB2 CB5 CE1 CE2 CE5 CE13 CE17 CT6 CT16
3. Capacity to manage the basic techniques of sampling and surveying	CB2 CE1 CE5 CE13 CE17 CT16
4. Capacity to manage the basic techniques of sediment characterization and analyses	CB2 CB5 CE1 CE2 CE5 CE6 CT6 CT16
5. Geological mapping and representation skills	CB2 CB5 CE1 CE5 CE6 CE16 CT16
6. Report elaboration and presentation skills	CB2 CB5 CE1 CE6 CE16 CT16

Contents

Topic	
T0. Presentation	0.1 Aims 0.2 Activities 0.3 Program 0.4 System of qualification
T1. Introduction	1.1 Methods of geological investigation in the coastal and littoral realms 1.2 Structure and general protocols
T2 Coastal Morphodynamics	2.1 Basic concepts 2.2 Morphodynamics of coastal systems 2.3 Transport assessment
T3 Methods of sampling and subsampling	3.1 Grabbers 3.2 Corers 3.3 Fluids and gases 3.4 Samples curation
T4 Seismo-acoustic methods	4.1 Basic Principles 4.2 Echosounders 4.3 Side Scan Sonar 4.4 Seismic Methods (HR) 4.5 Processing
T5 Electrical logging: physical properties (seminars)	5.1 Gamma density and natural gamma 5.2 Resistivity and poropermeability 5.3 Susceptibility and other magnetic properties 5.4 Color and imaging 5.5 X-Rays 5.6 Corescanning: GEOTEK and 2G

T6 Geochemical Methods (seminars)	6.1 Elemental analyses 6.1.1 LECO 6.1.2 Spectrometry 6.1.3 XRF 6.2 Mineralogical Analyses 6.2.1 XRD 6.2.2 SEM-EDAX 6.3 Corescanning: ITRAX and AVAATECH
T7 Dating Techniques	7.1 Radiometry 7.1.1 14C 7.1.2 210Pb 7.1.3 137Cs 7.2 Other Methods 7.2.1 d18O 7.2.2 Magnetic 7.2.3 Thermoluminescence
PA1 Survey Planning	How to plan a cruise (practical case) PA1.1 Objective definition PA1.2 Selection of methodologies PA1.3 Definition of tasks and scope PA1.4 Time Planning PA1.5 Economic assessment and budgets PA1.6 Reports
PA2 RV Mytilus Mini Cruise	PA2.1 Administrative requirements and basic security norms in oceanographic cruises PA2.2 Onboard life PA2.3 Sediment sampling techniques and operations PA2.4 Geophysical surveying techniques and operations PA2.5 Data management and archives

Planning

	Class hours	Hours outside the classroom	Total hours
Seminars	7	9	16
Studies excursion	5	5	10
Introductory activities	2	4	6
Case studies	15	30	45
Lecturing	23	48	71
Essay questions exam	2	0	2

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

Methodologies

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

Personalized assistance

Methodologies	Description
Lecturing	The tutorials will preferably take place on Monday and Thursday from 12:00 to 14:00 in the office D42, Block C , 3rd floor of the building CC Experimentales, as long as the lecturer does not have to attend other academic obligations. Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation

Seminars	The tutorials will preferably take place on Monday and Thursday from 12:00 to 14:00 in the office D42, Block C , 3rd floor of the building CC Experimentales, as long as the lecturer does not have to attend other academic obligations. Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation
Studies excursion	The tutorials will preferably take place on Monday and Thursday from 12:00 to 14:00 in the office D42, Block C , 3rd floor of the building CC Experimentales, as long as the lecturer does not have to attend other academic obligations. 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
Introductory activities	The tutorials will preferably take place on Monday and Thursday from 12:00 to 14:00 in the office D42, Block C , 3rd floor of the building CC Experimentales, as long as the lecturer does not have to attend other academic obligations. 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
Case studies	The tutorials will preferably take place on Monday and Thursday from 12:00 to 14:00 in the office D42, Block C , 3rd floor of the building CC Experimentales, as long as the lecturer does not have to attend other academic obligations. Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation

Assessment

	Description	Qualification Evaluated	Competences
Lecturing	Written individual test of 2 to 4 hours, whose aim will be the global evaluation of the process of learning and the acquisition of skills and knowledge. It will comprise one or several of the following types of assessments: long questions to elaborate, short questions, tests, problem resolution, interpretation of images, maps and diagrams. It will require a minimum of 4 over 10 to be able to compute with the rest of evaluation elements.	60	CB2 CB5 CE1 CE2 CE6 CT6
Seminars	Individual written report on the seminar activities. May include tests.	10	CB2 CE1 CE5 CE13 CE16 CE17 CT6 CT16
Studies excursion	It comprises an individual brief written summary. It has to reflect the activities performed in the field trip.	10	CB2 CE1 CE5 CE13 CE16 CE17 CT16
Case studies	Group report that comprise the practical activities, including objectives, methodology, results and conclusions	10 ó 20	CB2 CE5 CE13 CE16 CT16
Essay questions exam	Individual written report on an additional activity derived from the lectures, practicals or seminars, pursuing the students own interest. It does not have compulsory character. Its execution takes 10% off the laboratory practicals.	10 ó 0	CB2 CB5 CE1 CE2 CE5 CE6 CT6

Other comments on the Evaluation

The attendance to the field trip, seminars and practical is compulsory. A 20% or more of absence of attendance in the lectures or the non-attendance to a field trip will automatically disqualify. It is necessary to attain at least 40% of the maximum mark in each block to compensate. If one of the methodologies is not qualified, the final qualification will be the pure average divided by 2.

Students failing the course will have to retake all the parts the following year.

The official exam dates will be available at: <http://mar.uvigo.es/index.php/en/alumnado-actual-2/examenes-3>

The students are strongly asked to fulfill a honest and responsible behavior.

It is considered completely unacceptable any alteration or fraud (i.e., copy or plagiarism) contributing to modify the level of knowledge and abilities acquired in exams, evaluations, reports or any kind of teacher's proposed work. Fraudulent 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

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

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

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

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

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Complementary Bibliography

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

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

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

Recommendations

Subjects that continue the syllabus

Geological oceanography II/V10G060V01603

Subjects that are recommended to be taken simultaneously

Chemical oceanography I/V10G060V01304

Physical oceanography I/V10G060V01503

Subjects that it is recommended to have taken before

Statistics/V10G060V01303

Coastal and marine sedimentary habitats/V10G060V01402

Sedimentology/V10G060V01305

Other comments

DELIVERY OF ASSIGNMENTS

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

IMPORTANT

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

REGARDING THE AUTHORSHIP OF THE GROUP ASSIGNMENTS

Submission of the assignment is the responsibility of the coordinator, who must state the participants. All coauthors must

upload their copy at FAITIC to claim co-authorship.

Authorship cannot be modified after the deadline of the assignment.

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

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

THE TEMA PLATFORM IS THE OFFICIAL COMMUNICATION CHANNEL OF THE COURSE

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

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

Subject	Chemistry applied to the marine environment I			
Code	V10G060V01505			
Study programme	(*)Grao en Ciencias do Mar			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	3rd	1st
Teaching language	Spanish			
Department				
Coordinator	Couce Fortúnez, María Delfina Besada Pereira, Pedro			
Lecturers	Besada Pereira, Pedro Castro Fojo, Jesús Antonio Couce Fortúnez, María Delfina			
E-mail	delfina@uvigo.es pbes@uvigo.es			
Web				
General description	This subject includes the study of elements, inorganic substances and organic substances that can reach and alter the marine environment, acting as pollutants. Behaviour, influence and prevention of the effects produced by these elements, inorganic substances and organic substances in the environment will be studied. Moreover, the study of marine natural products (classification, function, pharmacological interest) will be addressed.			

Competencies

Code		Typology
CB1	Students have demonstrated knowledge and understanding in a field of study that builds upon their general secondary education, and is typically at a level that, whilst supported by advanced textbooks, includes some aspects that will be informed by knowledge of the forefront of their field of study	• know
CB2	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	• Know How
CB3	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	• Know How
CB4	Students can communicate information, ideas, problems and solutions to both specialist and non-specialist audiences	• Know How
CB5	Students have developed those learning skills that are necessary for them to continue to undertake further study with a high degree of autonomy	• Know How
CE1	To know the vocabulary, codes and concepts inherent to the oceanographic scientific field	• know
CE2	To know and understand the essential facts, concepts, principles and theories related to oceanography	• know
CE5	Basic knowledge of research methodology in oceanography	• know
CE6	Ability to identify and understand the problems in the field of oceanography	• know
CE12	To be able to operate the instrumental techniques applied to sea	• Know How
CE15	To recognize and implement good scientific practice in measurement and experimentation, both in the field and in the laboratory	• Know How
CE17	Ability to survey in the field and to work in the laboratory responsibly and safely, encouraging team work	• Know How
CE18	To transmit writing, verbal and graphical information for audiences of various types	• Know How
CE30	Identify and assess environmental impacts in the marine environment	• Know How
CT1	Analysis and synthesis ability	• Know How
CT15	Ability to apply knowledge in practice	• Know How
CT17	Sensitivity towards environmental issues	• Know be

Learning outcomes

Learning outcomes	Competences
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To describe global cycles of the elements, including the input and output processes.	CB1 CB2 CB3 CB4 CB5 CE1 CE2 CE6 CE18 CT1
To define and to explain concepts, principles and sources related to chemical pollution.	CB1 CB2 CB3 CB4 CB5 CE1 CE2 CE6 CE18 CE30 CT1 CT17
To describe the chemical composition and speciation in seawater and to determine the mechanisms and factors that regulate it.	CB1 CB2 CB3 CB4 CB5 CE1 CE2 CE6 CE18 CT1
To determine the processes that regulate chemical species complexation.	CB1 CB2 CB3 CB4 CB5 CE1 CE2 CE6 CE18 CT1
To identify the toxicity mechanisms of metal ions, as well as the factors that determine and control the biomethylation processes.	CB1 CB2 CB3 CB4 CB5 CE1 CE2 CE6 CE18 CE30 CT1 CT17
To identify the toxicity mechanisms of the major organic pollutants.	CB1 CB2 CB3 CB4 CB5 CE1 CE2 CE6 CE18 CE30 CT1 CT17

To identify the most important natural products in the marine environment.	CB1 CB2 CB3 CB4 CB5 CE1 CE2 CE6 CE18 CT1
To identify the main interactions between marine organisms.	CB1 CB2 CB3 CB4 CB5 CE1 CE2 CE6 CE18 CT1
To describe the main applications of marine natural products.	CB1 CB2 CB3 CB4 CB5 CE1 CE2 CE6 CE18 CT1
To analyze the results obtained in the laboratory using the theoretical concepts.	CB1 CB2 CB3 CB4 CB5 CE1 CE2 CE5 CE6 CE12 CE15 CE17 CE18 CE30 CT1 CT15
To develop the necessary skills for the resolution of the applications related with the subject.	CB1 CB2 CB3 CB4 CB5 CE1 CE2 CE5 CE6 CE12 CE15 CE17 CE18 CE30 CT15 CT17

Contents

Topic	
1. Introduction to environment	Cycles of the elements in the environment
2. Pollution of marine environment	Generalities. Major sources of pollution
3. Metal speciation	Aerobic and anaerobic environments. Pourbaix diagrams

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

Planning

	Class hours	Hours outside the classroom	Total hours
Seminars	16	24	40
Laboratory practical	12	2	14
Mentored work	0	17	17
Lecturing	24	48	72
Problem and/or exercise solving	3	0	3
Practices report	0	4	4

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

Methodologies

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

Personalized assistance

Methodologies	Description
Lecturing	Tutoring, support and motivation in the learning process, in the classroom, personally in the professor's office as well as through e-mail or the virtual campus. Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation. Tutorial hours: P. Besada: monday, wednesday and thursday from 11:00 to 13:00 h D. Couce: tuesday, wednesday and thursday from 12:00 to 14:00 h
Seminars	Tutoring, support and motivation in the learning process, in the classroom, personally in the professor's office as well as through e-mail or the virtual campus. Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation. Tutorial hours: P. Besada: monday, wednesday and thursday from 11:00 to 13:00 h D. Couce: tuesday, wednesday and thursday from 12:00 to 14:00 h
Laboratory practical	Tutoring, support and motivation in the learning process, in the classroom, personally in the professor's office as well as through e-mail or the virtual campus. Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation. Tutorial hours: P. Besada: monday, wednesday and thursday from 11:00 to 13:00 h J. Castro: tuesday and thursday from 10:00 to 13:00 h

Mentored work Tutoring, support and motivation in the learning process, in the classroom, personally in the professor's office as well as through e-mail or the virtual campus. Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation. Tutorial hours: P. Besada: monday, wednesday and thursday from 11:00 to 13:00 h D. Couce: tuesday, wednesday and thursday from 12:00 to 14:00 h

Assessment			
	Description	Qualification	Evaluated Competences
Seminars	Participation, attitude and ability to relate and apply acquired concepts will be evaluated	5	CB1 CB2 CB3 CB4 CB5 CE1 CE2 CE6 CE18 CE30 CT17
Mentored work	Student will developed a brief tutored work, and the report presented and its presentation will be assessed	20	CB1 CB2 CB3 CB4 CB5 CE1 CE2 CE6 CE18 CT1 CT17
Problem and/or exercise solving	In the final exam the theoretical contents that the students have learned in the master session will be assessed. The contents of this subject are divided in two blocks (Chapters 1-7 and 8-13) so the test will also be divided into two parts. To get promoted the student must obtain a minimum of a 3.5 out of 10 in each of the two parts in which the exam is divided.	65	CB1 CB2 CB3 CB4 CB5 CE1 CE2 CE6 CE18 CE30 CT1

Practices report	Students shall submit a report of the practice carried out in the laboratory. Attendance at the laboratory sessions as well as preparation of the report is compulsory to get promoted. The attitude in the lab sessions, the skills and the understanding of the experimental techniques used will be evaluated.	10	CB1 CB2 CB3 CB4 CB5 CE1 CE2 CE5 CE6 CE12 CE15 CE17 CE18 CE30 CT15
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Other comments on the Evaluation

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

<http://mar.uvigo.es/index.php/gl/alumnado-actual/examenes-3>

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

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

The percentages in each of the paragraphs will be maintained in the call of July.

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

Sources of information

Basic Bibliography

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R.P. Schwarzenbach, P.M. Gschwend, D.M. Imboden, Environmental Organic Chemistry, 2, John Wiley & Sons Inc, 2003,
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P. Yurkanis Bruice, Química Orgánica, 5, Prentice Hall México, 2007,

Complementary Bibliography

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H. G. Seiler, H. Sigel, A. Sigel, Handbook on toxicity of inorganic compounds, Marcel Dekker, 1988,
J. W. Moore, Inorganic Contaminants of Surface Water, Springer, 1991,
Paul M. Dewick, Medicinal natural products: A biosynthetic approach, 3, John Wiley & Sons Inc, 2009,
J. B. McClintock, B.J. Baker, Marine chemical ecology, CRC Press, 2001,
M.A. Martínez Grau, A.G. Csáky, Técnicas experimentales en síntesis orgánica, 2, Síntesis, 2012,
Journal of Natural Products,
Natural Products Reports,
Marine Chemistry,
Marine Pollution Bulletin,

Recommendations

IDENTIFYING DATA**Biological oceanography II**

Subject	Biological oceanography II			
Code	V10G060V01601			
Study programme	(*)Grao en Ciencias do Mar			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	3rd	2nd
Teaching language	Spanish			
Department				
Coordinator	Marañón Sainz, Emilio			
Lecturers	Jabalera Cabrerizo, Marco Marañón Sainz, Emilio Teira Gonzalez, Eva Maria			
E-mail	em@uvigo.es			
Web				
General description	This course addresses the study of the interaction between the composition and dynamics of biological communities and the production and fate of organic matter in the ocean. The diversity and metabolic activity of microbial plankton receive special attention, due to their key role in the regulation of marine biogeochemical cycles. Multiple levels of organization are considered, including cells, populations, communities and the ecosystem. The ultimate aim is to understand the role of ocean's biology in the functioning of the Earth system.			

Competencies

Code	Typology
CB1 Students have demonstrated knowledge and understanding in a field of study that builds upon their general secondary education, and is typically at a level that, whilst supported by advanced textbooks, includes some aspects that will be informed by knowledge of the forefront of their field of study	• know
CB2 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	• Know How
CB3 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	• Know How
CB4 Students can communicate information, ideas, problems and solutions to both specialist and non-specialist audiences	• Know How
CE1 To know the vocabulary, codes and concepts inherent to the oceanographic scientific field	• know
CE2 To know and understand the essential facts, concepts, principles and theories related to oceanography	• know
CE6 Ability to identify and understand the problems in the field of oceanography	• Know How
CE13 To acquire, evaluate, process and interpret oceanographic data within the theories currently in use	• Know How
CT1 Analysis and synthesis ability	• Know How
CT6 Problem management and solving skills	• Know How

Learning outcomes

Learning outcomes	Competences
Know and understand how organisms and communities drive the cycling of matter in the ocean, linking the physiological and ecological traits of key functional groups with their biogeochemical role.	CB1 CB3 CE1 CE2 CT1
Ability to connect the different physical, chemical and biological processes that determine the role of the ocean within the Earth system.	CB1 CB2 CB3 CB4 CE1 CE2 CE6 CT1
Know and understand the natural and anthropogenic variability in pelagic ecosystems and marine biogeochemical cycles, as well as their response to processes of global environmental change.	CB1 CB3 CE1 CE2 CE6 CT1

Ability to interpret biological oceanography data.	CB3 CE13 CT1 CT6
Ability to use computing applications to run mathematical models of biogeochemical processes.	CE13 CT6
Ability to use specialised bibliography	CB3 CT1

Contents

Topic	
Unit 1. Introduction	Distribution and abundance of chemical elements in the sea. Metabolic pathways and key plankton functional groups. Properties of element cycles.
Unit 2. Production of organic matter.	Variability and control of primary production. Stoichiometry of phytoplankton production. Dynamics of dissolved organic matter. New and regenerated production. Trophic organization and biogeochemical functioning of the ecosystem.
Unit 3. Remineralization.	Distributions of nutrients and oxygen. Oxygen utilization rates. Stoichiometric relations. Heterotrophic processes: quantification and variability. Photosynthesis respiration balance. Balance between N ₂ fixation and denitrification. Global nitrogen cycle.
Unit 4. Export.	The biological pump. Methodological issues. Spatio-temporal variability in export. Attenuation of vertical fluxes: controlling factors. Shallow and deep sedimentation. Coast-ocean gradients.
Unit 5. Biogeochemical processes in the sediments.	Physical structure of the sediment. Coast-ocean gradients. Reactions of organic matter oxidation. Redox potential. Spatio-temporal variability in benthic fluxes. Global carbon budget in the sediments.
Unit 6. The global carbon cycle.	Chemistry of dissolved inorganic carbon (DIC). Distribution and abundance of main DIC forms. CO ₂ fluxes between ocean and atmosphere. The biological pump and the solubility pump. Global C cycle: current unbalances.
Unit 7. The calcium carbonate cycle.	CaCO ₃ oceanic budget. Carbonate saturation. Production, export and redissolution of CaCO ₃ . Distribution of carbonates in the sediments. Pelagic calcification: coccolithophore blooms and biogeochemical impacts.
Unit 8. Global change and the biology of the ocean.	Multiple environmental stressors. Warming. Acidification. Deoxygenation. Eutrophication. Impacts on species, communities, ecosystems and biogeochemical cycles. Global feedback processes.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	22.5	49.5	72
Seminars	10	15	25
Problem solving	10	25	35
Computer practices	10	5	15
Problem and/or exercise solving	3	0	3

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

Methodologies

	Description
Lecturing	Presentation of fundamental contents of the course, supported by graphic material.
Seminars	Using data and scientific articles, specific topics are explored in detail. Subjects tackled include, amongst others, the ecology and biogeochemical role of diatoms and coccolithophores, the ecological and biogeochemical importance of iron, and ocean acidification.
Problem solving	Practical cases are solved using real data presented numerically and graphically.
Computer practices	Numerical modelling of the carbon biogeochemical cycle. Analysis of data on the size-scaling of phytoplankton abundance, biomass and metabolism.

Personalized assistance

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

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

Assessment			
	Description	Qualification	Evaluated Competences
Seminars	Students prepare a short synthesis of a scientific article, in which they present, using personal language, the main objectives, results and implications of a study. The clarity and correctness of the writing, as well as the rigour in the use and application of scientific concepts, are particularly valued. The mark obtained is conserved for the July call. Upon consultation with the course's coordinator, students may resubmit this work for the July call.	15	CB2 CB3 CB4 CE13
Problem solving	Students solve practical cases similar to those used during the practical sessions. The mark obtained is conserved for the July call. Upon consultation with the course's coordinator, students may resubmit this work for the July call.	10	CB2 CB4 CT6
Problem and/or exercise solving	Written test includes a questionnaire, short questions and practical cases. The test is designed to assess the acquisition of knowledge and skills covered during the lectures, seminars and practical sessions.	75	CB1 CB2 CE1 CE2 CE6 CT1 CT6

Other comments on the Evaluation

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

<http://mar.uvigo.es/index.php/en/alumnado-actual-2/examenes-3>

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

Sources of information

Basic Bibliography

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

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

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

Complementary Bibliography

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

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

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

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

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

Recommendations

Subjects that are recommended to be taken simultaneously

Physical oceanography II/V10G060V01602

Subjects that it is recommended to have taken before

Marine Ecology/V10G060V01401
Chemical oceanography I/V10G060V01304
Chemical oceanography II/V10G060V01403
Biological oceanography I/V10G060V01502
Physical oceanography I/V10G060V01503

IDENTIFYING DATA**Physical oceanography II**

Subject	Physical oceanography II			
Code	V10G060V01602			
Study programme	(*)Grao en Ciencias do Mar			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	3rd	2nd
Teaching language	Spanish			
Department				
Coordinator	Varela Benvenuto, Ramiro Alberto			
Lecturers	Varela Benvenuto, Ramiro Alberto			
E-mail	rvarela@uvigo.es			
Web	http://www.gofuvi.org			
General description	This course, mostly a practical one, brings to the student knowledges of the fundamental methodologies used in physical oceanography			

Competencies

Code	Typology
CB2 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	• know • Know How
CB3 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	• know • Know How
CE1 To know the vocabulary, codes and concepts inherent to the oceanographic scientific field	• know
CE2 To know and understand the essential facts, concepts, principles and theories related to oceanography	• know • Know How
CE4 To know the basic techniques to sample the water column, organisms, sediments and sea bottom, as well as the surveying methods for dynamic and structural variables	• know • Know How
CE5 Basic knowledge of research methodology in oceanography	• know • Know How
CE6 Ability to identify and understand the problems in the field of oceanography	• know • Know How
CE12 To be able to operate the instrumental techniques applied to sea	• know • Know How
CE13 To acquire, evaluate, process and interpret oceanographic data within the theories currently in use	• know • Know How
CE15 To recognize and implement good scientific practice in measurement and experimentation, both in the field and in the laboratory	• know • Know How
CE38 Technical use of renewable energies	• know
CT4 Basic computing skills related to the field of study	• know • Know How
CT15 Ability to apply knowledge in practice	• know • Know How

Learning outcomes

Learning outcomes	Competences
The student should be able to do measurements of temperature, salinity, currents, light attenuation, waves and tides with the present available methodologies in physical oceanography	CB3 CE5 CE12 CE13 CT15
The student should be able to interpret the meaning, implications and interrelationships of the main meteorological and oceanographic variables/parameters	CB3 CE1 CE4 CE5 CE12 CE13

The student has to know how to calculate variables derived from the basic parameters such as speed of the sound, dynamic height, density, frequency of Brunt-Vaisala, stability and interpret them properly.	CB2 CB3 CE1 CE4 CE12 CE13 CE15 CT4 CT15
The student has to understand the principles and main uses of several advanced oceanographic instruments and its implications in current physical oceanography (i.e., High Frequency radars, gliders, lines of data)	CB2 CB3 CE1 CE12 CE13 CT4 CT15
The student should understand and distinguish the advantages and disadvantages of the several wave and tide related energy systems available	CB2 CB3 CE1 CE5 CE6 CE15 CE38 CT15
The student has to be able to understand the complete process of treatment of pertinent data of oceanographic probes (CTD), and to use at an intermediate user level programs of generation of charts and analysis of the oceanographic information such as Surfer, Ocean Data View and the Seabird proprietary Seabird system.	CE2 CT4 CT15

Contents

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

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	18	54	72
Seminars	25.75	25.75	51.5
Studies excursion	4	2	6
Mentored work	9	9	18
Objective questions exam	0.25	0	0.25
Essay questions exam	2.25	0	2.25

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

Methodologies

	Description
Lecturing	The lecturer will give an insight of the main subjects treated during the course.

Seminars	Student work on subjects and exercises brought by the teachers. Data come from the real world and the discussion can either individual or in small groups. A questionnaire must be solved at the end of each session
Studies excursion	Cruise to practise several physical oceanography instruments.
Mentored work	Practical problems that the students must solve with the help of other students and/or the teacher

Personalized assistance

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

Assessment

	Description	Qualification	Evaluated	Competences
Seminars	During the seminars the student will be asked to solve several theoretical and practical subjects taken from real cruises/data. At the end of the seminar a questionnaire must be solved (and evaluated)	5		CB2 CB3 CE1 CE4 CE5 CE6 CE12 CE13 CT4 CT15
Studies excursion	After the cruise a report is required.	5		CB3 CE1 CE4 CE5 CE6 CE12 CE13 CE15 CT15
Mentored work	After classroom work reports are required	5		CB2 CB3 CE1 CE2 CE4 CE5 CE6 CE15 CE38 CT4

Objective questions exam	Multiple option test to validate the student's knowledge.	20	CE1 CE2 CE4 CE5 CE6 CE12 CE38 CT15
Essay questions exam	A series of questions and problems presented to the students to judge its knowledge.	65	CB2 CB3 CE1 CE2 CE4 CE12 CE13 CE38 CT15

Other comments on the Evaluation

It is necessary to have approved with a minimum qualification of 5 both the final exam and the questionnaires, and have presented all the required works (seminars and practical) to approve the course. Both the seminar and practical works are individual and must be delivered before the date term established in class. Any memory presented out of term will have a qualification to 0. The cycle of presentations that realises in class goes compulsory in the theory of the examination.

The questionnaires consist in 10 questions that have each one 5 options, with a value of a point each question. Only one of the possible options is correct. If two questions are answered wrong, 1 correct answer is deduced from the whole exam computation. If the qualification obtained by a student in the final examination is greater than the one obtained in the seminars, will appear in the final record the note of the examination, that will not see like this diminished by the one of questionnaires. If the note of the examination is lower that the one of the questionnaires, the final qualification will be computer using the proportion examination 70% questionnaires 30%. The questionnaires can be repeated (two times maximum), if the professor considers it necessary, so that the students can improve his note, but always answering to different questions for a determinate subject. The valid note final for a questionnaire will be the always the corresponding to the last questionnaire realised.

The assessment of questionnaires keeps during two academic courses. Happened this term, the student will have to redo the questionnaires. Qualifications obtained during the May-June period are kept to the July period.

The official exam dates can be obtained at: <http://mar.uvigo.es/index.php/en/alumnado-actual-2/examenes-3>

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

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 Sverdrup, HU; Johnson, MW y Fleming, RH, The Oceans. Their physics, chemistry and general biology, 2, Prentice-Hall, 1946, New York
 Varela, R y Rosón, G, Métodos en oceanografía Física, 1, Anthia., 2008,

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- Beer, T, Environmental Oceanography. An introduction to the behavior of coastal waters, Pergamon Press, 1983,
 Newman, G y Pierson, Jr, WJ, Principles of Physical Oceanography, Prentice-Hall, 1966,

Recommendations

Subjects that it is recommended to have taken before

Physical oceanography I/V10G060V01503

IDENTIFYING DATA**Geological oceanography II**

Subject	Geological oceanography II			
Code	V10G060V01603			
Study programme	(*)Grao en Ciencias do Mar			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	3rd	2nd
Teaching language	Spanish			
Department				
Coordinator	Alejo Flores, Irene			
Lecturers	Alejo Flores, Irene García Gil, María Soledad Nombela Castaño, Miguel Angel Pérez Arlucea, Marta María			
E-mail	ialejo@uvigo.es			
Web	http://https://sites.google.com/site/oceangeolvigo/			
General description	<p>The subject Geological Oceanography II, intends to train the student in the direct and indirect techniques for the characterization of the submarine bottoms, as well as the geological record in marine environments of continental shelf and deep environments (continental slope, continental abyssal plains, dorsal flanks, Ridges and ocean trenches). Therefore this subject has a different approach to the one of the Geological Oceanography I dedicated to the coastal and coastal areas. It is intended therefore that the student acquire the knowledge in the use and application of the latest generation techniques in sea surveys, as well as the ability to plan and develop oceanographic geological field works and prepare and submit reports. Students are required to take this course in responsible and honest behavior.</p> <p>Any form of fraud (i.e. copy and / or plagiarism) intended to falsify the level of knowledge or skill attained by a student in any type of test, report or work designed for this purpose is considered inadmissible. This fraudulent conduct will be sanctioned with the firmness and rigor that establishes the current regulation.</p>			

Competencies

Code		Typology
CB1	Students have demonstrated knowledge and understanding in a field of study that builds upon their general secondary education, and is typically at a level that, whilst supported by advanced textbooks, includes some aspects that will be informed by knowledge of the forefront of their field of study	• know
CB2	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	• Know How
CB3	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	• Know How
CB4	Students can communicate information, ideas, problems and solutions to both specialist and non-specialist audiences	• Know How
CB5	Students have developed those learning skills that are necessary for them to continue to undertake further study with a high degree of autonomy	• Know be
CE1	To know the vocabulary, codes and concepts inherent to the oceanographic scientific field	• know
CE4	To know the basic techniques to sample the water column, organisms, sediments and sea bottom, as well as the surveying methods for dynamic and structural variables	• know
CE5	Basic knowledge of research methodology in oceanography	• know
CE6	Ability to identify and understand the problems in the field of oceanography	• know
CE8	To understanding the fundamentals of the laws that regulate the use of the marine environment and its resources	• know
CE9	To be familiar with the public and private, national and international organizations and institutions related to the Marine Sciences	• know
CE12	To be able to operate the instrumental techniques applied to sea	• Know How
CE13	To acquire, evaluate, process and interpret oceanographic data within the theories currently in use	• Know How
CE14	To recognize and analyze new problems and to propose problem-solving strategies	• Know How
CE15	To recognize and implement good scientific practice in measurement and experimentation, both in the field and in the laboratory	• Know How
CE16	To plan, design and implement applied research from the recognition stage to the final evaluation of results and discoveries	• Know How
CE17	Ability to survey in the field and to work in the laboratory responsibly and safely, encouraging team work	• Know How
CE18	To transmit writing, verbal and graphical information for audiences of various types	• Know How
CE20	To find and evaluate marine resources of various kinds	• Know How
CE26	To plan, direct and write technical reports on marine issues	• Know How
CT2	Organization and planning skills	• Know How

Learning outcomes

Learning outcomes	Competences
1. Get skills to plan and carry out geological oceanographic surveys	CB1 CB2 CE1 CE4 CE5 CE9 CE13 CE17 CT2 CT15
2. Get familiar with oceanographic databases in public repositories	CB1 CB2 CB5 CE1 CE5 CE9 CE13 CE16 CE20 CT2 CT7
3. To know the basic methods of geophysical exploration	CB3 CB4 CB5 CE1 CE5 CE12 CE13 CE14 CE15 CE16 CE17 CT2 CT15
4. To know the basic techniques of compositional analysis and physical properties of sedimentary cores	CB2 CB3 CE1 CE4 CE5 CE12 CE13 CE15 CE16 CE17 CT2 CT7 CT15
5. To know and apply the techniques of geochemical characterization in sediments.	CB2 CB3 CB4 CB5 CE1 CE4 CE12 CE13 CE16 CE17 CT2 CT7 CT15

6. Get familiar with geophysical and geochemical data processing methods	CB3 CB4 CB5 CE1 CE5 CE6 CE12 CE13 CE15 CE16 CE17 CT2 CT15
7. Get skills to write and submit reports	CB3 CB4 CE1 CE6 CE9 CE13 CE14 CE15 CE16 CE17 CE18 CE26 CT7
8. Security during the execution of an oceanographic survey	CB5 CE1 CE5 CE6 CE8 CE12 CE13 CE15 CE17 CT2 CT7 CT15

Contents

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

Planning			
	Class hours	Hours outside the classroom	Total hours
Introductory activities	1	0	1
Lecturing	24	51.6	75.6
Laboratory practical	15	16.08	31.08
Mentored work	2.16	10.8	12.96
Seminars	4.34	13.02	17.36
Studies excursion	5	5	10
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	
Methodologies	Description
Introductory activities	Detailed introduction about the content of the subject and the methodology followed as well as the form of evaluation, field trips, practical classes and seminars. The materials necessary to follow lectures and practical sessions and references will be presented.
Lecturing	This includes the theoretical contents about all methods used in Oceanography Geology surveys, including selected applied examples. The student will be evaluated about this content in a final exam.
Laboratory practical	Laboratory practices consist of three sessions: 1- Corer description and interpretation. 2- Introduction to the interpretation of seismic records: reflection and refraction systems. 3- Data processing for the elaboration of bathymetric maps (the computer classroom will be used). Attendance is MANDATORY.
Mentored work	In groups of two or three students, the students will choose a applied scientific study on the subject for an oral presentations. The student will show their ability to work as a team and his ability to make an oral presentation on a scientific topic. In the ensuing discussion, the capacity for synthesis and understanding of the proposed topic will be evaluated. The activity is MANDATORY.
Seminars	The seminars that students will have to hold and deliver, consists of three sessions: 1- Handling of nautical charts, navigation parameters, point positioning and sampling path. Key tools for the preparation and conduct of oceanographic surveys. 2- Interpretation of Side Scan Sonar records. 3- Exhibition of examples of studies applied in Geological Oceanography, focusing into the specific methodology used for each specific work. These activities are MANDATORY.
Studies excursion	There will be a session onboard the B/O Mytilus along the Ria de Vigo where the student will participate in a oceanographic survey. The objective is to be able to familiarize themselves with the systems of acquisition of submarine acoustic data and of marine sediment samples (sediment cores, dredgers, etc.). It is also intended that they become familiar with the organization and procedure of an oceanographic survey, for which smaller groups of work will be created to carry out the activity on board the oceanographic vessel. At the end of the activity, each group will have to produce a "cruise report". Some of the collected data will be worked out in practical sessions. The activity is MANDATORY.

Personalized assistance	
Methodologies	Description
Introductory activities	This first part corresponds to the presentation of the subject: activities that will be developed along the course, material that will be needed and to specify the deliverables that the students will have to present along the course. The evaluation system to be followed will also be presented. The active participation of the students will be encouraged, basically aimed at clarifying all the doubts related to the approach and development of the subject. The tutoring schedule will be presented: Tuesday from 13:00 h to 14:00 h, Wednesday from 12:00 h. to 14:00 h. and Thursday from 11:00 h to 14:00 h. However, it will be that the student can contact the teacher to clarify doubts at all times, preferably in person, individually or in a group. The hours of tutoring may vary on time when the teacher has other teaching, research or management duties to attend. Also in case the student is unable to adjust to that schedule, it will be possible to arrange tutorial meetings outside the same.

Lecturing	The active participation of the students in the classes will be encouraged, encouraging the discussion and approach of small questions to be solved in class. The student can contact at all times with the teacher to clarify doubts, in person, individually or in a group. If the doubts require a greater personal attention will be agreed a tutorial to solve problems. Tutoring hours: Tuesday from 13:00 h to 14:00 h, Wednesday from 11:00 h h to 14:00 and Thursday from 12:00 h to 14:00 h. This schedule may vary on time when the teacher has other teaching, research or management duties to attend. Likewise in case that the student is impossible to adjust to that schedule, it will be possible to agree meetings of tutorials outside the same one.
Laboratory practical	The practical exercises presented in the different laboratory sessions and seminars will be solved in the same classroom, in order to resolve the doubts gradually as they arise as the work progresses in the complexity of the exercises. The active participation of students will be encouraged. Once completed, the student can contact at all times with the teacher to clarify doubts, preferably in person, individually or in a group. If the doubts require a greater personal attention will be agreed a tutorial to solve problems. Tutoring hours: Tuesday from 13:00 h to 14:00 h, Wednesday from 11:00 h to 14:00 h and Thursday from 12:00 h to 14:00 h. This schedule may vary on time when the teacher has other teaching, research or management duties to attend. Also in case the student is unable to adjust to that schedule, it will be possible to arrange tutorial meetings outside the same.
Studies excursion	A Oceanography Survey will be carried out in the B/O Mytilus, in groups of 5-6 students, where they will put in practice the methodology involve into Geological Oceanographic cruise. Some of the data collected on board will be worked out in practical sessions. After the activity, each group of student have to produce a cruise report, that will be evaluated. This will include: description of the methodology achieve and collected data.
Mentored work	In groups of two or three people, students will choose a current publication that shows an applied practical work of any of the equipment and methodologies that are included in the assignment. They will have to make an exhibition of the same before their colleagues and present a written paper with an article format. 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 schedule: Tuesday from 13:00 h to 14:00 h, Wednesday from 11:00 h to 14:00 h and Thursday from 12:00 h to 02:00 h. This schedule may vary on time when the teacher has other teaching, research and/or management duties to attend.
Seminars	

Assessment

	Description	Qualification	Evaluated	Competences
Laboratory practical	Attendance at the laboratory practices is MANDATORY. The correct implementation of the exercises proposed in these practices will be evaluated.	10		CB1 CB2 CB3 CB4 CB5 CE1 CE4 CE5 CE6 CE12 CE13 CE15 CE17 CE20 CT2 CT7 CT15

Studies excursion	Attendance at the sea survey is MANDATORY. The correct implementation of the exercises proposed in these practices will be evaluated.	10	CB5 CE1 CE4 CE5 CE6 CE12 CE13 CE15 CE16 CE17 CE18 CE26 CT2 CT7 CT15
Mentored work	The assignment of individual or paired work will be evaluated, assessing both the preparation of the topic, the presentation of a summary document of the subject as well as the presentation of the same. This activity is MANDATORY	15	CB1 CB2 CB3 CB4 CB5 CE1 CE4 CE5 CE6 CE9 CE13 CE14 CE15 CE16 CE17 CE18 CE20 CE26 CT2 CT7 CT15

Seminars	Seminar attendance is MANDATORY. The correct implementation of the exercises proposed in these seminars will be evaluated.	5	CB1 CB2 CB3 CB4 CB5 CE1 CE4 CE5 CE6 CE9 CE14 CE18 CE20 CE26 CT2 CT7 CT15
Objective questions exam	Questions and exercises to assess understanding, analytical capacity and synthesis of acquired knowledge. YOU WILL NEED TO PASS THIS EXAMEN TO BE AWARE OF THE NOTE OF THE REST OF THE ACTIVITIES, (get a minimum of 5 out of 10)	60	CB1 CB2 CB3 CB4 CB5 CE1 CE4 CE5 CE6 CE8 CE9 CE12 CE13 CE14 CE15 CE16 CT7 CT15

Other comments on the Evaluation

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

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

Sources of information

Basic Bibliography

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Hailwood, E.A., Kidd, R., Marine Geological Surveying and Sampling. Marine geophysical Researches., Kluwer academic Publishers. 12:169pp, 1990
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Telford, W.M.; Geldart, L.P., Sheriff, R.E., Applied Geophysics, 2nd Edition., Cambridge University Press, 770 pp., 1990

Trabant, P.K., Applied High-Resolution Geophysical Methods Offshore Geoenvironment Hazards., D. reidel Publishing Company. International Human Resources Development Corporation. Boston., 265 p., 1984

Udias, A., Mézcua, J., Fundamentos de Geofísica, Ed. Alhambra. 419 pp, 1986

Wille, P. C., Sound images of the Ocean in Research and Monitoring., Springer-Verlag, 471, 2005

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

Recommendations

Subjects that continue the syllabus

Applied marine geology/V10G060V01909

Subjects that are recommended to be taken simultaneously

Basin Analysis/V10G060V01901

Subjects that it is recommended to have taken before

Coastal and marine sedimentary habitats/V10G060V01402

Sedimentology/V10G060V01305

Geological oceanography I/V10G060V01504

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

Subject	Chemistry applied to the marine environment II			
Code	V10G060V01604			
Study programme	(*)Grao en Ciencias do Mar			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	3rd	2nd
Teaching language	Spanish			
Department				
Coordinator	Moldes Moreira, Diego Nieto Palmeiro, Óscar			
Lecturers	Leao Martins, Jose Manuel Moldes Moreira, Diego Nieto Palmeiro, Óscar Pena Pereira, Francisco Javier			
E-mail	diego@uvigo.es palmeiro@uvigo.es			
Web				
General description	<p>The student will acquire competences and skills on several topics of the chemistry in the marine environment. In the first part of the subject, students will tackle important application such as wastewater treatment, desalination and marine biotechnology.</p> <p>In the second part will acquire theoretical and practical competences in the analysis of chemical contaminants as well as other compounds of interest in the marine environment. In this case they will learn to use simple techniques for sample preparation prior to the measurement step and their applications in the compartments of the marine environment. The students will get knowledge about the relevance of the control of the environmental quality.</p>			

Competencies

Code		Typology
CB1	Students have demonstrated knowledge and understanding in a field of study that builds upon their general secondary education, and is typically at a level that, whilst supported by advanced textbooks, includes some aspects that will be informed by knowledge of the forefront of their field of study	
CB2	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	
CB3	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	<ul style="list-style-type: none"> • know • Know How • Know be
CB4	Students can communicate information, ideas, problems and solutions to both specialist and non-specialist audiences	<ul style="list-style-type: none"> • know • Know How • Know be
CB5	Students have developed those learning skills that are necessary for them to continue to undertake further study with a high degree of autonomy	<ul style="list-style-type: none"> • Know How • Know be
CE1	To know the vocabulary, codes and concepts inherent to the oceanographic scientific field	<ul style="list-style-type: none"> • know
CE3	Critical understanding of the history and current status of the Marine Sciences	<ul style="list-style-type: none"> • know
CE4	To know the basic techniques to sample the water column, organisms, sediments and sea bottom, as well as the surveying methods for dynamic and structural variables	<ul style="list-style-type: none"> • know • Know How • Know be
CE5	Basic knowledge of research methodology in oceanography	<ul style="list-style-type: none"> • know • Know How • Know be
CE6	Ability to identify and understand the problems in the field of oceanography	<ul style="list-style-type: none"> • know • Know How • Know be
CE8	To understanding the fundamentals of the laws that regulate the use of the marine environment and its resources	<ul style="list-style-type: none"> • know • Know How
CE9	To be familiar with the public and private, national and international organizations and institutions related to the Marine Sciences	<ul style="list-style-type: none"> • know
CE12	To be able to operate the instrumental techniques applied to sea	<ul style="list-style-type: none"> • know • Know How • Know be

CE13 To acquire, evaluate, process and interpret oceanographic data within the theories currently in use	<ul style="list-style-type: none"> • know • Know How
CE14 To recognize and analyze new problems and to propose problem-solving strategies	<ul style="list-style-type: none"> • know • Know How
CE15 To recognize and implement good scientific practice in measurement and experimentation, both in the field and in the laboratory	<ul style="list-style-type: none"> • know • Know How
CE16 To plan, design and implement applied research from the recognition stage to the final evaluation of results and discoveries	<ul style="list-style-type: none"> • know • Know How
CE17 Ability to survey in the field and to work in the laboratory responsibly and safely, encouraging team work	<ul style="list-style-type: none"> • know • Know How
CE18 To transmit writing, verbal and graphical information for audiences of various types	<ul style="list-style-type: none"> • know • Know How • Know be
CE22 To control marine pollution problems	<ul style="list-style-type: none"> • know • Know How
CE27 To understand the operation details of enterprises linked to the marine environment, and to recognize their specific problems and solutions	<ul style="list-style-type: none"> • know
CE30 Identify and assess environmental impacts in the marine environment	<ul style="list-style-type: none"> • know • Know How
CE32 Quality control of seafood	<ul style="list-style-type: none"> • know • Know How
CE35 Water quality control in water treatment plants	<ul style="list-style-type: none"> • Know How
CT1 Analysis and synthesis ability	<ul style="list-style-type: none"> • Know How
CT3 Written and oral communication in the official languages of the University	<ul style="list-style-type: none"> • know • Know How • Know be
CT6 Problem management and solving skills	<ul style="list-style-type: none"> • know • Know How • Know be
CT17 Sensitivity towards environmental issues	<ul style="list-style-type: none"> • know • Know How • Know be

Learning outcomes

Learning outcomes	Competences
Recognise the main characteristics of the wastewater. Classify the wastewater depending on their origin.	CB1 CB2 CB3 CB4 CE1 CE8 CE27 CE35 CT1 CT17
Knowing the main technologies used for wastewater treatment and choosing the suitable one depending on the wastewater properties.	CB1 CB2 CB3 CB4 CE14 CE18 CE22 CE27 CE35 CT1 CT17

Elaborate scientific documents with own data obtained by means of a simulation software	CB1 CB2 CB3 CB4 CB5 CE1 CE8 CE14 CE18 CE35 CT1 CT3
Recognise the main methodologies of sea water desalination	CB1 CB3 CB4 CE1 CE3 CE8 CE9 CE14 CE27 CT1 CT17
Knowing the potential of the marine environment as a source of marketable products by means of biotechnological processes	CB1 CB2 CB3 CB4 CB5 CE1 CE3 CE8 CE9 CE14 CE27 CT1
Enumerate the most important points regarding the setup of a control plan about marine pollution.	CB2 CB4 CB5 CE1 CE3 CE5 CE6 CE13 CE14 CE16 CE18 CE22 CE30 CE35 CT3 CT6 CT17

Choose and use the suitable material for sediments sampling. Choose the most important sentinel organisms for studying marine pollution.

CB3
CB4
CB5
CE1
CE4
CE5
CE6
CE12
CE13
CE15
CE16
CE17
CE18
CE22
CE30
CT3
CT6
CT17

Apply the suitable chemical analytical techniques for the most interesting compounds in Environmental Chemistry. Knowing the suitable experimental conditions for the determination of a chemical compound depending on the selected technique.

CB2
CB3
CB4
CB5
CE1
CE3
CE5
CE6
CE12
CE13
CE14
CE15
CE16
CE17
CE18
CE22
CE30
CE32
CE35
CT1
CT3
CT6
CT17

Being able to determine the concentration of a chemical compound in the marine environment depending on the analytical technique employed.

CB2
CB3
CB4
CB5
CE4
CE5
CE6
CE12
CE13
CE15
CE16
CE18
CE22
CE32
CE35
CT1
CT3
CT6

Apply the fundamental concepts of quality control in an analytical laboratory.

CB2
CB3
CB5
CE1
CE4
CE5
CE9
CE13
CE15
CE16
CE17
CE18
CE22
CE32
CE35
CT1
CT3
CT6
CT17

Contents

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

Planning

	Class hours	Hours outside the classroom	Total hours
Introductory activities	1	2	3
Lecturing	22	40	62
Mentored work	7	21	28
Laboratory practical	10	10	20
Computer practices	5	0	5
Studies excursion	5	0	5
Presentation	0.5	1.5	2
Objective questions exam	0.5	1	1.5
Problem and/or exercise solving	1	4	5
Essay	0	12	12
Practices report	0	2	2
Essay questions exam	1.5	3	4.5

*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 will present them to the students the syllabus to develop during the semester, as well as the aims, competitions and criteria of evaluation. Likewise it will explain them the form to develop the subject along the semester, will create the groups that will make the integrated methodologies.
Lecturing	The professor will make an exhibition of the contents of the syllabus to develop, where the professor can pose some question to the students for his resolution in class. Likewise, the students can ask to the professor the questions that go arising along the exhibition. The material of the presentation will be available for the students before the session and will have to assist to her with said material. At the end of each subject, or of each group of subjects, will have to make a questionnaire that will resolve individually.
Mentored work	During the session of practices in the room of computing, the students will obtain data related with the purification of residual waters. With the data obtained will have to elaborate a report with the same format that a scientific article. On the other hand, the students will study a practical case based in the analysis of a contaminant which developed in base to a bibliographic research and of agreement to some criteria of evaluation published in the platform TEMA. They do not have obligation to make these works those students that made them in the course 2018-19 and obtained the corresponding sufficiency.
Laboratory practical	The students will make some practices of laboratory on analysis of contaminants environmental related with the syllabus and will present the corresponding report that will be evaluated of agreement to some criteria published in the platform TEMA. They do not have obligation to make these practices those students that made them in the course 2018-19 and obtained the corresponding sufficiency.
Computer practices	The students will make some practices of computer on the treatment of residual waters. They will consist in the utilisation of a simulator in which it will study the effect of diverse parameters in the process of treatment of the residual waters. The students will have to take data of the different parameters studied, which will be employed for the preparation of the Supervised Works.
Studies excursion	It will make a visit to the main Station Debugger of Residual Waters of the municipality of Vigo, the EDAR of Lagares. In case that it was not possible, will treat to visit another EDAR. After the visit the students will have to answer to a brief questionnaire related with the same. In the measure of the economic possibilities of the centre, schedules and availability of companies of interest, could visit some company of interest related with the subject. This visit would have would have voluntary character.
Presentation	The students will do a brief presentation in public related with the analytical work made in the Supervised Works. The mates and the professor will be able to make questions on the presentation made.

Personalized assistance

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

Assessment

Description	Qualification	Evaluated	Competences
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Presentation	The students will do a brief public presentation related to the analytical work performed in tutored works. The lecturer will make questions about the presented work. The evaluation criteria will be previously published in the web platform (FAITIC).	2.5	CB3 CB4 CE1 CE4 CE5 CE6 CE12 CE13 CE14 CE15 CE16 CE17 CE18 CE22 CE30 CE32 CT1 CT3 CT17
Laboratory practical	Some lab activities regarding the analysis of marine contaminants will be carried out. A report should be presented following the previously provided rules. The evaluation criteria will be previously published in the web platform (FAITIC). Those students that have pass this activity in the previous course (2016-17), may conserve their qualifications.	2.5	CB3 CB4 CB5 CE5 CE12 CE13 CE15 CE16 CE17 CE18 CE22 CT1 CT3 CT6 CT17
Studies excursion	The students will visit a wastewater treatment facility. After that, a brief questionnaire must be answer.	5	CB1 CB3 CE9 CE22 CE27 CE35 CT17
Problem and/or exercise solving	In the final exam, a writing exam about the calculation of chemical concentrations will be carried out. The result obtained, as well as the clarity and the reasoning used to achieve this will be considered for evaluation.	12.5	CB2 CB3 CB4 CB5 CE13 CE18 CE22 CT1 CT3 CT6 CT17

Essay	A scientific article must be written by the students. The data will be obtained by means of a wastewater simulation software. Moreover, a bibliographic study must be carried out regarding the analysis of a typical marine contaminant. The evaluation criteria will be previously published in the web platform (FAITIC). Those students that have pass this activity in the previous course (2016-17), may conserve their qualifications.	30	CB2 CB3 CB4 CB5 CE1 CE5 CE6 CE12 CE13 CE14 CE16 CE18 CE22 CE32 CT1 CT3 CT6 CT17
Practices report	Some lab activities regarding the analysis of marine contaminants will be carried out. A report should be presented following the previously provided rules. The evaluation criteria will be previously published in the web platform (FAITIC). Those students that have pass this activity in the previous course (2016-17), may conserve their qualifications.	10	CB2 CB3 CB4 CB5 CE1 CE5 CE12 CE13 CE15 CE18 CE22 CE32 CT1 CT3 CT6 CT17
Objective questions exam	When finalising lessons 1 to 3, as well as in the final examination (for these lessons), a test exam will be performed.	15	CB2 CB3 CB4 CB5 CE1 CE8 CE14 CE22 CE30 CT1

Essay questions exam	When finalising lessons 1 to 3, as well as in the final examination (for these lessons), some questions should be answered by the students. This exam will count for 10% of the final qualification. At the end of the subject, some questions about the methodologies used in chemical analysis will be answered. It will count for 12,5% of the final qualification.	22.5	CB2 CB4 CE1 CE4 CE6 CE8 CE9 CE12 CE13 CE15 CE18 CE22 CE27 CE30 CE32 CE35 CT1 CT3 CT17
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Other comments on the Evaluation

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

<http://mar.uvigo.es/index.php/en/alumnado-actual-2/examenes-3>

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

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

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

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

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

For the following course, the qualification of the following activities will be conserved in the case of being surpassed:

- Presentations exhibitions
- Practical of laboratory
- Gone out of practical/study of field
- Works and projects
- Inform/memories of practices

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

Metcaf & Eddy, Wastewater Engineering. Treatment and Resource Recovery, 5, McGrawHill, 2014,
Aminot A., K erouel R., Hydrologie des  cosyst mes marins: param tres et analyses, Editions Quae, 2004,

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

Complementary Bibliography

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

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

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

<https://link.springer.com/content/pdf/10.1007%2F978-3-642-53971-8.pdf>

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

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

http://www.oecd-ilibrary.org/science-and-technology/marine-biotechnology_9789264194243-en

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

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

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

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

Recommendations

Subjects that it is recommended to have taken before

Chemical oceanography I/V10G060V01304

Chemical oceanography II/V10G060V01403

Chemistry applied to the marine environment I/V10G060V01505

IDENTIFYING DATA**Marine contamination**

Subject	Marine contamination			
Code	V10G060V01701			
Study programme	(*)Grao en Ciencias do Mar			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	4th	1st
Teaching language	#EnglishFriendly Galician English			
Department				
Coordinator	Beiras García-Sabell, Ricardo			
Lecturers	Beiras García-Sabell, Ricardo Montalvo Rodríguez, Javier Viana González, Inés			
E-mail	rbeiras@uvigo.es			
Web	http://www.ecotox.es			
General description	Main pollutants, sources, environmental distribution, toxic effects. Marine environmental legislation.			

Competencies

Code		Typology
CB1	Students have demonstrated knowledge and understanding in a field of study that builds upon their general secondary education, and is typically at a level that, whilst supported by advanced textbooks, includes some aspects that will be informed by knowledge of the forefront of their field of study	• know
CB2	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	• know
CB3	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	• know
CB4	Students can communicate information, ideas, problems and solutions to both specialist and non-specialist audiences	• know
CB5	Students have developed those learning skills that are necessary for them to continue to undertake further study with a high degree of autonomy	• know
CE4	To know the basic techniques to sample the water column, organisms, sediments and sea bottom, as well as the surveying methods for dynamic and structural variables	• know • Know How
CE8	To understanding the fundamentals of the laws that regulate the use of the marine environment and its resources	• know
CE9	To be familiar with the public and private, national and international organizations and institutions related to the Marine Sciences	• know
CE14	To recognize and analyze new problems and to propose problem-solving strategies	• know
CE16	To plan, design and implement applied research from the recognition stage to the final evaluation of results and discoveries	• know
CE22	To control marine pollution problems	• know • Know How
CE26	To plan, direct and write technical reports on marine issues	• Know How
CE30	Identify and assess environmental impacts in the marine environment	• know • Know How
CE31	Ability to function and operate in public and private, national and international institutions in the field of marine science	• know
CE32	Quality control of seafood	• know
CE35	Water quality control in water treatment plants	• know
CE37	Technical advice or assistance on issues related to the marine and coastal environment	• know • Know How
CT1	Analysis and synthesis ability	• know
CT9	Critical-review and self-criticism capacity	• Know be
CT11	Ability to learn independently and continuously	• know
CT15	Ability to apply knowledge in practice	• Know How
CT16	Research skills	• Know How
CT17	Sensitivity towards environmental issues	• Know be

Learning outcomes

Learning outcomes	Competences
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2. Learn to distinguish the different types of pollution that can affect a coastal ecosystem and the distinct environmental parameters that result affected by each type.	CB1 CB2 CB3 CB4 CB5 CG1 CG2 CG4 CG6 CG10 CG17 CE4 CE8 CE9 CE13 CE14 CE16 CE19 CE22 CE24 CE26 CE27 CE30 CE31 CE31 CE32 CE35 CE37 CT1 CT1 CT2 CT3 CT9 CT11 CT15 CT16 CT17
3. Know the effects of the pollution to the distinct levels of organisation, since molecular to ecosystem, from an integrated and practical perspective, aiming at the use of those effects as indicators of pollution.	CG1 CG2 CG4 CG6 CG10 CG17 CE13 CE16 CE19 CE24 CE27 CE31 CT1 CT2 CT3
4. Know how to design an integrated study of evaluation of pollution in a coastal ecosystem, including the variables to measure and the samples to collect.	CG1 CG2 CG3 CG4 CG5 CE8 CE14 CE14 CE19 CE20 CT1 CT2 CT3 CT4 CT5 CT7 CT11

5. To get familiar with the study and the management of the waste water effluents in regard to the uses of the surface water bodies, with particular attention to estuaries and marine waters. CG1
CG5
CG6
CG14
CE7
CE12
CE16

6. To get familiar with the instruments of management and control of the human actions with impact on the coastline, and basic notions of the legislation involved in pollution control, within the autonomic, state and international administrations CB1
CB2
CG1
CG2
CG3
CG4
CE8
CE8
CE10
CE12
CE22
CT1
CT5
CT8
CT14
CT18

Contents

Topic

Basic concepts	1. Introduction. Pollution, anthropogenic process. Pollution: deleterious effects. Environmental Quality Criteria and Standards. PBT substances. Sources, distribution and fate of pollutants in the marine compartments.
Urban and agriculture pollutants	2. Organic pollution. Sources: liquid wastes. Estimating the organic load in wastewaters and receiving waters: BOD, COD, TOC. Excess of organic matter: hypoxia and anoxia. 3. Pollution by excess of inorganic nutrients. Nitrogen and phosphorus in the marine environment; anthropogenic sources. Eutrophication and hypereutrophication. Detergents. 4. Microbial pollution. Pathogenic microorganisms present in marine waters. Microbiological analysis of water and shellfish. Self-depuration of natural waters. Disinfection of wastewaters.
Industrial pollutants	5. Hydrocarbons. Oil. Polycyclic Aromatic Hydrocarbons. Sources and weathering of oil in the sea. Effects on marine organisms. Oil spills, lessons learnt. 6. Organohalogenated pollutants. Organochlorine pesticides: sources and levels in the marine compartments; bioaccumulation and biomagnification. Toxicity. Polychlorinated biphenyls (PCBs). Polybrominated compounds (PBDEs); sources and levels in the marine compartments; toxicity. Dioxins and dibenzofurans. 7. Trace metals I. Background levels and enrichment factors. Distribution in the oceans. Mercury: Sources, distribution, bioaccumulation and biomagnification. Toxicity. Methylmercury. 8. Trace metals II. Copper, lead, cadmium. Sources, concentrations in marine compartments, toxicity. Tributyltin (TBT).

- 9. Distribution of pollutants in the environment. Fugacity models. Environmental persistence and half-life. Biodegradation. Chemical speciation and bioavailability of metals.
 - 10. Bioaccumulation. Toxicokinetics. Uptake, accumulation and biotransformation of pollutants in the organisms. Bioconcentration factor (BCF). First order kinetic bioaccumulation models. Thermodynamic bioaccumulation models, Kow.
 - 11. Molecular and cellular responses to pollutants: biomarkers. Biotransformation and elimination of toxic chemicals. Lysosomal alterations. Metallothioneins and stress proteins. Cytochrome P450. Enzymatic alterations.
 - 12. Lethal and sublethal toxicity. Basic principles of toxicology. Dose:response curves. LC50/EC50 and toxicity threshold. Time and other factors affecting toxicity. Effects on reproduction and development. Effects on the bioenergetics and growth.
 - 13. Effects of pollution at population and community levels. Changes in the presence and abundance of populations. Bioindicators by presence and absence. Biological indices in communities.
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- Managing and assessing marine environmental quality
- 14. Integrative assessment of marine pollution. Coastal pollution monitoring programs. Integration of chemical and biological methods. Use of wild organisms as bioindicators and laboratory bioassays. The mussel watch approach
 - 15. Ecotoxicological bioassays. requirements and methodological aspects. Liquid phase: copepod survival, Seurchin Embryo Test (SET). Solid phase: amphipod survival, bivalve burrowing. In situ bioassays.
 - 16. Protection of the marine environment. I. Control at the point source discharges. Identification of priority pollutants. Evaluation of the ecological risk. Regulation of new chemical products. REACH. Regulation of complex effluents.
 - 17. Protection of the marine environment. II. Control of the levels of pollutants in receiving waters. Sediment and Water Quality Criteria and standards. International legislation. Water Framework Directive. Marine Strategy Framework Directive.

Planning			
	Class hours	Hours outside the classroom	Total hours
Lecturing	20	40	60
Seminars	12	28	40
Studies excursion	5	0	5
Laboratory practical	15	30	45

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

Methodologies	
	Description
Lecturing	The theoretical contents that will be evaluated in a final exam will be presented
Seminars	The basic scheme of the seminars consists in the following: 1. preparation by the student of a questionnaire and a practical case available through TEMA. 2. handing over the questionnaire to the teacher at the beginning of the seminar. 3. resolution and discussion of the case in common with the teacher.
Studies excursion	Field trip to a supposedly polluted zone with basic sampling material for sediments, water and biota. Collection of representative samples with support of the professor for further analysis in laboratory.
Laboratory practical	The practices consist in a field trip to an impacted site in the Port of Vigo, and the collection of environmental matrices (water *sub-superficial with oceanographic bottle, *sediment with *draga Vain *Veen dredge) and native mussels, with object to realize a series of observations, chemical analyses and biological essays in the laboratory, including the solids in suspension, phosphates, BOD5 and faecal microorganisms in water, organic matter, presence of indicator species and ecotoxicological bioassays with the sediments. After the days of laboratory the data obtained are shared in the TEMA platform, and individual memories must be elaborated and handed over to the teacher by the date of the final exam.

Personalized assistance	
Methodologies	Description
Lecturing	Power point presentations in the classroom; personal assistance in my office at tutorial times

Laboratory practical Practical work in the laboratory

Seminars Questionnaire elaboration and discussion

Assessment			
	Description	Qualification	Evaluated Competences
Lecturing	multiple choice questions exam	70	CB1 CB2 CB3 CB4 CB5 CE8 CE9 CE14 CE16 CE22 CE31 CE32 CE35 CE37 CT1 CT9 CT11 CT16 CT17
Laboratory practical	Mandatory presence in the practices and an individual report	15	CB1 CB2 CB3 CB4 CB5 CE4 CE26 CE31 CT15
Seminars	Mandatory presence in the seminars. Delivery of the corresponding individual questionnaires	15	CE22

Other comments on the Evaluation

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

<http://mar.uvigo.es/index.php/en/alumnado-actual-2/examenes-3>

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

Sources of information

Basic Bibliography

Beiras, R., Marine Pollution, 1, Elsevier, 2018,

Clark, R.B., Marine Pollution, 5ª ed., Clarendon Press. Oxford, 2001, Oxford

Walker C.H. et al., Principles of ecotoxicology, 4th ed., Taylor & Francis, 2012, London

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Beiras, R. e Pérez, S, Manual de métodos básicos en contaminación acuática, ECIMAT, 2013, Vigo

Complementary Bibliography

Kennish, M.J., Estuarine and marine pollution, CRC Press, 1997,

Recommendations

Subjects that it is recommended to have taken before

Marine Ecology/V10G060V01401

IDENTIFYING DATA				
Ocean Dynamics				
Subject	Ocean Dynamics			
Code	V10G060V01702			
Study programme	(*)Grao en Ciencias do Mar			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	4th	1st
Teaching language	Spanish English			
Department				
Coordinator	Souto Torres, Carlos Alberto			
Lecturers	Souto Torres, Carlos Alberto			
E-mail	ctorres@uvigo.es			
Web				
General description	Equations of the ocean and its solutions. The student will learn about the seven ocean equations and their main solutions, from the ocean waves scale to the planetary scale, like Rossby waves and Sverdrup and Stommel models.			

Competencies	
Code	Typology
CB4	Students can communicate information, ideas, problems and solutions to both specialist and non-specialist audiences
CE2	To know and understand the essential facts, concepts, principles and theories related to oceanography
CE6	Ability to identify and understand the problems in the field of oceanography • know
CT1	Analysis and synthesis ability

Learning outcomes	
Learning outcomes	Competences
The ability to calculate solutions to those equations related with those dynamics.	CB4 CE2 CE6
Basic understanding of the role of the ocean in the global climate dynamics.	CE6 CT1

Contents	
Topic	
Development of the ocean equations.	1.1 f plane approximation. 1.2 Beta plane approximation. Problems. 1.3 Continuity equation, deduction and interpretation. 1.4 Gauss theorem. 1.5 Momentum equation. Pressure forces. Viscous forces. Coriolis acceleration. Application and simplifications. 1.6 Energy conservation equation and salt conservation equation. 1.7 Equation of state. Approximations. 1.8 Recapitulation. 1.9 Problems.
Wavelike solutions of the equations	Wave kinematics. Dispersion relation. 2.1 Wavelike solutions I: Wave's dynamics. Short waves (deep water waves) and long waves (shallow water waves) approximations. Pressure and particles movement. Stokes drift. Problems. 2.2 Inertial movement and forced inertial movement. 2.3 Wavelike solutions II: Planetary waves. Kelvin waves. Rossby waves. Poincaré Waves. 2.4 Wavelike solutions III. Internal waves. Dynamics of internal waves with and without rotation. Stratified Internal waves.

Non wavelike solutions of the equations.

3.1 Geostrophic currents. Thermal wind equations. Sverdrup relation.
3.2 Barotropic currents.
Problems
3.3 Ekman's surface and bottom layer and Ekman theory. Ekman's transport. Problems
3.4 Barotropic wind forced oceanic circulation. Ekman's pumping. Vertically integrated equations. Sverdrup and Stommel model's. Vertical structure.
Problems
3.5 Baroclinic currents. Theory and applications. Problems.
3.6 Stratification in the ocean. Static stability and friction. Problems.
3.7 Eighth equation: Vorticity conservation. Applications.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	36	58	94
Seminars	16	40	56

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

Methodologies

	Description
Lecturing	Lectures developing the theory for 36 hours.
Seminars	Guided problem solving during 8 clases of 2 hours.

Personalized assistance

Methodologies	Description
Lecturing	Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation
Seminars	These sessions will be used to solve problems, previously available to the students, and to solve any doubt with the theory related.

Assessment

	Description	Qualification	Evaluated Competences
Lecturing	Final test.	80	CB4 CE2 CE6
Seminars	Seminars test.	20	CE6

Other comments on the Evaluation

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

The tests' classroom, date and time will be published at the Marine Sciences' website:

<http://mar.uvigo.es/index.php/es/alumnado-actual/examenes>

Sources of information

Basic Bibliography

CUSHMAN-ROISIN, B., Introduction to Geophysical Fluid Dynamics. Physical and Numerical Aspects, Ray Henderson & Deirde Cavanaugh. U.S.A., 1994

POND, S., G.L.PICKARD, Introductory Dynamical Oceanography, Pergamon Press. Oxford, 1983

Complementary Bibliography

Periáñez, Raúl, Fundamentos de oceanografía dinámica, Secretariado de Publicaciones de la Universidad de Sevilla, 2010

Recommendations

Subjects that continue the syllabus

Modelling/V10G060V01905

Subjects that it is recommended to have taken before

Physical oceanography I/V10G060V01503

Physical oceanography II/V10G060V01602

IDENTIFYING DATA				
Fisheries				
Subject	Fisheries			
Code	V10G060V01703			
Study programme	(*)Grao en Ciencias do Mar			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	4th	1st
Teaching language	Spanish			
Department				
Coordinator	González Castro, Bernardino			
Lecturers	González Castro, Bernardino			
E-mail	bcastro@uvigo.es			
Web				
General description	This course aims to serve as an introduction to the dynamics of exploited populations and to the basic methodologies used in their assessment and management.			

Competencies	
Code	Typology
CB1 Students have demonstrated knowledge and understanding in a field of study that builds upon their general secondary education, and is typically at a level that, whilst supported by advanced textbooks, includes some aspects that will be informed by knowledge of the forefront of their field of study	• know
CB2 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	• know • Know How
CB3 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	• Know How
CB5 Students have developed those learning skills that are necessary for them to continue to undertake further study with a high degree of autonomy	• Know be
CE4 To know the basic techniques to sample the water column, organisms, sediments and sea bottom, as well as the surveying methods for dynamic and structural variables	• know • Know How
CE10 To know the problems and the basic principles of sustainability in relation to the use and exploitation of the marine environment	• know
CE15 To recognize and implement good scientific practice in measurement and experimentation, both in the field and in the laboratory	
CE29 Skill in the practical use of models and in the incorporation of new data for their validation, improvement and development	• Know How
CE33 Fisheries control	• know
CT1 Analysis and synthesis ability	• Know How
CT6 Problem management and solving skills	• Know How

Learning outcomes	
Learning outcomes	Competences
Understand the population processes that affect the dynamics of living resources	CB3 CE10 CE33 CT1
Estimate parameters of interest for marine fisheries resources exploitation	CB2 CE15 CE29 CT6
Understand the basic methods of fisheries resource assessment	CB2 CE4 CE33 CT1
Understand and apply basic methods of fitting mathematical models for parameter estimation, population dynamics and assessment of marine living resources	CB1 CB2 CB5 CE15 CE29 CT6
Develop skills to use basic fisheries computer programs	CB2 CB5 CE29 CT6

Contents	
Topic	
Characterization of marine fisheries resources	Types of resources. Marine areas of interest in the exploitation of resources. Degree of exploitation of marine living resources.
The fishing process	Fishing gears, boats and methods. Selectivity of fishing gears
The unit stock	Population and stock. Population parameters. Characterization of management units. Estimation of abundance of exploited stocks
Reproduction	Maturation and fecundity. Estimation of maturity. Age and size of first maturity. Estimation of fecundity.
Recruitment	Estimation of recruitment. Stock-recruitment relationship. Population dynamics and stock-recruitment relationships.
Age and growth	Concept of cohort. Determination of age. Length-weight relationship. Allometry and isometry. Condition indices. Mathematical expressions of growth. Age-length keys.
Growth parameters	The von Bertalanffy growth model. Estimation of growth parameters: length-frequency analysis, separation of cohorts, size-at-age analysis, length increments analysis. Conversion of length to age.
Mortality	Survivorship curves. Mortality rates. Natural and fishing mortalities. Fishing effort. Capturability. Catch: Catch equations, Catch rates. Estimation of total, natural and fishing mortalities. Estimation of catchability.
Population dynamics and assessment models of fish stocks	Cohort Analysis: Virtual Population Analysis, Pope's Cohort Analysis. Biomass dynamic models. Yield and biomass per recruit models.
Fisheries Management	Biological reference points. Harvest strategies. Harvest tactics. International organizations and resource management.
Methodologies of parameter estimation	Estimation with Excel. Estimation with FISAT. Application of an age-structured model of harvested populations.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	32	48	80
Laboratory practical	4	2	6
Computer practices	12	6	18
Problem solving	4	4	8
Mentored work	0	34	34
Essay questions exam	3	0	3
Problem and/or exercise solving	1	0	1

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

Methodologies

	Description
Lecturing	Oral presentation of the contents of the subject using the blackboard and computer presentations.
Laboratory practical	Size selectivity of a dredge for shellfish resources.
Computer practices	Learning and application of numerical methodologies for resolution of parameters and resolution of quantitative problems related to the contents of the subject. Learning and use of basic programs used in the evaluation of marine living resources. Simulation of the dynamics of an exploited population and calculation of Reference Points for fisheries management.
Problem solving	Solution of numerical problems related to the methods explained in the lectures and practices.
Mentored work	Reading of a scientific publication related to the contents of the subject and answering several questions about it.

Personalized assistance

Methodologies	Description
Lecturing	It will be available mainly in the tutoring schedule, except for unforeseen circumstances. It is recommended that the student contact the teacher about when to carry out the tutoring. Tutoring hours: Monday and Wednesday from 15:00 to 18:00 h. Outside of these hours according to availability of the teacher.

Laboratory practical	It will available mainly in the tutoring schedule, except for unforeseen circumstances. It is recommended that the student contact the teacher about when to carry out the tutoring. Tutoring hours: Monday and Wednesday from 15:00 to 18:00 h. Outside of these hours according to availability of the teacher.
Computer practices	It will available mainly in the tutoring schedule, except for unforeseen circumstances. It is recommended that the student contact the teacher about when to carry out the tutoring. Tutoring hours: Monday and Wednesday from 15:00 to 18:00 h. Outside of these hours according to availability of the teacher.
Mentored work	It will available mainly in the tutoring schedule, except for unforeseen circumstances. It is recommended that the student contact the teacher about when to carry out the tutoring. Tutoring hours: Monday and Wednesday from 15:00 to 18:00 h. Outside of these hours according to availability of the teacher.
Problem solving	It will available mainly in the tutoring schedule, except for unforeseen circumstances. It is recommended that the student contact the teacher about when to carry out the tutoring. Tutoring hours: Monday and Wednesday from 15:00 to 18:00 h. Outside of these hours according to availability of the teacher.

Assessment			
	Description	Qualification	Evaluated Competences
Lecturing	Written examination on the contents of the master sessions	50	CB1 CB2 CB5 CE10 CE33 CT1
Laboratory practical	Written examination on the contents of the laboratory practices.	5	CB1 CB2 CE4 CE15
Computer practices	Written examination on the contents of the computer room sessions.	10	CB2 CB5 CE15 CE29
Mentored work	Reading of a scientific work on content related to the subject and answering in writing a question form about it.. This task is voluntary, if the student does not do it, his qualification will be based exclusively on the written exam.	15	CB2 CB3 CE33 CT1
Problem solving	Written examination of numerical problems of the subject.	20	CB1 CB2 CB5 CT6

Other comments on the Evaluation

The "Laboratory practices" and "Practices in computer rooms" are shown separately by requirement of this platform, but their evaluation and scoring is joint, not making a distinction between both. In other words, there will be a single evaluation of "Practices" whose Qualification represents 15% of the total qualification.

The tutored work is voluntary and must be delivered before December 13, 2019 at 13:00 h. The mark of the tutored work will be preserved for the second call. If the student does not do it, the qualification of the subject will be derived exclusively from the rest of the sections, in the following way "Master lesson" 58.3%, Practices ("Laboratory practices" + "Practices in computer classroom") 25% and " Problem solving "16.7%. The mark of the tutored work will be preserved for the second call.

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

asked to open a disciplinary record

Sources of information

Basic Bibliography

King, M., Fisheries biology, assessment and management, Blackwell Publishing, 2007,

Sparre, P. y Venema, S. C., Introducción a la evaluación de recursos pesqueros tropicales. Part 1, FAO, 1997,

Jennings, S.; Kaiser, M. J. and Reynolds, J. D., Marine Fisheries Ecology, Blackwell Science, 2001,

Complementary Bibliography

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

Recommendations

Subjects that it is recommended to have taken before

Marine Ecology/V10G060V01401

Statistics/V10G060V01303

Fish and shellfish biology/V10G060V01902

Other comments

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

IDENTIFYING DATA**Marine and coastal management**

Subject	Marine and coastal management			
Code	V10G060V01704			
Study programme	(*)Grao en Ciencias do Mar			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	4th	1st
Teaching language	Spanish			
Department				
Coordinator	Pérez Arlucea, Marta María			
Lecturers	Alejo Flores, Irene Méndez Martínez, Gonzalo Benito Pérez Arlucea, Marta María			
E-mail	marlucea@uvigo.es			
Web	http://www.researchgate.net/profile/Marta_Perez-Arlucea			
General description	In this matter presents a multidisciplinary vision of the coastal and marine zone, identifying the conflicts and risks associated to these areas. They enter the main tools for the management of these two environments as well as the administrative context-legislative in that it is framed the coastal and marine management.			

Competencies

Code		Typology
CE1	To know the vocabulary, codes and concepts inherent to the oceanographic scientific field	• know
CE3	Critical understanding of the history and current status of the Marine Sciences	
CE6	Ability to identify and understand the problems in the field of oceanography	• know
CE8	To understanding the fundamentals of the laws that regulate the use of the marine environment and its resources	• know
CE9	To be familiar with the public and private, national and international organizations and institutions related to the Marine Sciences	• know
CE10	To know the problems and the basic principles of sustainability in relation to the use and exploitation of the marine environment	• know
CE11	To manage the use of littoral and coastal region and their resources in a sustainable way	• know • Know How
CE14	To recognize and analyze new problems and to propose problem-solving strategies	• know • Know How • Know be
CE21	To manage marine and coastal protected areas	• know • Know How
CE26	To plan, direct and write technical reports on marine issues	• Know How
CE30	Identify and assess environmental impacts in the marine environment	• know • Know How
CE37	Technical advice or assistance on issues related to the marine and coastal environment	• Know How
CT1	Analysis and synthesis ability	• know • Know How
CT2	Organization and planning skills	• know • Know How
CT17	Sensitivity towards environmental issues	• know

Learning outcomes

Learning outcomes	Competences
Critical understanding of the history and current state of the management of the coastal and marine zones	CE3 CT1
Knowledge and critical assessment of the sources of information for coastal and sea planning and management	CE1
Elaborate thematic maps	CE11 CT1
Capacity to understand the application of the corresponding sectorial legislations	CE6 CE8 CE9 CE10 CT2

To know and evaluate the legal uses of the coastal and marine areas	CE10 CE11 CE14 CT1 CT2
To understand the sustainable use of the resources	CE21 CE26 CT2 CT17
To evaluate the environmental impacts in the coastal and marine zones	CE30 CE37 CT17

Contents

Topic	
1. Processes and state of the coastal environments	1.1. Processes and state of the coastal environments
2. Management of the coastal space	2.1. Criteria of management 2.2. Experiences
3. Tools and Technics for the planning and management of the sea	3.1. Methodologies 3.2. Technics
4. Intervention instruments in the coast and marine areas	4.1. The Law of the Coast 4.2. Urbanistic Legislation applicable to the protection of the seaboard 4.3. Protection of natural areas, elements and species of interest 4.4. Use and conservation of the coastal spaces for turistic uses. 4.5. Management of port spaces 4.6. The management of the installations and spaces for the aquaculture
5. Evaluations of impact	5.1. Basic concepts 5.2. Evaluation of projects 5.3. Evaluation of plans and programs
6. Jurisdictional Waters and territorial sea	6.1. Basic concepts and international norms 6.2. Methodologies 6.3. The Spanish rule 6.4. Examples of application
7. Impact of the global change in the half marine and coastal	7.1. General problems 7.2. Models of prediction and mitigation measures.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	23	46	69
Seminars	14	30	44
Studies excursion	8	11	19
Computer practices	7	9	16
Problem and/or exercise solving	2	0	2

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

Methodologies

	Description
Lecturing	Theoretical contents. Concepts, etc.
Seminars	7 Seminars on subjects related with the Theory: preparation of bibliographic works and exhibition
Studies excursion	Field trip to Lanzada Beach for the observation of natural environments and human modifications, impacts, etc.
Computer practices	P1-Legal territorial boundaries P2-Evaluation of environmental impact

Personalized assistance

Methodologies	Description
Seminars	7 seminars of 2 hours in which the lecturer will enter a subject and the students will work on a questionnaire. All the questions will be solved in the seminars. There will be personal tutorials for the preparation of the oral and written presentations in previously scheduled sessions.
Lecturing	23 classes of 1 hour. Students will have access to tutorials, mainly in the indicated schedules. It is advisable that the student contact the lecturer by e-mail.

Computer practices	1 sessions of 4 hours, in the computer room. They will approach different subjects applied of coastal management, where the students will have to solve problems posed during the practice. The doubts and questions will be addressed during the practice.
Studies excursion	Field trip to Lanzada Beach. The students will have the opportunity to ask any scientific questions along the day to complete their field memory.

Assessment			
	Description	Qualification	Evaluated Competences
Seminars	Assistance is compulsory.	30	CE3
	To be approved, the student need to obtain a minimum of 4.5 points on the condition that the global average reaches 5 points.		CE6 CE8 CE14 CE30 CT1 CT2 CT17
Lecturing	The evaluation will consist of a written exam.	45	CE3
	To be approved, the student need to obtain a minimum of 4.5 points on the condition that the global average reaches 5 points.		CE6 CE8 CE9 CE10 CE11 CE14 CE21 CE26 CE30 CE37 CT1 CT2 CT17
Computer practices	Assistance is compulsory.	20	CE6
	To pass the proofs, the students will need to obtain a minimum of 4.5 points on the condition that the global average reaches 5 points.		CE8 CE10 CE11 CE14 CE21 CE26 CE30 CT1 CT17
Studies excursion	The students will present the required tests, memoires, etc. the same day at the end of the practice.	5	CE14
	Delivery of a memory of field/questionnaire		CE21 CE26 CE30 CT1 CT17

Other comments on the Evaluation

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

The students are required a responsible and honest behaviour. Any form of fraud (i.e. copies and/or plagiarism) directed to alter the level of knowledge or skill reached by the student/to in any type of proof, report or work designed with this purpose is consider inadmissible. The fraudulent behaviours will suppose the suspension of the subject during a complete course. An internal file containing these irregular behaviors will be started, and subsequently the lecturer would be able to request the opening of a disciplinary file in the rectorship.

Sources of information

Basic Bibliography

Barragán Muñoz, J.M., Las áreas litorales de España. Del análisis geográfico a la gestión integrada, Ed. Ariel, 2004

Doménech, J.L., Sardá, R., Carballo, A., Villasante, C.S., Barragán, J.M., Borja, A., Rodríguez, M.J, Gestión integrada de zonas costeras, AENOR ediciones, 2009

Masselink, G. y Gehrels, R., Coastal environments and global change, Wiley, 2014

Gómez Orea, D. y Gómez Vilarino, A., Evaluación de impacto ambiental, MP, 2013

Complementary Bibliography

Barragán Muñoz, J.M., Coastal management and public policy in Spain, Ocean and Coastal Management, 2010

Comisión Europea, Programa de demostración de la UE sobre la Gestión Integrada de las Zonas Costeras 1997-1999. Hacia una estrategia europea para la gestión integrada de las zonas costeras. Principios generales y opciones, Luxemburgo, Oficina de Publicaciones Oficiales de las Comunidades Europeas, 1999

Prada, A., Vázquez-Rodríguez, M.X., Soliño-Millán, M., Desarrollo sostenible en la costa gallega, CIEF, Centro de Investigación Económica y Financiera, Fundación Novacaixagalicia, 2012

Barragán Muñoz, J.M., Política, Gestión y Litoral: Una nueva visión de la Gestión Integrada de Áreas Litorales, Tébar Flores, 2014

Barragán Muñoz, J.M., Medio Ambiente y desarrollo en áreas litorales, Servicio de publicaciones de la U. Cádiz. , 2009

Gómez Orea, D., Evaluación ambiental estratégica, Mundiprensa, 2007

Prada, A., Vázquez-Rodríguez, M.X., Soliño-Millán, M., Desarrollo sostenible en la costa gallega,, CIEF, Centro de Investigación Económica y Financiera, Fundación Novacaixagalicia, 2012

Recommendations

Subjects that continue the syllabus

Final Year Dissertation/V10G060V01991

Subjects that are recommended to be taken simultaneously

Applied marine geology/V10G060V01909

Subjects that it is recommended to have taken before

Marine Ecology/V10G060V01401

Coastal and marine sedimentary habitats/V10G060V01402

Sedimentology/V10G060V01305

Economics and legislation/V10G060V01903

Geological oceanography I/V10G060V01504

Geological oceanography II/V10G060V01603

IDENTIFYING DATA				
Aquaculture				
Subject	Aquaculture			
Code	V10G060V01801			
Study programme	(*)Grao en Ciencias do Mar			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	4th	2nd
Teaching language	Spanish			
Department				
Coordinator	Rocha Valdes, Francisco Javier			
Lecturers	Rocha Valdes, Francisco Javier			
E-mail	frocha@uvigo.es			
Web				
General description	This course aims to provide to the students with the knowledge, skills and abilities that enable their to conceive, design and carry out research projects in the field of aquaculture. At the same time, this matter allows the student to design, manage and control aquaculture farming facilities on land and sea.			

Competencies		Typology
Code		
CB2	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	• know • Know How
CB3	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	• know • Know How
CE8	To understanding the fundamentals of the laws that regulate the use of the marine environment and its resources	• know
CE14	To recognize and analyze new problems and to propose problem-solving strategies	• know • Know How • Know be
CE16	To plan, design and implement applied research from the recognition stage to the final evaluation of results and discoveries	• know • Know How • Know be
CE23	To design, control and manage recovery centers for threatened marine species	• know • Know How • Know be
CE30	Identify and assess environmental impacts in the marine environment	• know • Know How • Know be
CE32	Quality control of seafood	• know • Know How
CE34	To design, control and manage aquaculture production plants	• know • Know How • Know be
CE36	aquariology	• know • Know How • Know be
CT2	Organization and planning skills	• know • Know How • Know be
CT15	Ability to apply knowledge in practice	• know • Know How • Know be

Learning outcomes	
Learning outcomes	Competences
Knowing the potentially cultivable marine species in the world	CB3 CE34 CE36 CT15
Know the aquaculture installations in land and sea	CE23 CE30 CE34 CE36

Dominate the aquaculture auxiliary techniques (phytoplankton and zooplancton) and the culture technics of the main species that are cultivate now in Europe	CB2 CE14 CE23 CE34 CE36 CT15
Know the treatments for the water in the culture systems	CE30 CE34 CE36
Recognise and analyse problems and propose solution strategies	CB2 CB3 CE14 CT2 CT15
Identify and control problems of environmental impact and marine pollution caused by marine aquaculture	CB2 CE14 CE30 CT2 CT15
Design, control and management of culture centres and recovery of marine endangered Species	CE16 CE23 CT2 CT15
Known the operational details of marine companies, recognise specific problems and propose solutions	CE8 CE14 CE16 CE30 CE34 CT2
Design, control and manage culture production plants	CB2 CE23 CE30 CE32 CE34 CE36 CT2 CT15
Aquariology	CB2 CE36 CT15

Contents

Topic	
INTRODUCTION	Aquaculture objectives. Current situation and prospects in the world and Spain. History. Types of aquaculture.
WATER QUALITY AND ITS CONTROL	Seawater as culture medium. Undergoes changes in water cultivation. Biological filtration. Mechanical filtration. Physical absorption. Disinfection. Decantation. Aeration. Water quality criteria for aquaculture.
FACILITIES	Water intake. Storage tanks and slop. Culture tank design. Designs for culture ponds. Floating rafts. Rafts. auxiliary Equipment
FOOD AND NUTRITION	Introduction. Food intake (larval, juvenile and adults). Nutritional requirements (molluscs, crustaceans, fish). types food used in aquaculture. Formulation of diets
SPECIES SELECTION CRITERIA	Introduction. Commercial criteria (consumption and market). Biological criteria (reproductive characteristics, production and health). Freshwater species cultured. Cultured marine species. species potentially cultivable
PHYTOPLANKTON CULTURE	Introduction. Optimum properties to the choice a culturable phytoplankton species. Physical requirements. Nutritional requirements. Culture media. Growth characteristics in culture. Culture phytoplankton methods
ZOOPLANKTON CULTURE	Introduction. Artemia culture: general characteristics, life cycle, culture methodology, employment in aquaculture. Rotifer culture: general characteristics, life cycle, culture methodology, employment in aquaculture. Other planktonic crustaceans used in aquaculture: copepods, cladocerans.

MOLLUSKS FARMING

Culture of *Ostrea edulis*: collection and transportation of broodstock, preparation and production of larvae, larval rearing, collection natural seeds, cultivation of post-larvae, pre-fattening, fattening. cultivation clams: gathering and transportation of players, conditioning and obtaining gametes, embryo culture, larval rearing, natural seed collection, growing post-larvae, pre-fattening, fattening.
Cultivation of *Pecten maximus*: obtaining and transporting broodstock, Conditioning and obtaining gametes, embryo culture, larval rearing, natural seed collection, growing post-larvae, pre-fattening, fattening.
Mussel farming: natural seed collection, fattening on rafts. Treatment plants.
Potential species: octopus culture: obtaining and transporting players and conditioning. Embryo culture, larval rearing, juvenile collection and fattening.

CRUSTACEAN FARMING

Shrimp farming: gathering and transportation of spawners, conditioning and obtaining gametes, embryo culture, larval rearing, cultivation of post-larvae, pre-fattening, fattening. Lobster culture: obtaining and transporting players, conditioning, cultivation embryonic, larval rearing, cultivation of post-larvae, pre-fattening, fattening. Caetarias

FLAT FISH FARMING

Turbot culture: obtaining and transporting reproductive individuals, conditioning and obtaining gametes, embryo culture, larval rearing, nursery, pre-fattening, fattening.
Cultivation of sole: obtaining and transporting reproductive individuals, conditioning and obtaining gametes, embryo culture, larval rearing, weaning pre-fattening, fattening.

GILTHEAD SEABREAM FARMING

Collection and transportation of spawners, conditioning and obtaining gametes, embryo culture, larval rearing, weaning pre-fattening, fattening

EUROPEAN SEABASS FARMING

Collection and transportation of reproductive individuals, conditioning and obtaining gametes, embryo culture, larval rearing, weaning pre-fattening, fattening.

SALMON FARMING

Collection and transportation of spawners, conditioning and obtaining gametes, embryo culture, larval rearing, weaning pre-fattening, fattening.

DISEASES OF CULTIVATED SPECIES

Mortality. Prevention, isolation, environmental manipulation and treatment. Examination of the animals. Viral diseases. Bacterial diseases. Fungal Infections. Protozoan diseases. Diseases caused by metazoans.

MACROALGAE FARMING

Introduction of seaweed farming, advantages and features. Cultivated species. Methodology.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	30	45	75
Seminars	7	14	21
Laboratory practical	15	15	30
Seminars	2	0	2
Studies excursion	7	0	7
Essay questions exam	3	7.5	10.5
Objective questions exam	1	1.5	2.5
Practices report	0	2	2

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

Methodologies

	Description
Lecturing	Program contents will be explained through classes. During the sessions the students will encourage the realization of comments and questions for clarification of questions during class. For the classes preparation by the students, notes on each of the topics will be available on the platform Tem@ before classes begin.
Seminars	Each group will prepare a seminar topic related to aquaculture, which will be presented and discussed in groups. Similarly, each group should prepare a brief abstract on the subject matter to be placed on the platform Tem@. This abstract will be distributed among all students and will be evaluated in the test.
Laboratory practical	They are an essential complement to the theoretical sessions. Laboratory practices will be used to explain the techniques of cultivation and laboratory culture. To take full advantage of these practices, the student will write a resume for each practice. Text will include all possible information about this activity, including the theoretical foundation, the purpose of practice and job description to be held.

Seminars	During the tutorials its will be discussed questions concerning any aspect of the subject. Moreover, as this matter is attended in the last year of the degree, this tutoring time may also be used by students to see career or incorporation into different graduate curricula related to aquaculture.
Studies excursion	It is planned to conduct two studio outputs, aimed at students to observe the practical application of knowledge taught in class. The outputs shall be performed: <ol style="list-style-type: none"> 1. Visit the farmed salmon in Cotobade (Pontevedra). 2. Site visit of the Galician Institute for Aquaculture Training of the Galician Government in the Island of Arousa.

Personalized assistance

Methodologies	Description
Seminars	These activities will be developed in small groups. Students can obtain help and guidance to guide them in the seminar preparation and learning process. These activities will be developed in person (by direct consultations in the classroom or during tutorials and consultation sessions in the teacher's office) or via email.
Seminars	These activities will be developed individually or in small groups. Its purpose will be to meet the needs and queries of students related to the study, topics related to the subject and correction of exams, providing guidance, support and motivation in the learning process. These activities will be developed in person or via email. The tutorials, both individual and group, will be held from Monday to Thursday from 11:30 to 12:30 a.m. Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation
Tests	Description
Essay questions exam	For the preparation of the tests, students may consult questions or clarify aspects of the subject that are evaluated in the exam. The assistance will be developed in person (by direct consultations in the classroom or during tutorials and consultation sessions by the teacher in his office) or via email. Similarly, once the test has been completed, the students will have a consultation schedule and review of exams to solve doubts and make inquiries about the exam itself.
Objective questions exam	The tests will be developed weekly with the objective that the students prepare each week the subject that will be discussed during the sessions. For the preparation of the tests, students may consult questions or clarify aspects of the subject that will be evaluated in the exam. The assistance will be developed in person (by direct consultations in the classroom or during tutorials and consultation sessions by the teacher in his office) or via email.

Assessment

	Description	Qualification	Evaluated Competences
Seminars	Following the completion of the seminars, each student group must submit a summary report of the subject matter, which will be evaluated. A minimum of 5 will required to approve.	10	CE30 CE34 CE36
Laboratory practical	Laboratory practics are considered an essential part of the subject. Practics will be evaluatted by the attendance and assistance of students to them.	5	CB2 CE14 CT2 CT15
Essay questions exam	There will be a long written test on the official date will be assessed on the knowledge gained throughout the course. This test will assess all the knowledge acquired in the course of the subject. The minimum grade to pass the exam will be 5	40	CB2 CB3 CE14 CE23 CE30 CE34 CE36
Objective questions exam	There will be several quizzes, multiple choice, during the course of lectures. Since the objective of these tests is that students prepare in advance the subjects to be discussed, questions of each test will cover the topics that are being treated that week (including topics to be covered in that class or the next if they are part of issue). The minimum grade to pass the test will be 5.	15	CE30 CE36

Practices report	For the evaluation of practices each student must prepare a written report on the implementation and results of laboratory practices, which will be evaluated. The minimum grade to approve the report will be 5.	30	CE14 CE30 CT2
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Other comments on the Evaluation

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

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

The official calendar of the evaluation will be published in:

<http://mar.uvigo.es/index.php/en/alumnado-actual-2/examenes-3>

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

Sources of information

Basic Bibliography

Barnabe, G., Bases biológicas y ecológicas de la acuicultura, 1996, Zaragoza: Acribia

Abalde, J. et al., Microalgas: cultivo y aplicaciones, 1995, A Coruña: Servizo de Publicacións da Universidade

Fingerman, M. y R. Nagabhushanam, Aquaculture, 2000, Enfield: Science Publisher

FAO, Fichas de la FAO sobre acuicultura, 2012, Página de la FAO

Stickney, R., Acuicultura. Texto introductorio, 2016, ACRIBIA S.A., 2016, Zaragoza, España

Complementary Bibliography

Costa-Pierce, B. A., Ecological Aquaculture: the Evolution of the Blue Revolution, 2003, Oxford: Malden

Xunta de Galicia - VV.AA., Unidades didácticas de acuicultura, 1991, A Coruña: Dirección Xeral de Formación Pesqueira e

Beveridge, M, Cage Aquaculture, 2004, Oxford: Fishing News Books

Fernández Souto, B. y X.L. Rodríguez Villanueva, Guía da piscicultura europea, 2002, Santiago: Consellaría de Pesca e Asuntos Marítimos

Huguenin, J. E. y J. Colt, Design and Operating Guide for Aquaculture Seawater Systems, 2002, Amsterdam/New York: Elsevier

Lee, D. O. y J. F. Wickings, Cultivo de crustáceos, 1996, Zaragoza: Acribia

Southgate, P. et al., Aquaculture: farming aquatic animals and plants, 2012, Oxford: Fishing News Books

Stead, S. M. y L. Laird, Handbook of Salmon farming, 2001, New York: Springer

Wedmeyer, G. A., Physiology of fish in intensive culture systems, 1996, New York: Chapman

Wedemeyer, G. A., Fish Hatchery Management, 2001, Bethesda (Maryland): American Fisheries Society

Recommendations

Subjects that are recommended to be taken simultaneously

Marine Ecology/V10G060V01401

Marine and coastal management/V10G060V01704

Subjects that it is recommended to have taken before

(*)/

Marine Ecology/V10G060V01401

Marine zoology/V10G060V01405

Fish and shellfish biology/V10G060V01902

Marine and coastal management/V10G060V01704

IDENTIFYING DATA**Basin Analysis**

Subject	Basin Analysis			
Code	V10G060V01901			
Study programme	(*)Grao en Ciencias do Mar			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Optional	3rd	2nd
Teaching language	Spanish			
Department				
Coordinator	García Gil, María Soledad			
Lecturers	Diz Ferreiro, Paula Francés Pedraz, Guillermo García Gil, María Soledad Pérez Arlucea, Marta María			
E-mail	sgil@uvigo.es			
Web	http://http://webs.uvigo.es/c10/webc10/			
General description	This matter allows the introduction to the analysis of sedimentary basins and of the interpretation of the history of his filling using technical multidisciplinary.			

Competencies

Code		Typology
CB3	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	• Know How
CB4	Students can communicate information, ideas, problems and solutions to both specialist and non-specialist audiences	• Know How
CB5	Students have developed those learning skills that are necessary for them to continue to undertake further study with a high degree of autonomy	• know
CE1	To know the vocabulary, codes and concepts inherent to the oceanographic scientific field	• know
CE2	To know and understand the essential facts, concepts, principles and theories related to oceanography	• know
CE5	Basic knowledge of research methodology in oceanography	• know
CE13	To acquire, evaluate, process and interpret oceanographic data within the theories currently in use	• Know How
CE14	To recognize and analyze new problems and to propose problem-solving strategies	• Know How
CE16	To plan, design and implement applied research from the recognition stage to the final evaluation of results and discoveries	• Know How
CE18	To transmit writing, verbal and graphical information for audiences of various types	• Know How
CE19	To map and characterize the seabed and the underground in marine and coastal areas	• Know How
CT1	Analysis and synthesis ability	• know
CT6	Problem management and solving skills	• Know How
CT15	Ability to apply knowledge in practice	• Know How

Learning outcomes

Learning outcomes	Competences
Take oceanographic data-geological, evaluate them, process them and interpret them in regard to the theories of Sequential Analysis.	CB5 CE13 CT6
Recognise and analyse new problems in the analysis of basins and propose new interpretations	CE14 CT6
Schedule, design and execute investigations applied of the analysis of basins from the stage of recognition until the evaluation of results-geological resources.	CE16 CT1 CT6 CT15
Transmit information of form written, verbal and graphic for audiences of diverse types	CB4 CE18 CT1
Characterice and mapping of marine bottoms, marine sub-bottoms and coastal areas-continental	CE19 CT6 CT15

Contents

Topic	
SUBJECT 1. INTRODUCTION TO THE ANALYSIS OF BASINS	1.1. Definitions. Sedimentary basins. Classification 1.2. Origin and evolution of the oceanic basins 1.3. Interest and applications of the analysis of basins
SUBJECT 2. EXTERNAL AND INTERNAL FACTORS CONTROLLING THE EVOLUTION OF THE SEDIMENTARY BASINS	2.1. Tectonics, Climate, Supply and Sea-level changes 2.2. Sequential stratigraphy: Types of sections, 3D architecture of facies and correlation criteria
SUBJECT 3. DATING METHODS	3.1. Introduction to dating methods. 3.2. Methods of dating in the Quaternary
SUBJECT 4. SEISMIC STRATIGRAPHY	4.1. Sedimentary discontinuity surfaces: Criteria of recognition 4.2. System tracks in the cycle of sea-level oscillation 4.3. Sequences and models of sequences.
SUBJECT 5. PALEOCEANOGRAPHY AND PALAEOCLIMATOLOGY	5.1. Palaeoceanography and palaeoclimatology proxies 5.2. Natural mechanisms of climatic and oceanographic changes

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	18	27	45
Case studies	15	30	45
Seminars	14	14	28
Practices report	5	25	30
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	Presentations of the theoretical concepts that allow the students to acquire or improve the skills to perform the analysis of sedimentary basins. This involves the relationship of multidisciplinary theoretical concepts. The classes will be of 1h.
Case studies	Each student will have several real seismic profiles corresponding to a sedimentary basin. They will have to perform the interpretation of each one and to elaborate an individual memory explaining the evolution of the basin. 4 practices of 5h
Seminars	The contents of the master sessions will be practiced with different exercises (recognition of sedimentary basins types in different marine contexts, stratigraphic surfaces, system tracks, signals that allow to identify sea-level variations, identification of the presence of gas/oil, dating of sediments and geological and paleoceanographic events. Paleoclimatological reconstruction of basins. They will be 7 theoretical seminars-practical of 2h each one

Personalized assistance

Methodologies	Description
Lecturing	Students that wish it will be able to attend to personalized tutorials to resolve doubts, mainly in the indicated schedules. To optimize time, it is necessary that the student to contact with the lecturer previously. The tutorials will be able to be individual or in group in accordance with the schedules of the lecturer: Prof. Soledad García Gil (Tuesday and Thursday: 11 - 14 h) that would be modified according to educational needs.
Seminars	Students that wish it will be able to attend to personalized tutorials to resolve doubts, mainly in the indicated schedules. To optimize time, it is necessary that the student to contact with the lecturer previously. The tutorials will be able to be individual or in group in accordance with the schedules of the lecturer: Prof. Soledad García Gil (Tuesday and Thursday: 11 - 14 h) that would be modified according to educational needs.

Case studies Students that wish it will be able to attend to personalized tutorials to resolve doubts, mainly in the indicated schedules. To optimize time, it is necessary that the student to contact with the lecturer previously. The tutorials will be able to be individual or in group in accordance with the schedules of the lecturer: Prof. Soledad García Gil (Tuesday and Thursday: 11 - 14 h) that would be modified according to educational needs.

Tests	Description
Practices report	Students that wish it will be able to attend to personalized tutorials to resolve doubts, mainly in the indicated schedules. To optimize time, it is necessary that the student to contact with the lecturer previously. The tutorials will be able to be individual or in group in accordance with the schedules of the lecturer: Prof. Soledad García Gil (Tuesday and Thursday: 11 - 14 h) that would be modified according to educational needs.

Assessment			
	Description	Qualification	Evaluated Competences
Seminars	Reports of Seminars	30	CE5 CE13 CE14 CE18 CE19 CT1 CT6 CT15
Case studies	Sequential seismic analysis of a sedimentary basin from the interpretation of seismic records and profiles.	30	CE13 CE14 CE16 CE18 CE19 CT1 CT6 CT15
Practices report	Report/memory of work on the study of a real sedimentary basin.	10	CE13 CE14 CE16 CE18 CE19 CT1 CT6 CT15
Objective questions exam	Exam with short answer questions on theory and practical topics.	30	CB3 CB4 CE13 CE14 CE16 CE18 CE19 CT1 CT15

Other comments on the Evaluation

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

□Students are strongly requested to fulfil a honest and responsible behaviour. It is considered completely unacceptable any alteration or fraud (i.e., copy or plagiarism) contributing to modify the level of knowledge and abilities acquired in exams, evaluations, reports or any kind of teacher's proposed work. Fraudulent behaviour may cause failing the course for a whole

academic year. An internal dossier of these activities will be built and, when reoffending, the university rectorate will be asked to open a disciplinary record□

Sources of information

Basic Bibliography

Rogers, J.W. y Santosh, M., Continents and supercontinents, 1, Oxford University Press, 2004, UK

Allen, P.A. y Allen, J.R., Basin Analysis: Principles and Application to Petroleum Play Assessment, 3rd, Wiley-Blackwell, 2013, UK

Walker, M., Quaternary dating methods, 1, Wiley-Blackwell, 2005, UK

Shanmugam, G., Deep-Water Processes and Facies Models: Implications for sandstone petroleum reservoirs, 1, Elsevier, 2006, Amsterdam

Nichols, G., Williams, G. y Paola, Ch., Sedimentary Processes, Environments and Basins: a Tribute to Peter Friend, 1, Wiley, 2008, UK

Treitel, S. y Helbig, K., Handbook of Geophysical Exploration: Seismic Exploration, 1, Elsevier, 2011, Amsterdam

Huneke, H. y Mulder, T., Deep-Sea Sediments, 1, Elsevier, 2010, Amsterdam

Schlager, W., Carbonate sedimentology and Sequence Stratigraphy, 1, SEPM Society for Sedimentary Geology, 2005, USA

Catuneanu, O., Principles of Sequence Stratigraphy, 1, Elsevier, 2006, Amsterdam

Complementary Bibliography

Leeder, M.R. y Pérez-Arlucea, M., Physical processes in Earth and environmental sciences, 1, Wiley, 2006, UK

Burbank, D.W. y Anderson, R.S., Tectonic Geomorphology, 1, Wiley, 2001, UK

Recommendations

Subjects that continue the syllabus

Applied marine geology/V10G060V01909

Final Year Dissertation/V10G060V01991

Subjects that are recommended to be taken simultaneously

Geological oceanography II/V10G060V01603

Subjects that it is recommended to have taken before

Coastal and marine sedimentary habitats/V10G060V01402

Sedimentology/V10G060V01305

Geological oceanography I/V10G060V01504

IDENTIFYING DATA**Biología de peixes e mariscos**

Subject	Biología de peixes e mariscos			
Code	V10G060V01902			
Study programme	Grao en Ciencias do Mar			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Optional	3	2c
Teaching language	Castelán			
Department	Ecoloxía e bioloxía animal			
Coordinator	Domínguez Martín, José Jorge			
Lecturers	Domínguez Martín, José Jorge Fernández Marchan, Daniel Noguera Amoros, Jose Carlos			
E-mail	jdguez@uvigo.es			
Web				
General description	Trátase dunha Zooloxía especial na que se estudia a bioloxía das especies pesqueiras e marisqueiras mais importantes de Galicia.			

Competencias

Code		Typology
CB1	Que os estudantes demostren posuír e comprender coñecementos nunha área de estudo que parte da base da educación secundaria xeral e adoita atoparse a un nivel que, malia se apoiar en libros de texto avanzados, inclúe tamén algúns aspectos que implican coñecementos procedentes da vangarda do seu campo de estudo.	• saber • saber facer
CB2	Que os estudantes saiban aplicar os seus coñecementos ó seu traballo ou vocación dunha forma profesional e posúan as competencias que adoitan demostrarse por medio da elaboración e defensa de argumentos e a resolución de problemas dentro da súa área de estudo.	• saber • saber facer • Saber estar / ser
CB3	Que os estudantes teñan a capacidade de reunir e interpretar datos relevantes (normalmente dentro da súa área de estudo) para emitir xuízos que inclúan unha reflexión sobre temas relevantes de índole social, científica ou ética.	• saber • saber facer • Saber estar / ser
CB4	Que os estudantes poidan transmitir información, ideas, problemas e solución a un público tanto especializado coma non especializado.	• saber • saber facer • Saber estar / ser
CB5	Que os estudantes desenvolvan aquelas habilidades de aprendizaxe necesarias para emprender estudos posteriores cun alto grao de autonomía.	• saber • saber facer • Saber estar / ser
CE4	Coñecer as técnicas básicas de mostraxe na columna de auga, organismos, sedimentos e fondos, así como de medida de variables dinámicas e estruturais	• saber • saber facer
CE8	Comprender os principios das leis que regulan a utilización do medio mariño e os seus recursos	• saber • saber facer
CE10	Coñecer a problemática e os principios básicos da sustentabilidade en relación coa utilización e explotación do medio mariño	• saber • saber facer
CE11	Planificar usos do litoral e do medio mariño e xestión sustentable dos recursos	• saber • saber facer
CE13	Tomar datos oceanográficos, avalialos, procesalos e interpretalos con relación ás teorías en uso	• saber • saber facer
CE17	Saber traballar en campañas e en laboratorio de xeito responsable e seguro, fomentando as tarefas en equipo	• saber • saber facer
CE18	Transmitir información de forma escrita, verbal e gráfica para audiencias de diversos tipos	• saber • saber facer • Saber estar / ser
CE19	Caracterizar, clarificar e cartografar fondos mariños, subsolos mariños e áreas litorais	• saber • saber facer
CE20	Buscar e avaliar recursos de orixe mariña, de diversas clases	• saber • saber facer • Saber estar / ser
CT1	Capacidade de análise e síntese	• saber • saber facer
CT3	Comunicación oral e escrita nas linguas oficiais da Universidade	• saber • saber facer • Saber estar / ser

CT6 Resolución de problemas

- saber
- saber facer
- Saber estar / ser

CT8 Capacidade de traballar nun equipo

Resultados de aprendizaxe

Learning outcomes	Competences
Capacidade de aplicar os coñecementos na práctica	CB1 CB2 CB3 CB4 CB5 CE4 CE8 CE10 CE11 CE13 CE17 CE18 CE19 CE20 CT1 CT3 CT6
Coñecer as técnicas básicas de mostraxe na columna de auga, organismos, sedimentos e fondos, así como de medida de variables dinámicas e estruturais	CB1 CB2 CB3 CB4 CB5 CE4 CE8 CE10 CE11 CE13 CE17 CE18 CE19 CE20 CT1 CT3 CT6
Habilidades de investigación	CB1 CB2 CB3 CB4 CB5 CE4 CE8 CE10 CE11 CE13 CE17 CE18 CE19 CE20 CT1 CT3 CT6

Identificación de peixes e mariscos.	CB1
Coñecemento da morfoloxía externa e interna de peixes e mariscos.	CB2
Coñecemento da distribución, hábitat e xeitos de vida de peixes e mariscos.	CB3
Coñecemento da reprodución e dos ciclos vitais de peixes e mariscos.	CB4
Xestión de recursos pesqueiros e marisqueiros.	CB5
Bases biolóxicas necesarias para o estudo de Pesquerías e Acuicultura.	CE8
	CE18
	CE20
	CT1
	CT3
	CT6
	CT8

Contidos	
Topic	
INTRODUCCION	Historia da Explotación das especies marinas Especies marisqueiras Especies pesqueiras Estratexias vitais
MOLUSCOS Introducción	Características xerais dos moluscos Clasificación
Bivalvos	Morfoloxía externa: concha, manto e pé. Hábitos e xeitosde vida: excavadores de fondos blandos, habitantes fixos de superficie, habitantes libres de superficie. Alimentación e respiración. Dixestión, circulación, repiración, excreción. Sistema nervioso e órganos dos sentidos. Reprodución. Desarrollo embrionario e larvario. Crecemento Clasificación
Especies explotables de Bivalvos	Mytilus galloprovincialis (mexilón) Cardium edule (berberecho) Tapes decussatus (ameixa fina) Venerupis pullastra (ameixa babosa) Ostrea edulis (ostra plana) Pecten maximus (vieira) Chlamys opercularis (volandeira) Chlamys varia (zamburiña)
Cefalópodos	Distribución e hábitat Morfoloxía externa Hábitos e modos de vida. Locomoción e flotabilidade. Migraciones. Color e bioluminiscencia. Depredadores Alimentación Dixestión, circulación e intercambio de gases e excreción Sistema nervioso e órganos dos sentidos Reprodución Desarrollo embrionario e larvario. Crecemento Explotación Clasificación Principales especies explotables. Clasificación. Morfoloxía. Bioloxía. Reprodución, desarrollo embrionario e crecemento.
Especies explotables de Cefalópodos	Sepia officinalis Loligo vulgaris Illex coindetti Octopus vulgaris
CRUSTACEOS Introducción	Características xerais Clasificación. Decápodos Distribución e hábitat. Morfoloxía externa. Clasificación Hábitos e xeitosde vida Locomoción Alimentación Sistema nervioso e órganos dos sentidos Excreción Reprodución e Desarrollo embrionario e larvario. Crecemento Principales especies explotables. Modos e ciclos de vida.

Especies pesqueiras de Crustáceos	Palaemon serratus Palinurus elephas Homarus gammarus Necora puber Maja squinado Nephros norvegicus Pollicipes pollicipes
PEIXES Introducción	Características xerais. Sinopse sistemática e taxonómica
Especies peláxicas costeiras	Características xerais Distribución e Hábitat Alimentación Ciclo biolóxico Reproducción: áreas de posta, larvas e mortalidade larvaria, fecundidade absoluta Sardiña Bocarte Arenque Xarda Xurelo
Peixes demersales	Merluza Bacallao Bacaladiña Peixe sapo Peixes planos Outros

Planificación docente

	Class hours	Hours outside the classroom	Total hours
Prácticas de laboratorio	20	40	60
Seminario	6	18	24
Lección maxistral	20	40	60
Resolución de problemas e/ou exercicios	1	1	2
Exame de preguntas obxectivas	1	1	2
Exame de preguntas de desenvolvemento	1	1	2

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

Metodoloxía docente

	Description
Prácticas de laboratorio	As prácticas organizanse seguindo o seguinte esquema: ao comenzo de cada práctica explicanse brevemente os conceptos teóricos necesarios para a comprensión dos exemplares que se van a observar, e se suministra ao alumno un guión no que se recordan ditos conceptos, explicanse as técnicas a seguir e os obxetivos que se desexan acadar.
Seminario	Os alumnos deberán realizar un traballo independente tutelado que expondrán a os seus compañeiros na aula. O traballo realizarase acompañado polo profesor en tres tutorías; na primeira propoñeráse o tema e se orientará aos alumnos para buscar información sobre o tema, na segunda tutoría discutiránse os contidos atopados polos alumnos e se aclararán as dúbidas, e na terceira orientarase o traballo de exposición. Nas tutorías evaluarase o traballo independente dos alumnos. Os temas para a realización do traballo serán variados, admitiéndose temas suxeridos polos alumnos.
Lección maxistral	O profesor fará a presentación dos diferentes temas do programa utilizando diferentes formatos segundo o tema a estudar, formatos que serán: teoría, casos prácticos e/ou exemplos particulares. O profesor pode contar con apoio de medios audiovisuais e informáticos pero, en xeral, os estudantes non precisan manexalos na clase. A asistencia a estas clases aínda que non é obligatoria é altamente recomendable para un bo aproveitamento da materia.

Atención personalizada

Methodologies	Description
Lección maxistral	Durante a mesma se establecen discusións sobre algúns dos tópicos máis relevantes. Tutorías: Luns e Mércores de 12 a 2. O alumno que o desexe poderá acudir a tutorías personalizadas para resolver dúbidas, principalmente nos horarios que se indican. Para optimizar o tempo, é necesario que o alumno contacte co profesor con antelación suficiente.

Prácticas de laboratorio	Ao comenzo de cada práctica explicanse brevemente os conceptos teóricos necesarios para a comprensión dos exemplares que van ser observados. Se resolven todas as cuestións que sexan plantexadas durante a realización das prácticas. O alumno que o desexe poderá acudir a titorías personalizadas para resolver dúbidas, principalmente nos horarios que se indican. Para optimizar o tempo, é necesario que o alumno contacte co profesor con antelación suficiente.
Seminario	Se discuten e elixen os traballos e os grupos de traballo. Se fai un seguimento dos mesmos. Se fai unha revisión crítica e unha discusión xeral de cada traballo. O alumno que o desexe poderá acudir a titorías personalizadas para resolver dúbidas, principalmente nos horarios que se indican. Para optimizar o tempo, é necesario que o alumno contacte co profesor con antelación suficiente.
Tests	Description
Resolución de problemas e/ou exercicios	Realización de examen de preguntas tipo test
Exame de preguntas obxectivas	Realización de exame de preguntas curtas que inclúen tanto datos relevantes e obxectivos da materia como preguntas de elaboración argumental e manexo combinado de distintos datos.
Exame de preguntas de desenvolvemento	Realización de exame de preguntas longas relativas a ciclos de vida das especies estudadas no curso, incluíndo información xeral e á vez detallada daqueles aspectos máis relevantes. Valórase especialmente o desenvolvemento elaborado de argumentos e a capacidade de síntesis e explicación clara dos desenvolvementos.

Avaliación			
	Description	Qualification	Evaluated Competences
Lección maxistral	Examen	75	CB1 CB2 CB3 CB4 CB5 CE4 CE8 CE18 CE20 CT1 CT3 CT6 CT8
Prácticas de laboratorio	Examen	15	CB1 CB2 CB3 CB4 CB5 CE4 CE8 CE18 CE20 CT1 CT3 CT6 CT8

Seminario	Traballo redactado ou expositivo	10	CB1 CB2 CB3 CB4 CB5 CE4 CE8 CE18 CE20 CT1 CT3 CT6 CT8
Resolución de problemas e/ou exercicios	Exame tipo test	40	CB1 CE4 CT1
Exame de preguntas obxectivas	Preguntas cortas	30	CB1 CB2 CB3 CB4 CE4 CE18 CT1 CT3 CT6
Exame de preguntas de desenvolvemento	Temas a desenvolver	30	CB1 CB2 CB3 CB4 CE4 CE18 CT1 CT3

Other comments on the Evaluation

A data, hora e lugar de realización das probas de avaliación, serán publicadas na web oficial da Facultade de Ciencias do Mar: <http://mar.uvigo.es/index.php/gl/alumnado-actual/examenes-2>

Requírese do alumnado que curse esta materia unha conduta responsable e honesta. Considérase inadmisíbel calquera forma de fraude (copia ou plaxio) encamiñado a falsear o nivel de coñecementos e destrezas alcanzado en todo tipo de proba, informe ou traballo. As condutas fraudulentas poderán supoñer suspender a asignatura durante un curso completo. Levarase un rexistro interno de esas actuacións para que, no caso de reincidencia, solicitar ao rectorado a apertura dun expediente disciplinario.

Bibliografía. Fontes de información

Basic Bibliography

C.P.J. Hickman, Principios integrales de Zoología, 14, McGraw-Hill, 2009,

Complementary Bibliography

Recomendacións

Subjects that continue the syllabus

Acuicultura/V10G060V01801

Subjects that it is recommended to have taken before

Zoología marítima/V10G060V01405

IDENTIFYING DATA				
Economía e lexislación				
Subject	Economía e lexislación			
Code	V10G060V01903			
Study programme	Grao en Ciencias do Mar			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Optional	3	2c
Teaching language	Castelán			
Department	Economía aplicada			
Coordinator	Amigo Dobaño, Josefina Lucy			
Lecturers	Amigo Dobaño, Josefina Lucy			
E-mail	lamigo@uvigo.es			
Web				
General description	Achegamento ás principais variables que permiten realizar análises básicas de situación e evolución da economía.			

Competencias	
Code	Typology
CE3 Comprensión crítica da historia e do estado actual das Ciencias do Mar	• saber facer
CE7 Coñecer as técnicas básicas da economía de mercado aplicada aos recursos mariños	• saber • saber facer
CE8 Comprender os principios das leis que regulan a utilización do medio mariño e os seus recursos	• saber • saber facer • Saber estar / ser
CE9 Coñecer as Institucións e Organismos públicos e privados, nacionais e internacionais relacionados coas Ciencias do Mar	• saber
CE10 Coñecer a problemática e os principios básicos da sustentabilidade en relación coa utilización e explotación do medio mariño	• Saber estar / ser
CT1 Capacidade de análise e síntese	• saber • saber facer • Saber estar / ser
CT8 Capacidade de traballar nun equipo	• saber facer

Resultados de aprendizaxe	
Learning outcomes	Competences
Comprender a manexar conceptos económicos necesarios para a xestión dos recursos naturais	CE3 CE7 CE8 CE9 CE10 CT1 CT8
Capacidade para identificar problemas relacionados cos recursos mariños, a súa consideración desde a perspectiva económica e interpretación dos posibles resultados necesarios para a xestión dos mesmos.	CE3 CE7 CE8 CE9 CE10 CT1 CT8
Capacidade para desenvolver traballos ou informes breves no campo dos recursos mariños	CE3 CE7 CT1 CT8

Contidos	
Topic	
I. INTRODUCCION. ASPECTOS BÁSICOS	1. A Economía española. 2. A economía española no contexto europeo ou mundial 3. Renda e Distribución

II. As ACTIVIDADES PRODUTIVAS	4. Actividades Primarias. 5. Sector enerxético. 6. Industria. 7. Sector Servizos
III. ANÁLISE DO MEDIO MARIÑO. A PESCA	8.-Aspectos Institucionais e marco xurídico 9- Análise do Mercado

Planificación docente

	Class hours	Hours outside the classroom	Total hours
Seminario	14	33	47
Prácticas en aulas informáticas	15	37	52
Lección maxistral	23	28	51

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

Metodoloxía docente

	Description
Seminario	Nos seminarios, realizaranse fundamentalmente tarefas de elaboración e exposición de traballos sobre aspectos relacionados co temario.
Prácticas en aulas informáticas	Formulación e resolución de problemas e/ou exercicios relacionados coa materia. O alumno debe desenvolver as solucións.
Lección maxistral	Exposición por parte do profesor dos contidos da materia. Realización de exames parciais.

Atención personalizada

Methodologies	Description
Lección maxistral	O alumno que o desexe poderá acudir a titorías personalizadas para resolver dúbidas, principalmente nos horarios que se indican. Para optimizar o tempo, é necesario que o alumno contacte co profesor con antelación suficiente
Seminario	Realizaranse tutorías en grupo sobre a evolución no proceso de aprendizaxe da materia.

Avaliación

	Description	Qualification	Evaluated	Competences
Lección maxistral	-Comprender a manexar conceptos económicos necesarios para a xestión dos recursos mariños. -Capacidade para identificar problemas relaciones cos recursos mariños, tratamentos económico e interpretación de resultados.	50		CE3 CE7 CE8 CE9 CE10
Seminario	Talleres de traballo. Poderase utilizar os seminarios para exposicións e realización de probas parciais. Resultados de aprendizaxe: -Comprender a manexar conceptos económicos necesarios para a xestión dos recursos mariños. -Capacidade para identificar problemas relaciones cos recursos mariños, tratamentos económico e interpretación de resultados.- Comprender a manexar conceptos económicos necesarios para a xestión dos recursos mariños. -Capacidade para identificar problemas relaciones cos recursos mariños, tratamentos económico e interpretación de resultados.	35		CE3 CE7 CE8 CE9 CE10 CT1 CT8
Prácticas en aulas informáticas	Estudo de casos. Análise empírica. Posibilidade de realizar e presentar traballos. Resultados de aprendizaxe: -Comprender a manexar conceptos económicos necesarios para a xestión dos recursos mariños. -Capacidade para identificar problemas relaciones cos recursos mariños, tratamentos económico e interpretación de resultados.	15		CE3 CE7 CE8 CE9 CE10 CT1 CT8

Other comments on the Evaluation

COMPROMISO ÉTICO

Requírese do alumnado que curse esta materia unha conduta responsable e honesta. Considérase inadmisíbel calquera

forma de fraude (copia ou plaxio) encamiñado a falsear o nivel de coñecementos e destrezas alcanzado en todo tipo de proba, informe ou traballo. As condutas fraudulentas poderán supoñer suspender a materia durante un curso completo. levará un rexistro interno destas actuacións para que, en caso de reincidencia, solicitar a apertura ao reitorado dun expediente disciplinario.

Bibliografía. Fontes de información

Basic Bibliography

Complementary Bibliography

GARCÍA DELGADO, J.L.; MYRO, R:(Dir), Lecciones de Economía Española, duodécima, 2015,

GARCÍA DELGADO, J.KL; MYRO, R., Economía Española. Una Introducción, 2012, Civitas-Thomson

GARCÍA DE LA CRUZ, J.M.; RUESGA BENITO, S. (coord.), Economía española. Estructura y regulación, 2014, Paraninfo

GARZA, M.D., Coord., La actividad pesquera a escala mundial, 2008, Ed. Netbiblo. A Coruña

VARELA, M., COORD., Unha estratexia marítima para Galicia, 2010, Editorial Galaxia. Vigo.

GONZÁLEZ LAXE, F., Lecciones de Economía Pesquera, 2008, Ed. Netbiblo. A Coruña.

J. Surís y M. Varela, Introducción a la Economía de los Recursos Naturales, Cívitas, 1995, 1995

INSTITUTO NACIONAL DE ESTADÍSTICA Anuario estadístico de España, España en cifras, otras publicacion, www.ine.es, 2016,

EUROSTAT Anuarios e Informes, <http://epp.eurostat.ec.europa.eu>, 2016,

FAO Informes anuales agricultura, pesca, alimentación, www.fao.org, 2016,

Recomendacións

IDENTIFYING DATA**Geographic analysis methods**

Subject	Geographic analysis methods			
Code	V10G060V01904			
Study programme	(*)Grao en Ciencias do Mar			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Optional	3rd	2nd
Teaching language	Spanish			
Department				
Coordinator	Torres Palenzuela, Jesús Manuel Méndez Martínez, Gonzalo Benito			
Lecturers	González Villanueva, Rita Méndez Martínez, Gonzalo Benito Torres Palenzuela, Jesús Manuel			
E-mail	mendez@uvigo.es jesu@uvigo.es			
Web	http://mendez.webs.uvigo.es/			
General description	Principles of territorial analysis and their cartographic representation.			

Competencies

Code		Typology
CB1	Students have demonstrated knowledge and understanding in a field of study that builds upon their general secondary education, and is typically at a level that, whilst supported by advanced textbooks, includes some aspects that will be informed by knowledge of the forefront of their field of study	• Know How
CB2	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	• Know How
CB3	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	• Know How
CE1	To know the vocabulary, codes and concepts inherent to the oceanographic scientific field	• know
CE3	Critical understanding of the history and current status of the Marine Sciences	• know
CE5	Basic knowledge of research methodology in oceanography	• Know How
CE6	Ability to identify and understand the problems in the field of oceanography	• Know How
CE9	To be familiar with the public and private, national and international organizations and institutions related to the Marine Sciences	• know
CE11	To manage the use of littoral and coastal region and their resources in a sustainable way	• Know How
CE12	To be able to operate the instrumental techniques applied to sea	• Know How
CE13	To acquire, evaluate, process and interpret oceanographic data within the theories currently in use	• Know How
CE15	To recognize and implement good scientific practice in measurement and experimentation, both in the field and in the laboratory	• Know How
CE18	To transmit writing, verbal and graphical information for audiences of various types	• Know How
CE19	To map and characterize the seabed and the underground in marine and coastal areas	• Know How
CE26	To plan, direct and write technical reports on marine issues	• Know How
CE37	Technical advice or assistance on issues related to the marine and coastal environment	• Know How
CT1	Analysis and synthesis ability	• Know How
CT5	Information technology skills (search and data analysis)	• Know How

Learning outcomes

Learning outcomes	Competences
Projection Systems and Reference Systems	CB1 CE12 CE13 CE15 CE18 CE37 CT5

Digital Terrain Models	CB2 CB3 CE1 CE5 CE6 CE11 CE12 CE13 CE19 CT5
Improvement, corrections and transformation of images	CB3 CE1 CE5 CE6 CE12 CE13 CE15 CE18 CT5
Interpolation of data (Creation of surfaces from point data)	CB1 CB3 CE1 CE5 CE6 CE12 CE13 CE15 CT5
3D visualization and navigation.	CB1 CB3 CE1 CE3 CE5 CE12 CE13 CE15 CT5
GIS Applications	CB1 CB2 CB3 CE1 CE3 CE5 CE6 CE9 CE11 CE12 CE18 CE19 CE26 CE37 CT1 CT5

Contents

Topic	
1. Introduction to cartography and geographic information systems	(* Non hai subtemas
2. The scale	There are not subtopics
3. Reference systems and projection systems	There are not subtopics
4. Geographic information systems software	There are not subtopics
5. Data acquisition and processing: locations and attributes	There are not subtopics
6. Sources of geographic and cartographic information.	There are not subtopics
7. Digital terrain models	There are not subtopics
8. Digital analysis and processing of geographic information	There are not subtopics

9. 3D visualization.	There are not subtopics
10. Applications of geographic information systems. Thematic maps.	There are not subtopics

Planning			
	Class hours	Hours outside the classroom	Total hours
Computer practices	20	30	50
Seminars	7	14	21
Lecturing	25	50	75
Problem and/or exercise solving	1.5	0	1.5
Laboratory practice	2.5	0	2.5

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

Methodologies	
	Description
Computer practices	The methodology is the directed study.
Seminars	Personalized attention and referring to the techniques and contents and its application in the works and practices
Lecturing	The lecture is the method mainly employed, using the dialogue as much as possible

Personalized assistance	
Methodologies	Description
Lecturing	The assessment of the knowledge will be carried out continuously during the course period. This implies, the compulsory accomplishment of a series of exercises by the student, in order to observe his/her progress. The control of all the activities carried out during the teaching period, especially the practical classes, and the verification of the results of the compulsory exercises, will be used by the teacher as elements to judge if the student has achieved the initial objectives of training in the contents of a discipline. Tutorials by Professor Jesus Torres: from Monday to Wednesday from 16h to 17h. Tutorials by Professor Gonzalo Méndez: Monday through Wednesday from 12 a.m. to 1 p.m. Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation.
Computer practices	The assessment of the knowledge will be carried out continuously during the course period. This implies, the compulsory accomplishment of a series of exercises by the student, in order to observe his/her progress. The control of all the activities carried out during the teaching period, especially the practical classes, and the verification of the results of the compulsory exercises, will be used by the teacher as elements to judge if the student has achieved the initial objectives of training in the contents of a discipline. Tutorials by Professor Jesus Torres: from Monday to Wednesday from 16h to 17h. Tutorials by Professor Gonzalo Méndez: Monday through Wednesday from 12 a.m. to 1 p.m.
Tests	
	Description
Problem and/or exercise solving	The assessment of the knowledge will be carried out continuously during the course period. This implies, the compulsory accomplishment of a series of exercises by the student, in order to observe his/her progress. The control of all the activities carried out during the teaching period, especially the practical classes, and the verification of the results of the compulsory exercises, will be used by the teacher as elements to judge if the student has achieved the initial objectives of training in the contents of a discipline. Tutorials by Professor Jesus Torres: from Monday to Wednesday from 16h to 17h. Tutorials by Professor Gonzalo Méndez: Monday through Wednesday from 12 a.m. to 1 p.m.

Assessment		
	Description	QualificationEvaluated Competences

Computer practices	The methodology is the directed study.	30	CB2 CB3 CE1 CE5 CE9 CE11 CE12 CE13 CE18 CE19 CT5
Seminars	Personalized attention	10	CB1 CE3 CE6 CE15 CE26 CE37 CT1
Problem and/or exercise solving	The exam should be part of a systematic evaluation, understood as the one that follows a previously established schedule and that is not done in an occasional or incidental way. The intention of the exam is to evaluate: * The knowledge that the student possesses about the subject. * The ability to relate some knowledge to others. * The application of knowledge to solve specific problems.	30	CB1 CB2 CB3 CE1 CE5 CE6 CE12 CE15 CE26 CT1
Laboratory practice	Practical tests are particularly useful in assessing the application of the acquired knowledge, both theoretical and practical. They imply difficulties of implementation but they provide an excellent mean for the assessment of the application of the acquired knowledge.	30	CB1 CB2 CB3 CE5 CE6 CE9 CE11 CE12 CE13 CE18 CE19 CE26 CT1 CT5

Other comments on the Evaluation

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

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

<http://mar.uvigo.es/index.php/en/alumnado-actual-2/examenes-3>

Sources of information

Basic Bibliography

Robinson, Arthur H., Elementos de cartografía, Omega, 1987,

Joly, Fernand, La Cartografía, Oikos-Tau, 1988, Barcelona

Complementary Bibliography

BOSQUE SENDRA, J. et al, Sistemas de Información Geográfica., Rama, 1994, Madrid

LONGLEY, P., GOODCHILD M.F., MAGUIRRE, D.J., RHIND, D.W., Geographic Information Systems and Science., John Wiley & Sons., 2011, Chichester

Recommendations

IDENTIFYING DATA				
Modelling				
Subject	Modelling			
Code	V10G060V01905			
Study programme	(*)Grao en Ciencias do Mar			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Optional	3rd	2nd
Teaching language	Spanish			
Department				
Coordinator	Souto Torres, Carlos Alberto			
Lecturers	Souto Torres, Carlos Alberto Varela Benvenuto, Ramiro Alberto			
E-mail	ctorres@uvigo.es			
Web				
General description	The student will learn how to operate an oceanographic numerical simulation model. In order to achieve this goal, besides the specifics of the simulation code, he/she will learn some basics of the operative system Linux, NetCDF file format and Matlab.			

Competencies		Typology
Code		
CB3	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	
CB5	Students have developed those learning skills that are necessary for them to continue to undertake further study with a high degree of autonomy	
CE29	Skill in the practical use of models and in the incorporation of new data for their validation, improvement and development	• know • Know How
CT2	Organization and planning skills	• know • Know How
CT11	Ability to learn independently and continuously	• know • Know How

Learning outcomes		Competences
Learning outcomes		
Hability to calculate ocean dynamic solutions using numerical simulation models.		CB3 CB5 CE29 CT2 CT11

Contents	
Topic	
Ocean equations.	Discretization and introduction of the ocean equations in the model.
Matlab.	Basics of Matlab coding (loops, conditional, input and output of data). Examples.
Numerical integration methods	Implicit and explicit methods. Runge-Kutta, Predictor-Corrector, Leap-Frog, etc.
NetCDF data files.	Structure of a NetCDF file: Global and local attributes, dimensions, data. Reading and writing of NetCDF files.
The ROMS model.	Introduction. Model input structure. Bathymetry, forcing and boundary condition.
Examples with ROMS.	Run and analysis of simple examples.
Nesting with ROMS.	Nested grids: Why and how. Structure, run and analysis of results.
Biogeochemical models.	Examples with simple biogeochemical models. NPDZ and N2P2Z2D2. The PISCES module.

Planning			
	Class hours	Hours outside the classroom	Total hours
Computer practices	50	50	100
Lecturing	20	20	40
Presentation	5	5	10

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

Methodologies	
	Description
Computer practices	Using Linux as the operative system and Matlab as a tool, the student will learn to use the NetCDF data file format and the use of a numerical simulation model.
Lecturing	The equations of the ocean and different methods to solve those equations numerically with a computer code will be introduced to the student.

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
Computer practices	Will be adapted to the timeframe determined by the Faculty's dean.
Tests	
	Description
Presentation	

Assessment			
	Description	Qualification	Evaluated Competences
Computer practices	The consecution of different goals (preparation of the input data, run of the model, preparation of graphics with the results, etc...) will be evaluated following a previously informed rubric.	100	CE29 CT2 CT11
Presentation		0	

Other comments on the Evaluation

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

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

<http://mar.uvigo.es/index.php/en/alumnado-actual-2/examenes-3>

Sources of information

Basic Bibliography

Cushman-Roisin, Benoit and Beckers, Jean-Marie, Introduction to Geophysical Fluid Dynamics. Physical and Numerical Aspects, Academic Press, 2009,

Complementary Bibliography

Recommendations

Subjects that it is recommended to have taken before

Ocean Dynamics/V10G060V01702

IDENTIFYING DATA**Marine microbiology and parasitology**

Subject	Marine microbiology and parasitology			
Code	V10G060V01906			
Study programme	(*)Grao en Ciencias do Mar			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Optional	3rd	2nd
Teaching language	Spanish			
Department				
Coordinator	García Estévez, José Manuel			
Lecturers	García Estévez, José Manuel Longo González, Elisa			
E-mail	jestevez@uvigo.es			
Web				
General description	<p>It should be kept in mind that parasitism is the most widespread life strategy in nature. The study of the impact of parasitism can provide relevant information for a better management and exploitation of resources. This is why we describe the diversity of parasitic animals in all their manifestations and the adaptations of each species to their habitat and study the parasite-host relationships: anatomy, morphology, biology, epidemiology, diagnosis and treatment.</p> <p>Microbiology will deal with aspects related to microbial contamination, the infectious pathology of marine organisms and the applications of marine microorganisms.</p>			

Competencies

Code	Typology
CE11 To manage the use of littoral and coastal region and their resources in a sustainable way	• know • Know How
CE17 Ability to survey in the field and to work in the laboratory responsibly and safely, encouraging team work	• Know How
CE18 To transmit writing, verbal and graphical information for audiences of various types	• Know How
CE20 To find and evaluate marine resources of various kinds	• Know How
CE22 To control marine pollution problems	• Know How
CE23 To design, control and manage recovery centers for threatened marine species	• Know How
CE26 To plan, direct and write technical reports on marine issues	• Know How • Know be
CE27 To understand the operation details of enterprises linked to the marine environment, and to recognize their specific problems and solutions	• Know How
CE30 Identify and assess environmental impacts in the marine environment	• Know How
CE32 Quality control of seafood	• know • Know How
CE33 Fisheries control	• know • Know How
CE34 To design, control and manage aquaculture production plants	• know • Know How
CE35 Water quality control in water treatment plants	• know • Know How
CE36 aquariology	• know • Know How
CT8 Teamwork ability	• Know How • Know be
CT15 Ability to apply knowledge in practice	• know • Know How

Learning outcomes

Learning outcomes	Competences
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Acquire basic knowledge of Parasitology and identify the main pathogenic parasite groups of marine organisms.	CE18 CE22 CE23 CE26 CE27 CE30 CE32 CE33 CE34 CE35 CE36 CT8 CT15
Know and purchase skill in the technicians of diagnostic in Parasitology.	CE11 CE17 CE22 CE23 CE26 CE27 CE30 CE32 CE33 CE34 CE36 CT15
Understand the complexity of the biological cycles of the parasites of the half marine like key appearance for the control of the parasitic illnesses	CE23 CE26 CE30 CE32 CE33 CE34 CE35 CE36 CT15
Know the importance and the possible applications of the main parasites of the half marine	CE11 CE22 CE26 CE30 CE32 CE33 CE34 CE35 CE36 CT8 CT15
Know the main strategies of control of the parasitic illnesses	CE22 CE27 CE32 CE35
To know the importance and the possible applications of the main parasites of the marine environment. Implications in public health and fisheries.	CE18
Know the microbial activities in relation with the half biotic and abiotic	CE32 CE34 CE35 CT8
To know the main infectious diseases by marine microorganisms.	CE30 CE32
Know how to interpret the origin and consequences of polluting microorganisms in the marine environment.	CE18 CE22 CE30

Possess general notions on the interest applied of the microorganisms of the half marine

CE11
CE17
CE18
CE20
CE22
CE23
CE26
CE27
CE30
CE32
CE34
CE36
CT8
CT15

Contents

Topic	
PART I. INTRODUCTION AND GENERAL CONCEPTS	I.1. Parasitology and Marine Parasitology. Concept of parasitism. Adjustments to the parasitism. Actions of the parasite on the host. Parasite specificity. Parasites and biological cycles. I.2. Ecological terms in Parasitology.
PART II. PROTROOLOGY	II.1. Introduction to the study of the parasitic protozoans. Classification of Protozoos. II.2. Dinoflagellates. Flagellates. Amoebae. Apicomplexa. Ciliates. II.3. Microsporidia. II.4. Mixosporidia. II.5. Protozoa of bivalve mollusks: Perkinsus, Haplosporidia, Marteilia.
PART III. HELMINTHS AND ARTHROPODS	III.1. Flatworms : Monogenean . Digeneans Tapeworms. Turbellarian. III.2 . Roundworms : Nematodes. Acanthocephala. III.3. Crustacea.
PART IV. RESPONSE HOST - PARASITE	IV.1 . Defense mechanisms of marine organisms against parasites. IV.2 . Production of vaccines against parasites. IV.3 . Drug treatments. Chemical products.
PART V. APPLICATIONS OF MARINE PARASITOLOGY	V.1 . Parasites as biological markers. V.2 . Applications of parasites in the control of fishing operations : Its use in differentiating stocks. V.3 . Economic and hygienic importance of marine parasites.
PART VI . MICROBIAL CONTAMINATION IN THE MARINE ENVIRONMENT	VI.1 . Public Health Risks and biotic pollution of the marine environment. VI.2 . indigenous bacteria and microorganisms introduced by waste disposal. VI.3 . Waterborne infections. Microorganisms indicators of health control methods coastal waters and marine food products. VII.4 . Wastewater treatment and purification of water supplies.
PART VII . MECHANISMS OF MICROBIAL PATHOGENICITY	VII.1. Mechanisms microbial pathogenicity. VII.2. Major bacterial and viral infections of marine organisms. VII.3. Métodos diagnostic and identification of microbial pathogens. VII.4. Prophylaxis in aquaculture.
PART VIII . INDUSTRIAL APPLICATIONS OF MICRO MARINE ENVIRONMENT	VIII.1. Search and genetic manipulation of microorganisms. VIII.2. Principal uses of marine microorganisms for industrial purposes. VIII.3. Use of microorganisms in biodegradation and bioremediation of marine pollutants. VIII.4. Harmful effects of marine microorganisms : biodeterioration biofilms and metal and wood.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	20	30	50
Laboratory practical	20	43.88	63.88
Seminars	8.5	25.5	34
Objective questions exam	0.62	0	0.62
Problem and/or exercise solving	1.5	0	1.5

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

Methodologies

Description

Lecturing	Professor structure and/or explain the objectives and content of each block. For their study, students have seen in class presentations and worksheets for each topic in the platform Faitic
Laboratory practical	Explanation of the theoretical foundations and practical protocols , overseeing its implementation and resolving doubts raised by students. The practices will focus on techniques useful in the practice of the profession.
Seminars	Discussion, processing and/or exposure by groups of students of subjects related to the theory and practices of matter. Topics will be proposed to the students individually or in groups organized. Before the dates marked for the exhibition, each group of students must submit a written report of the work done to prepare.

Personalized assistance

Methodologies	Description
Lecturing	The doubts that have the students will be attended in class
Laboratory practical	In the laboratory, will be participatory and allow to set custom actions reinforcement. While performing laboratory practices teachers give individual attention to each student for the correct understanding of the experimental objectives and methodology or technique used.
Seminars	In the seminars: Development and exposure by groups of students of subjects related to the theory and practices of matter. 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. Tutorials: Prof. García Estévez: Tuesday, Wednesday and Thursday from 9:00 to 11:00 h. Prof. Longo González: Monday, Tuesday and Wednesday from 16:00 to 18:00 h.

Assessment

	Description	Qualification	Evaluated Competences
Laboratory practical	The knowledge acquired by students in practical classes will be evaluated by test type / short question organized in two tests corresponding to the contents of Microbiology and Marine Parasitology (30 %). Also it is evaluable attitude and skill shown in the laboratory (10%).	45	CE17 CE22 CE26 CE27 CE30 CE32 CE33 CE34 CE35 CE36 CT8 CT15
Seminars	The quality of the memory of the works presented, the quality of the exhibition and participation and discussion in each of the topics will be valued.	20	CE18 CE23 CE26 CE27 CT8 CT15

Objective questions exam	The theoretical knowledges purchased by the student are evaluated by means of an examination of type test and short questions, organized in two corresponding proofs to the contained of Microbiology and Marine Parasitology	15	CE11 CE17 CE18 CE20 CE22 CE23 CE26 CE27 CE30 CE32 CE33 CE34 CE35 CE36 CT8 CT15
Problem and/or exercise solving	Resolution of problems and cases related with the contained of the Microbiology and Marine Parasitology.	20	CE17 CE22 CE26 CE27 CE30 CE32 CE33 CE34 CE35 CE36 CT8 CT15

Other comments on the Evaluation

The student to pass the subject shall: 1) Perform all mandatory workshops and seminars. To overcome the matter only a fault is allowed, because of force majeure and documented. 2) Get a score of 5 out of 10 in each of the Parasitology and Microbiology parties and a minimum score of 4 out of 10 in each of the evaluable activities. If the June overcomes one of the parties it is kept for July . In successive courses surpassed the ratings of activities be preserved. Students are required to take this course in responsible and honest behavior. Any form of fraud (copying and / or plagiarism) intended to falsify the level of knowledge and skills achieved in any type of test, report or work is considered inadmissible. Fraudulent conduct may involve suspending the course during a full course. An internal record of these actions will be kept so that, in case of recidivism, request the opening to the rectorado of a disciplinary file.

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

Sources of information

Basic Bibliography

Eiras, J.; Segner, H.; Wahli, T. & Kapoor, B.G., Fish Diseases, 2008, Science Publishers, U.S.

Rohde, K., Marine Parasitology, 2005, Csiro Publishing

M.T. Madigan; J.M. Martinko; K.S. Bender; D.H. Buckley; D.A. Stahl & T. Brock, Brock Biology of Microorganisms, 14, 2015, Pearson

J.M. Willey; L.M. Sherwood & C.J. Woolverton, Prescott Microbiology, 10, 2017, McGraw-Hill.

Munn, C. B., Marine Microbiology Ecology and Applications. (2ª Edición), 2011, Bios Scientific Publishers

Patrick T.K. Woo & Kurt Buchmann, Fish Parasites: Pathobiology and protection, 2012, CAB International

Complementary Bibliography

Goater, T.M.; Goater, C.M. & Esch, G.W., Parasitism: The Diversity and ecology of animal parasites, 2, 2013, Cambridge University Press

L. Roberts J. Janovy, Jr. & S. Nadler, Foundations of Parasitology, 9, 2013, McGraw-Hill Science

Williams, H. & Jones, A., Parasitic Worms of Fish, 1994, Taylor & Francis Ltd. U.K

Woo, P.T.K., Fish Diseases and Disorders. Volumen 1. (2ª Edición). Protozoan and Metazoan Infections., 2006, CAB International. Cambridge. U.K.

Noga, E. J., Fish Disease. Diagnosis and treatment, 2010, Wiley

Loker, E.S. & Hofkin, B.V., Parasitology: A Conceptual Approach, 2015, Garland Science

Austin, B., Infectious Disease in Aquaculture, 2012, Woodhead Publishing

LeBoffe, M.J. & Pierce, B.E., Microbiology: Lab Theory and Application, 4, 2015, MortonPublishing Company

Recommendations

IDENTIFYING DATA**Marine genetic resources**

Subject	Marine genetic resources			
Code	V10G060V01907			
Study programme	(*)Grao en Ciencias do Mar			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Optional	3rd	2nd
Teaching language	Spanish Galician			
Department				
Coordinator	Sanjuan López, Andrés			
Lecturers	Sanjuan López, Andrés			
E-mail	asanjuan@uvigo.es			
Web				
General description	<p>The "Marine Resources" appear with frequency in the curricular profile of the graduated in Sciences of the Sea. They are hence one of the fundamental objects of academic study during the career, and of professional management after her. This rol central of the biota marine owes to studied from industrial perspectives, technological, physical-chemical oceanographic and biological (biochemical, physiology, genetic, ecology, etc.). The Genetic "approach" is crucial in the management of the biological resources so much since it ponto of natural sight (genetic preservation) how of the sua explotación well was merely extractiva (pesquerías and marisqueo) or by means of crop to different levels of producción (acuicultura). ¿That it would serve to elaborate a complex plan of exploitation of a resource that include studies of economic feasibility, technical and sociological, yes when putting in practice it realized that the resource lacks of the sufficient genetic diversity to adapt to environmental changes, to design strategies of genetic selection or simply to keep in the his excellent reproductive?. The Genetic plays so a central paper in the management of resources, whose knowledge no can obviate given the current eases stop the analysis of the genomes.</p>			

Competencies

Code	Typology
CB3 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	• Know How • Know be
CB4 Students can communicate information, ideas, problems and solutions to both specialist and non-specialist audiences	• Know How • Know be
CB5 Students have developed those learning skills that are necessary for them to continue to undertake further study with a high degree of autonomy	• Know be
CE1 To know the vocabulary, codes and concepts inherent to the oceanographic scientific field	• know
CE2 To know and understand the essential facts, concepts, principles and theories related to oceanography	• know
CE5 Basic knowledge of research methodology in oceanography	• know
CE6 Ability to identify and understand the problems in the field of oceanography	• know
CE8 To understanding the fundamentals of the laws that regulate the use of the marine environment and its resources	• know
CE10 To know the problems and the basic principles of sustainability in relation to the use and exploitation of the marine environment	• know
CE12 To be able to operate the instrumental techniques applied to sea	• Know How
CE14 To recognize and analyze new problems and to propose problem-solving strategies	• Know How
CE15 To recognize and implement good scientific practice in measurement and experimentation, both in the field and in the laboratory	• Know How
CE17 Ability to survey in the field and to work in the laboratory responsibly and safely, encouraging team work	• Know How
CE18 To transmit writing, verbal and graphical information for audiences of various types	• Know How
CE20 To find and evaluate marine resources of various kinds	• Know How
CE24 To participate and carry out training and outreach programs on the marine and coastal environments	• Know How
CE32 Quality control of seafood	• know • Know How
CE33 Fisheries control	• Know How
CE36 aquariology	• know • Know How
CT6 Problem management and solving skills	• know • Know How
CT11 Ability to learn independently and continuously	• Know How • Know be

Learning outcomes

Learning outcomes	Competences
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To. Specific:	CB5
Cognitive (know): Comprise the concepts and the basic processes of the genetic variability, of the genetic differentiation interpopoacional and of the evolution and divergence of the species in quantitative genetic characters and qualitative	CE1 CE2 CE5 CE6 CE8 CE10 CE12 CE14 CE15 CE17 CE18 CE20 CE24 CE32 CE33 CE36 CT6 CT11
To. Specific:	CB3
Procedimentales/Instrumental (know do): Make genetic analyses; Carry out genetic advice: Analyse and characterise biological samples; Make phylogenetic analyses. Obtain and organise information, design experiments and interpret results. Apply the molecular technicians to practical cases of management of the marine genetic resources	CE1 CE2 CE10 CE12 CE17 CE18 CE20 CE24 CE32 CE33 CE36
To. Specific:	CB5
Actitudinales (be): Autonomous; Able to design experiments	CE20 CE36 CT11
B. Transversal/Generic:	CB4
- Personal: critical Reasoning; Work in team	CT6
- Others: capacity to apply the theoretical knowledges in the practice; use of Internet like media and like source of information	CT11

Contents

Topic	
Subject 1. Introduction	Presentation and analysis of the program. Taking of decisions on the process of learning and the system of evaluation of the course. Evaluation of the level of genetic knowledge of the students. Review of basic genetic concepts.
Subject 2. The genetic variability. The Mendelian Traits.	Genetic Variability and Classes of Hereditary Characters. Mendelian Genetics. Dominance Relationships and Multiple Alleles. Gene Interactions and Lethal Alleles. Selection of Mendelian Characters in Aquaculture.
Subject 3. Quantitative characters.	Genetic analysis of the Continuous Traits. The biometrical methods in Quantitative Genetics. Heritability. Response to Selection and Application in Aquaculture.
Subject 4. Genetic Structure of Populations and Molecular Markers.	The Discrete Genetic Variability. The Ideal Population. Non Random Mating and Inbreeding. Measuring Genetic Variation at Protein and DNA Levels. Allozyme Polymorphisms. RFLPs. PCR. Minisatellites and Microsatellites. Sequences of DNA Sequence Variation.
Subject 5. Populational Genetic Structure and Evolutionary agents	Agents that Change Gene Frequencies in Populations. Mutation. Migration. Random Genetic Drift. Natural Selection.
Subject 6. Populational Genetic Structure and Management of Marine Genetic Resources.	Populational Genetic Structure. Genetic management of Fisheries and the Biological Stock Concept. Genetic Management in Aquaculture: Exploitation and Aquaculture Stocks. Conservation Genetics and Marine Biodiversity. Genetics and Biological Invasions.
Practice 1. Experimental Genotyping of Populations by PCR. Identification of species.	DNA Extraction. DNA Amplificacion PCR. Molecular separation using Agarose Electrophoretic Migration. Visualisation of PCR Products. Interpretation of genotypes and Record of data.

Practice 2. Experimental Genotyping of Populations by PCR-RFLP. Populational analysis or authentication of Fishery Products.	DNA Extraction. PCR of a mitochondrial gene. Digestión of PCR Products with Restriction Enzymes. Electrophoretic Migration. Interpretation of the Electrophoretic Patterns. Populational analyses or Identification of species for each Fishery Product.
Practice 3. Bioinformatic Analyses of intra e interspecific populational genetic data.	Tabulation of the genetic data obtained in the Laboratory or in the International Databases. Molecular Phylogenetic Inference employing Genetic Distances and Phylogenetic Methods.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	18	21.6	39.6
Computer practices	5	7	12
Laboratory practical	15	18	33
Problem solving	12	14.4	26.4
Mentored work	1	8	9
Objective questions exam	1	5	6
Problem and/or exercise solving	2	10	12
Essay questions exam	2	10	12

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

Methodologies

	Description
Lecturing	The professor will present the conceptual foundations of each subject. The student has to complete each subject consulting the bibliographic resources and webs corresponding to each subject.
Computer practices	The professor will prepare a guide of each one of the practices. The students will make diverse practices with distinct computer applications and with data facilitated by the professor or achieved by the students.
Laboratory practical	The professor will prepare a guide of each one of the practices. The students will make several experiments that will allow to obtain products of PCR and patterns electroforéticos of PCR and PCR-RFLP products of individuals of distinct populations, species or fishery products.
Problem solving	Problems resolved in the classroom and practical cases adapted to each theoretical concept, technic or biological situation of the resources.
Mentored work	Individual work or in group on subjects or articles related with the subjects. The professor will propose a list of the subjects or articles, although it admits the suggestion of the same by the students. Identification of the subject and of the materials, preparation and presentation.

Personalized assistance

Methodologies	Description
Computer practices	There will be a personalised attention according to the needs of each student.
Lecturing	In the case of questions or explanations by part of the students, there will be a personalised attention according to the needs of each student
Laboratory practical	There will be a personalised attention according to the needs of each student
Mentored work	There will be a personalised attention according to the needs of each student
Problem solving	There will be a personalised attention according to the needs of each student

Assessment

	Description	Qualification	Evaluated Competences
Computer practices	Correct execution of the analytical process alone based on a series of data previously provided by the teacher or obtained from international databases. A report will be sent with the Tables, Figures, statistical tests, relevant hypotheses and conclusions.	10	CE12 CE18 CE32 CE33 CT6 CT11

Mentored work	Realization of a written work on a subject or articles previously agreed with the tutor. The interaction with the tutor and the rest of the group will be taken into account, if applicable, the interest and depth of the approach, clarity and precision in the concepts and developments carried out.	10	CE12 CE18 CE32 CE33 CT6 CT11
Problem and/or exercise solving	Resolution of 50% of the written partial or final exam, consisting of problems, or practical cases with simple mathematical applications	35	CE1 CE2 CE8 CE14 CE32 CE33 CE36 CT6 CT11
Essay questions exam	Resolution of 50% of the written partial or final exam, consisting of questions of more or less long development, laws, demonstrations, exhibition of models, etc.	35	CE1 CE2 CE8 CE14 CE32 CE33 CE36 CT6 CT11
Objective questions exam	Tests to strengthen the concepts, clarify the differences between different concepts or processes or laws, to perform simple data calculations or significance tests.	10	CB3 CB4 CB5 CE1 CE2 CE8 CE14 CE32 CE33 CE36 CT6 CT11

Other comments on the Evaluation

The contents imparted, included lectures, experimental and informatic practises and seminars, will be evaluate in the control proofs and in the partial and final examinations.

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

Faculty: <http://mar.uvigo.es/index.php/en/alumnado-actual-2/examenes-3>

Along course, but mainly in the first 6 weeks will realize at least 2 short proofs of 30 min each (no eliminatory of subject).

These marks, joint the appreciations of the active participation in the class in the resolution of problems, and in the experimental and informatic practices will be about 10 % of the Final Qualification. The assessment of the report of the Informatic Application to distinct data, and of other work will be other 10 % of the Total. An examination or partial proof will be realize for the first half of the course that will be subject to elimination. At the end of the course a final examination will include the two halves of the course. These last examinations will consist in distinct definitions, demonstrations, exercises, problems and developmental questions.

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

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

Pandian, T.J, Strüssmann, C.A. & Marian, C. (Eds.), Fish Genetics and Aquaculture Biotechnology, Oxford & IB Publi./Science Publish, 2005, Oxford(UK)

Fontdevila, A. & Moya, A., Introducción a la genética de poblaciones, Ed. Sintesis, 1999, Madrid

Complementary Bibliography

Avise, J., Molecular Markers: Natural History and Evolution, Chapman & Hall, 1994, New York

Recommendations

Other comments

The students that take this subject, would have previous knowledges on the nature of the hereditary material (DNA), his transmission, mutation, and expression (Biology, first course of the degree), on the calculation of probabilities, test of of significance (as Tests of X²), and on concepts and calculations of correlation, regression and analysis of variance.

It is required of the students a responsible and honest behaviour.

It is considered inadmissible any form of fraud (as Copy or Plagiarism) to change the level of knowledge or skill reached by a person in any type of proof, test, report or work designed with this purpose. This fraudulent behaviour will be sanctioned with the firmness and rigour that establishes the valid rule.

IDENTIFYING DATA**Oceanographic remote sensing**

Subject	Oceanographic remote sensing			
Code	V10G060V01908			
Study programme	(*)Grao en Ciencias do Mar			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Optional	3rd	2nd
Teaching language	Spanish			
Department				
Coordinator	Torres Palenzuela, Jesús Manuel			
Lecturers	Torres Palenzuela, Jesús Manuel			
E-mail	jesu@uvigo.es			
Web	http://www.tgis.uvigo.es			
General description	Introduction to the physical principles of the Teledetection and his Oceanographic Applications			

Competencies

Code	Typology
CB1 Students have demonstrated knowledge and understanding in a field of study that builds upon their general secondary education, and is typically at a level that, whilst supported by advanced textbooks, includes some aspects that will be informed by knowledge of the forefront of their field of study	• know
CB2 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	• know • Know How
CB5 Students have developed those learning skills that are necessary for them to continue to undertake further study with a high degree of autonomy	
CE12 To be able to operate the instrumental techniques applied to sea	
CE18 To transmit writing, verbal and graphical information for audiences of various types	• know • Know How • Know be
CT4 Basic computing skills related to the field of study	• Know How
CT5 Information technology skills (search and data analysis)	• Know How

Learning outcomes

Learning outcomes	Competences
Know the physical principles of the Teledetection and applications in the field of the Oceanography	CE12 CT4 CT5
Learn to use programs of Treatment of Images of Satellite in marine applications.	CB1 CB2 CB5 CE18 CT4

Contents

Topic	
1.-INTRODUCTION To THE Objective	1.1.- Teledetection in Oceanography 1.2.- Brief history of the space observation of the oceans
TELEDETECTION	1.3.- Possibilities for the oceanography 1.4.- Temporary and space scales of the phenomena of interest.
Pretend with this first subject enter to the student in the world of the teledetection and the paper that this plays in the modern oceanography.	

2.- PHYSICAL PRINCIPLES OF THE Objective	Contents
TELEDETECTION	2.1.- Radiation and electromagnetic spectrum. 2.2.- Terms and units of measure. 2.3.- Principles of the electromagnetic radiation. 2.4.- *Caractrísticas Spectral of the covers. 2.5.- Interaction of the atmosphere with the radiation. 2.5.1.- Absorption. 2.5.2.- Dispersion. 2.5.3.- Broadcast.
In this unit pretends that the student know the principles of the physics of the electromagnetic radiation, his interaction with the atmosphere, as well as the spectral characteristics of the covers.	

3.- ELEMENTS OF A SYSTEM OF Objective	Contents:
TELEDETECTION:	3.1. System of reception of images Elements of the system Platform and sensor Orbits Resolution of a sensor Types of sensors Platforms
In this unit enters to the student in the characteristics that define to a sensor and space platform as well as the steps required from the capture of an image by a sensor until his application and utilisation by part of an user. Finally they describe the most used satellites.	

4.- *ANALISIS And DIGITAL TREATMENT OF Objective	Contents:
IMAGES:	4.1. Visual analysis 4.1.1. Criteria of Interpretation 4.2. Digital treatment 4.2.1. Digital image 4.2.2. Corrections 4.2.3. It enhance 4.2.4. Transformations
In this unit establish the principles of visual and digital interpretation as well as the processing of the information with the object to delete errors (correction), improve some appearance of the information obtained (enhance) or obtain other parameters from the data of radiance (transformations). Finally it will enter to the student in the digital classification and the integration of information in systems of geographic information.	

5.- APPLICATIONS	Aims:
	In this last unit enumerate the applications of the teledetection in meteorology and study of the oceans. In each one of these applications realises a description of the physical principles that make it possible, as well as the interpretation of the results obtained and the sensors used.

Planning			
	Class hours	Hours outside the classroom	Total hours
Computer practices	20	10	30
Seminars	7	15	22
Lecturing	25	52	77
Laboratory practice	4	0	4
Essay	0	15	15
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
Computer practices	The methodology that uses in the practical is the one of study directed.
Seminars	There will be an individualized tracking techniques and content for the development of the scheduled jobs. Its main objective is to clarify the concepts that have been explained in the kind of theory or solve any of the problems of practical classes.
Lecturing	The lesson *magistral is the method mainly employee, using in the measure of the possible the lesson had a conversation.

Personalized assistance	
Methodologies	Description
Lecturing	The master lesson is the method mainly employee, using in the measure of the possible the lesson had a conversation. 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
Computer practices	The methodology that uses in the practical is the one of study directed.
Seminars	It will realise a individualised follow-up of technicians and contents for the development of the works scheduled . His main aim is to clear the concepts that have been explained in the class of theory or resolve any of the problems of the practical classes.
Tests	
Tests	Description
Essay	They will be works on subjects of applications of the teledetection in base to scientific publications and the matter of the subject

Assessment			
	Description	Qualification	Evaluated Competences
Lecturing	The lesson *magistral is the method mainly employee, using in the measure of the possible the lesson had a conversation.	0	CB1 CB2
Computer practices	The methodology that uses in the practical is the one of study directed.	10-20	CB1 CB2 CE12
Seminars	It will realise a follow-up *individualizado of technicians and contents for the development of the works scheduled	0-5	CB1 CB2 CT5
Laboratory practice	By his part, the practical examinations outline of particular use to the hour to evaluate the application of the knowledges purchased. So many theorists like practical. They comport difficulty of implementation regarding the available places for the same and to the necessary variety of examinations, but provide an excellent half for the assessment regarding the application of the knowledges.	20	CB1 CB2 CT4
Essay	*Seran Assigned subjects by groups of two students	10-60	CB1 CB2 CE12 CT4 CT5
Problem and/or exercise solving	The examination has to form part of a systematic evaluation, understood this as the one who obeys to a previously established programming and that does not realise of an occasional or incidental way. By means of the realisation of an examination pretends , generally, evaluate: * The knowledges that about a matter possesses the student. * The capacity of relation of some knowledges with others. * The application of the knowledges to the resolution of concrete problems.	60-0	CB1 CB2 CB5 CE12

Other comments on the Evaluation

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

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

Oceanografía y Satélites, Tebar, 2009,

CRACKNELL, A.P. u HAYES, L.W.B., Introduction to Remote Sensing, Taylo & Francis, 1991,

Complementary Bibliography

Recommendations

Subjects that are recommended to be taken simultaneously

Geographic analysis methods/V10G060V01904

Other comments

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

<http://mar.uvigo.es/index.php/en/alumnado-actual-2/examenes-3>

IDENTIFYING DATA**Applied marine geology**

Subject	Applied marine geology			
Code	V10G060V01909			
Study programme	(*)Grao en Ciencias do Mar			
Descriptors	ECTS Credits	Type	Year	Quadmester
	6	Mandatory	4th	1st
Teaching language	Spanish Galician			
Department				
Coordinator	Méndez Martínez, Gonzalo Benito Gago Duport, Luís Carlos			
Lecturers	Díez Ferrer, José Bienvenido Francés Pedraz, Guillermo Gago Duport, Luís Carlos González Villanueva, Rita Méndez Martínez, Gonzalo Benito			
E-mail	duport@uvigo.es mendez@uvigo.es			
Web	http://http://webc10.webs.uvigo.es/ficha.php?id=16			
General description	It is a theoretical-practical subject that is directed to the integration of previous acquired geological knowledge, focusing its application on the study of geological risks, marine geological resources and advice in coastal engineering.			

Competencies

Code		Typology
CB1	Students have demonstrated knowledge and understanding in a field of study that builds upon their general secondary education, and is typically at a level that, whilst supported by advanced textbooks, includes some aspects that will be informed by knowledge of the forefront of their field of study	• know
CB2	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	• Know How
CB3	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	• Know How
CB5	Students have developed those learning skills that are necessary for them to continue to undertake further study with a high degree of autonomy	• know
CE6	Ability to identify and understand the problems in the field of oceanography	• know
CE11	To manage the use of littoral and coastal region and their resources in a sustainable way	• know • Know How
CE13	To acquire, evaluate, process and interpret oceanographic data within the theories currently in use	• Know How
CE14	To recognize and analyze new problems and to propose problem-solving strategies	• know • Know How
CE16	To plan, design and implement applied research from the recognition stage to the final evaluation of results and discoveries	• know • Know How
CE20	To find and evaluate marine resources of various kinds	• know
CE26	To plan, direct and write technical reports on marine issues	• know • Know How
CE30	Identify and assess environmental impacts in the marine environment	• know
CE37	Technical advice or assistance on issues related to the marine and coastal environment	• know
CT1	Analysis and synthesis ability	• know • Know How
CT6	Problem management and solving skills	• know • Know How • Know be

Learning outcomes

Learning outcomes	Competences
1. Know and locate the main marine geological resources	CB1 CB2 CB3 CB5 CE6 CE20 CT1

2.- Know interpret and integrate geophysical and geological data in the exploration and prospection of marine geological resources	CB1 CE13 CE20 CT1 CT6
3. Know the main geological risks sea coasts and submarines and the consequences	CB3 CE6 CE14 CE16 CE30 CT1
4. Geochemical modelling of pollution processes in the marine environment.	CB2 CB3 CE11 CE13 CE16 CE30 CE37 CT1
5. Realisation of geological reports.	CB3 CE14 CE26 CE30 CE37 CT1

Contents

Topic	
1-Introduction. (1 hour class).	1.0. Introduction.
2 - Coastal and submarine Geological Risks (GR). (6 hours class) (6 hours seminars) (8 hours field trip) (4 hours practical works)	<p>Theory</p> <p>2.1. Definition and types of coastal and submarine GR.</p> <p>2.2. Coastal and submarine GR linked to the external geodynamics</p> <p>2.3. Coastal and submarine GR linked to the internal geodynamics.</p> <p>2.4. Changes in sea level.</p> <p>Field trip: Risks of coastal flood. Data collection.</p> <p>Practices: Geochemistry of marine pollution processes.</p> <p>Seminars 1, 2 and 3: Submarines volcanic risks and tsunamis.</p>
3- Marine Geological Resources (11 hours class) (6 hours seminars)	<p>Theory</p> <p>3.1. Distribution and origin of the elements present in the sea and in the marine sediments.</p> <p>3.2. Methods and technical of exploration and exploitation of marine geological resources.</p> <p>3.3. Marine mineral resources (MMR).</p> <p>3.3.1. Sediments no consolidated: Arid, placers deposits and salts.</p> <p>3.3.2. deposits in nodules and crusts: Phosphorites, nodules and crusts of Fe-Mn.</p> <p>3.3.3. Hydrothermal deposits.</p> <p>3.4. Marine energetic resources (MER) and Geology of the Carbon.</p> <p>3.4.1. Exploration and exploitation of hydrocarbons</p> <p>3.4.2. Origin and interest of the hydrates of gas as resource.</p> <p>3.5. Mechanisms of capture and transformation of the CO2</p> <p>Seminars 4, 5 and 6: Resolution of practical exercises in relation to the exploration of hydrocarbons.</p>
4 □ Impact of human activity in the coast. Marine geology and Society (8 hours field trip) (2 hours seminars)	<p>Field Trip: Different coastal examples in which detailed geological studies are needed</p> <p>Seminar 7. Discussion on the treatment given to different past and present coastal geological problems.</p>

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	18	54	72

Seminars	14	28	42
Laboratory practical	4	12	16
Studies excursion	16	0	16
Essay questions exam	2	0	2
Problem and/or exercise solving	1	0	1
Problem and/or exercise solving	1	0	1

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

Methodologies	
	Description
Lecturing	Theoretical classes
Seminars	Exhibition of practical cases. Resolution of exercises related. Debate.
Laboratory practical	Seawater pollution geochemistry
Studies excursion	Risks of coastal flood and data collection. Human activity in coasts, geological context analysis.

Personalized assistance	
Methodologies	Description
Lecturing	Theoretical classes. □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	Analysis of different topics related to the competences of the subject. Detailed instructions on how to report a file. Specialised Database query. Advise on the choice of a topic to develop in the report. Resolution of doubts through individualised tutoring. □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	Explanation and preparation of geological risk maps in coastal zones in small groups. □Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation□
Studies excursion	Risk mapping. Data analysis of anthropic activity in the coast and its relationship with the geological environment. □Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation□

Tests	Description
Essay questions exam	Part of the theoretical-practical test
Problem and/or exercise solving	Part of the theoretical-practical test
Problem and/or exercise solving	Part of the theoretical-practical test

Assessment			
	Description	Qualification	Evaluated Competences
Lecturing	Compulsory assistance	0	
Seminars	Assistance, participation and content of the deliverables with various issues and resolution of exercises related to the content of the seminar. One deliverable at the end of each block of seminars (3 in total). Fundamentally, in the debate are valued the scientific-technical datas that support the presented arguments.	40	CB1 CB2 CB3 CE6 CE30 CT1

Laboratory practical	Assistance, participation and delivery of the memory.	10	CB1 CB3 CE11 CE13 CT1 CT6
Studies excursion	Assistance, participation and delivery of the report.	10	CB3 CE11 CE13 CE14 CE20 CE30 CT1
Essay questions exam	Part of the theoretical-practical test.	30	CB1 CB5 CE11 CE20 CE30 CE37
Problem and/or exercise solving	Part of the theoretical-practical test.	5	CB1 CE20 CE30 CT6
Problem and/or exercise solving	Part of the theoretical-practical test.	5	CB2 CE6 CE11 CT1 CT6

Other comments on the Evaluation

The attendance to the theoretical classes, practices, seminars and field trips is obligatory. Students who do not attend seminars or practices may not submit the relevant reports and be presented to the overall assessment.

For a student to be considered "Not Presented" does not have to have been evaluated in any item.

The final exam, in any of the calls, will include any theoretical and/or practical aspects exposed during the course, including fieldtrips, practices and seminars.

Ordinary call.

In order to pass the subject by **continuous evaluation** and to take the final written test that represents 40% of the mark, it will be necessary to exceed 40% of the mark in each and every evaluable items. Otherwise it is considered that the student goes to **global evaluation** and is presented to a single final written test for 100% of the score.

Extraordinary call

A single exam that counts 100% of the score.

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

Individualised tutoring

Tutoring schedules of teachers of the subject can be found on the TEMA platform.

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

Sources of information

Basic Bibliography

Beatley, T., An Introduction to coastal zone management, second edition, Island Press, 2002,

Burns, R. (Ed.), Marine Minerals. Reviews in Mineralogy, vol 6, Mineralogical Society of America, 1979,

Craig, J.R., Vaughan, D.J. & Skinner, B.J., Recursos de la Tierra y el Medio Ambiente., 4ª Ed., Pearson Education, 2012,

Cronan, D.S., (Ed.), Marine Minerals in Exclusive Economics Zones, Chapman & Hall, 1992,

Earney, P.C.E., Marine Mineral Resources, Taylor & Francis, 2012,

Complementary Bibliography

Couper, A., The Times Atlas and Encyclopaedia of The Sea, Times Book Ltd., 1989, London

Cronan, D.S., Handbook of Marine Mineral Deposits, CRC Press, 1999,

Keller, E.A., Blodgett, R.H., Riesgos Naturales: Procesos de la Tierra como riesgos, desastres y catástrofes, Pearson Educación, 2007,

Méndez, G., Rey, D., Bernabeu, A.M., Manso, F. y Vilas, F., Recursos minerales marinos en la costa gallega y plataforma adyacente, Journal Iberian Geology, 26, 2000, Madrid

Seibold, E.; Berger, W.H., The sea floor. An introduction to marine geology, third Edition, Springer, 2010,

Teleki, P.G, Dobson, M.R., Moore, J.R. & von Stackelberg, U. (Eds.), Marine Minerals. Advances in Research and Resource Assessment, Springer, 1987,

Recommendations

Subjects that are recommended to be taken simultaneously

Marine contamination/V10G060V01701

Marine and coastal management/V10G060V01704

Subjects that it is recommended to have taken before

Coastal and marine sedimentary habitats/V10G060V01402

Sedimentology/V10G060V01305

Geological oceanography I/V10G060V01504

Geological oceanography II/V10G060V01603

IDENTIFYING DATA**Traballo de Fin de Grao**

Subject	Traballo de Fin de Grao			
Code	V10G060V01991			
Study programme	Grao en Ciencias do Mar			
Descriptors	ECTS Credits	Type	Year	Quadmester
	12	Mandatory	4	2c
Teaching language	Castelán Galego Inglés			
Department	Xeociencias mariñas e ordenación do territorio			
Coordinator	Francés Pedraz, Guillermo			
Lecturers	Francés Pedraz, Guillermo			
E-mail	gfrances@uvigo.es			
Web	http://http://webs.uvigo.es/facultadeccdomar/index.php/es/trabajo-fin-de-grado			
General description	O Traballo de Fin de Grao (TFG) é unha materia dentro do plan de estudos do título de Grao de Ciencias do Mar. É un traballo persoal que cada estudante realizará de forma autónoma baixo titorización docente e debe permitirlle mostrar de forma integrada a adquisición de contidos formativos e as competencias asociadas ao título de Ciencias do Mar.			

Competencias

Code	Typology
CB1	• saber
CB2	• saber facer
CB3	• saber facer
CB4	• saber facer
CB5	• Saber estar / ser
CE1	• saber
CE2	• saber
CE3	• saber
CE4	• saber
CE5	• saber
CE6	• saber facer
CE7	• saber
CE8	• saber
CE9	• saber
CE10	• saber
CE11	• saber facer
CE12	• saber facer
CE13	• saber facer
CE14	• saber facer
CE15	• saber • saber facer
CE16	• saber facer
CE17	• saber • saber facer
CE18	• saber facer
CE19	• saber facer

CE20	Buscar e avaliar recursos de orixe mariña, de diversas clases	• saber • saber facer
CE21	Xerir áreas mariñas e litorais protexidas	• saber facer
CE22	Controlar problemas de contaminación mariña	• saber facer
CE23	Deseñar, controlar e xerir centros de recuperación de especies mariñas ameazadas	• saber facer
CE24	Participar e realizar programas de formación e divulgación sobre os medios mariño e litoral	• saber facer
CE25	Participar e asesorar en investigacións sobre clima mariño	• saber facer
CE26	Planificar, dirixir e redactar informes técnicos sobre cuestións mariñas	• saber facer
CE27	Comprender os detalles do funcionamento de empresas vinculadas ao medio mariño, recoñecer problemas específicos e propoñer solucións	• saber • saber facer
CE28	Impartir docencia no ámbito científico nos diferentes niveis educativos	• saber facer
CE29	Destreza no uso práctico de modelos, incorporando novos datos para a validación, mellora e evolución dos mesmos	• Saber estar / ser
CE30	Identificar e avaliar impactos ambientais no medio mariño	• saber facer
CE31	Capacidade para desenvolverse e entenderse nas institucións públicas e privadas, nacionais e internacionais do ámbito das Ciencias do mar	• Saber estar / ser
CE32	Control de calidade de alimentos mariños	• saber • saber facer
CE33	Control de pesqueiras	• saber • saber facer
CE34	Deseñar, controlar e xerir plantas de produción acuícola	• saber • saber facer
CE35	Control de calidade de augas en plantas depuradoras	• saber • saber facer
CE36	Acuarioloxía	• saber • saber facer
CE37	Asesoría ou asistencia técnica en temas relacionados co tema mariño e litoral	• saber facer
CE38	Usos técnicos de enerxía renovables	• saber
CT1	Capacidade de análise e síntese	• saber facer • Saber estar / ser
CT2	Capacidade de organización e planificación	• saber facer
CT3	Comunicación oral e escrita nas linguas oficiais da Universidade	• saber facer
CT4	Habilidades básicas do manexo do ordenador, relacionadas co ámbito de estudo	• Saber estar / ser
CT5	Habilidade na xestión da información (procura e análise da información)	• Saber estar / ser
CT6	Resolución de problemas	• saber facer
CT7	Toma de decisións	• Saber estar / ser
CT8	Capacidade de traballar nun equipo	• Saber estar / ser
CT9	Capacidade crítica e autocrítica	• Saber estar / ser
CT10	Compromiso ético	• Saber estar / ser
CT11	Capacidade de aprender de forma autónoma e continua	• saber facer
CT12	Capacidade para adaptarse a novas situacións	• Saber estar / ser
CT13	Capacidade de xerar novas ideas (creatividade)	• Saber estar / ser
CT14	Iniciativa e espírito emprendedor	• Saber estar / ser
CT15	Capacidade de aplicar os coñecementos na práctica	• saber facer
CT16	Habilidades de investigación	• saber facer
CT17	Sensibilidade cara a temas ambientais	• Saber estar / ser

Resultados de aprendizaxe

Learning outcomes	Competences
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Inclúe todos os resultados de aprendizaxe da titulación, desenvolvendo máis en profundidade un ou outro segundo o foco e a materia específica de cada un dos traballos de Fin de Grao

CB1
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Contidos

Topic

Dado o seu carácter especial a materia non ten contidos propios, dependerá do tema asignado aona páxina web, pola cal se asignan o TFG e os respectivos Profesores alumno. Dentro da oferta de TFG da Facultade, o Tutores. Os traballos poden ser realizados e defendidos en galego, castelán alumno terá a opción de optar por calquera delas.e inglés. Tanto o idioma de realización como o de exposición constarán na acta individual de cada estudante.

Planificación docente			
	Class hours	Hours outside the classroom	Total hours
Presentación	1	10	11
Lección maxistral	2	0	2
Traballo tutelado	0	282	282
Traballo	2	1	3

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

Metodoloxía docente	
	Description
Presentación	O TFG debe ser defendido ante un tribunal formado por tres profesores da titulación, nos termos establecidos nas normas da Facultade.
Lección maxistral	Dúas horas de clase están reservadas, onde o coordinador da materia de Traballo de Fin de Grao presentará as claves para a elaboración e defensa do TFG.
Traballo tutelado	Como resultado final, presentarase un informe axustado ás condicións establecidas nas normas da Facultade.

<http://mar.uvigo.es/index.php/es/alumnado-actual/trabajo-fin-de-grado>

Atención personalizada	
Methodologies	Description
Traballo tutelado	Corresponderalle ao tutor asignado para cada TFG titorizar ao alumno no desenrolo do traballo elexido. O alumno que deberá acudir as titorías personalizadas para resolver dúbidas, principalmente nos horarios que indique o seu titor. Para optimizar o tempo, é necesario que o alumno contacte co profesor con antelación suficiente
Lección maxistral	O profesor coordinador e responsable das sesións maxistrais poderá asesorar e titorizar aos estudantes no que se refire a estrutura, redacción, inclusión de citas e obtención do documento de defensa na aplicación do TFG. O alumno que o desexe poderá acudir a titorías personalizadas para resolver dúbidas, principalmente nos horarios que se indican. Para optimizar o tempo, é necesario que o alumno contacte co profesor con antelación suficien

Avaliación			
Description	Qualification	Evaluated Competences	
Traballo Avaliación por parte do titor das competencias desenvolvidas polo alumno no traballo e na redacción da memoria final.	30		
Na normativa de TFG da Facultade pódese atopar en detalle todo o procedemento que debe adoptar o alumno e o seu titor, tanto para a realización do TFG (memoria) como para a súa avaliación.			

Other comments on the Evaluation

O Traballo Fin de Grao (TTG) réxese pola normativa aprobada na Xunta de Facultade e publicada na páxina web do centro.

A Comisión Académica de TFG, con anterioridade ao comezo do traballo, fará públicos os criterios de avaliación que utilizarán tanto o titor para emitir o seu informe como o tribunal para avaliar a memoria do traballo e o seu defensa.

Faranse públicos na páxina web (<http://mar.uvigo.es/index.php/es/alumnado-actual/trabajo-fin-de-grado>) todos os prazos que alcanzan a presentación das memorias, as defensas e a presentación dos informes polos titores. Estes prazos serán aprobados pola Comisión Académica do TFG.

No caso de que o alumno supere a avaliación do Titor e non supere o TFG, o tribunal de avaliación emitirá un informe justificativo. Unha vez atendidas as recomendacións do informe, devandito alumno poderá volver presentar o TFG no período seguinte de avaliación.

Requírese do alumnado que curse esta materia unha conduta responsable e honesta. Considérase inadmisíbel calquera forma de fraude (copia ou plaxio) encamiñado a falsear o nivel de coñecementos e destrezas alcanzado en todo tipo de proba, informe ou traballo. As condutas fraudulentas poderán supoñer suspender a materia durante un curso completo. levará un rexistro interno destas actuacións para que, en caso de reincidencia, solicitar a apertura ao reitorado dun expediente disciplinario.

Bibliografía. Fontes de información

Basic Bibliography

Complementary Bibliography

Recomendacións

Other comments

Como en todas as materias, o esforzo persoal é esencial, así como atender ás instrucións do titor e entregar o informe no decanato dentro dos prazos establecidos polo Comité Académico de TFG.

Recoméndase ler con atención as normativas relacionadas coa elaboración e defensa do TFG do Centro e toda a documentación relacionada que se pode atopar en

<http://mar.uvigo.es/index.php/es/alumnado-actual/trabajo-fin-de-grado>
