



(*)Facultade de Ciencias do Mar

(*)Grao en Ciencias do Mar

Subjects

Year 3rd

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

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

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:	<ul style="list-style-type: none"> 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.

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	<p>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.</p> <p>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.</p> <p>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.</p>	100	CB2	CE14	CT8	CE17	CT12	CE27	CT15

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**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	
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
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
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
CE5	Basic knowledge of research methodology in oceanography
CE6	Ability to identify and understand the problems in the field of oceanography
CE12	To be able to operate the instrumental techniques applied to sea
CE17	Ability to survey in the field and to work in the laboratory responsibly and safely, encouraging team work
CT3	Written and oral communication in the official languages of the University
CT5	Information technology skills (search and data analysis)
CT6	Problem management and solving skills

Learning outcomes

Learning outcomes	Competences		
PLANT PHYSIOLOGY	CB1	CE1	
1. To identify and understand key physiological processes in the development of photosynthetic marine organisms.	CB2		
	CB3		
2. To know the relationships among the photosynthetic marine organisms and the marine environment by means of the study of changing physiological processes	CB1	CE6	
	CB2		
	CB3		
	CB5		
3. To handle equipments and techniques to study plant physiology.	CB2	CE4	CT5
	CB3	CE5	
		CE12	
4. To understand the scientific methodology and the technologies applied to plant physiology research.	CB1	CE1	CT5
	CB3	CE4	
	CB5	CE5	
		CE12	
5. To gain capacity of analysis and approaching to hypothesis in plant physiology.	CB2	CE5	CT3
	CB3	CE6	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:			
7. To know the mechanisms of acquisition and integration of the sensory information in marine animals	CB2 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 addapted 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

Contents

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, cromatophora and bioluminescence 4. Sensory physiology in marine animals: mecanoreception, electroreception, magnetoreception, quimioreception, fotoreception and vision. 5. Physiology of the neuroendocrine and endocrine systems in marine animals 6. Circulatory fluids and operation of the cardiovascular systems in marine animals 7. Operation of the respiratory systems in marine animals 8. Physiology of excretion and osmorregulation in marine animals 9. Physiology of the digestive systems in marine animals

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	28	70	98
Laboratory practical	10	4	14
Mentored work	0	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	
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

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			
Lecturing	Attendance will be valued	0	CB1	CE1	CT3	
			CB2	CE4	CT5	
			CB3	CE5	CT6	
			CB5	CE6		
	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.					
	The final exam will consist on short answer tests, long answer tests, and resolution of exercises.					

Laboratory practical	In the module of Plant Physiology (5% of the qualification) the evaluation will be by attendance and questions in the final exam. In the module of Animal Physiology (5% of the qualification) the evaluation will be by attendance	10	CB1 CB2 CB3 CB5	CE1 CE4 CE5 CE12 CE17	CT5 CT6
Mentored work	Voluntary for Plant Physiology	0			
Discussion Forum	Voluntary for Plant Physiology	0			
Seminars	It is compulsory the attendance to the seminars In the module of Plant Physiology (10% qualification) the assessment will be by attendance and performance, and the problems will be matter of examination. 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.	10	CB1 CB2 CB3	CE1 CE6	CT5 CT6
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

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

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

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

Complementary Bibliography

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

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

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

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

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

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

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

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

Recommendations

Subjects that 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	
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
CB4	Students can communicate information, ideas, problems and solutions to both specialist and non-specialist audiences
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
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
CE14	To recognize and analyze new problems and to propose problem-solving strategies
CE15	To recognize and implement good scientific practice in measurement and experimentation, both in the field and in the laboratory
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
CE18	To transmit writing, verbal and graphical information for audiences of various types
CT2	Organization and planning skills
CT8	Teamwork ability
CT16	Research skills

Learning outcomes

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

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 zooplankton 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

	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 have finalised. Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation. Schedule of tutorials: 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
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 CE1 CT2 CB2 CE5 CT8 CB3 CE6 CT16 CB4 CE13 CB5 CE14 CE15 CE16 CE17 CE18
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 CE1 CB5 CE15 CE16 CE17
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 CE1 CT2 CB2 CE5 CT8 CB3 CE6 CT16 CB4 CE13 CB5 CE14 CE15 CE16 CE17 CE18

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

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

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

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

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

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

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

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

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

Complementary Bibliography

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

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

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

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

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

Little, C. & Kitching, J.A, **The Biology of rocky shores**, Second edition, Oxford University, 2009

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

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	
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
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
CE14	To recognize and analyze new problems and to propose problem-solving strategies
CE16	To plan, design and implement applied research from the recognition stage to the final evaluation of results and discoveries
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

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 its relationship with balance precipitation + runoff - evaporation. Estuaries and estuarine circulation. Coupling estuarine circulation with upwelling and downwelling.
 II.3. MASAS DE AGUA Y DIAGRAMAS TS
 II.3.1. Water masses and water types. Abyssal circulation. Types of density variation in relation with water masses formation. The core method. Identification of water masses circulation.
 II.3.2. Equation of state of Seawater. Isopycnals. Density vertical profiles of by latitudes: The pycnocline. Density gradient and water masses stability.
 II.3.3. TS diagrams. Mixing of water types; caballing. Stability of water masses using TS diagrams.

III. DYNAMICS OF OCEAN CURRENTS

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

IV. REGIONAL OCEANOGRAPHY

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

Planning

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

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

Methodologies

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

Personalized assistance

Methodologies	Description
---------------	-------------

Lecturing	Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation. 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	
Essay questions exam	(*)EXAME OFICIAL	50	CB1 CB2 CB3	CE1 CE2 CE5 CE6 CE14	CT1

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,

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

Complementary Bibliography

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

TOMCZCAK, M. y J. STUART GODFREY, **Regional Oceanography: an introduction**, Pergamon. 422 p.,

<http://www.es.flinders.edu.au/~mattom/regoc/pdfver>,

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

R. STEWART, **Introduction to Physical Oceanography**, Texas A&M University.,

<http://www.uv.es/hegigui/Kasper/por%20Robert%20H%2>,

Recommendations

Subjects that continue the syllabus

Physical oceanography II/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 proceses affecting sedimentation in litoral areas, since sediments are the main geological feature of these region. The subject will cover the fundamental techniques to study the topography, structure, sedimentation, and associated geological processes of these areas to discover how they were formed and how ongoing processes (coastal dynamics, climate change, human impact...) may change them in the future. The subject will deal with the peculiarity of combining terrestrial and marine data to study litoral and coastal processes.			

Competencies

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
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

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
Seminars	Individual written report on the seminar activities. May include tests.	10 CB2	CE1 CT6 CE5 CT16 CE13 CE16 CE17

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
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
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

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

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

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

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

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	
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
CB4	Students can communicate information, ideas, problems and solutions to both specialist and non-specialist audiences
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
CE12	To be able to operate the instrumental techniques applied to sea
CE15	To recognize and implement good scientific practice in measurement and experimentation, both in the field and in the laboratory
CE17	Ability to survey in the field and to work in the laboratory responsibly and safely, encouraging team work
CE18	To transmit writing, verbal and graphical information for audiences of various types
CE30	Identify and assess environmental impacts in the marine environment
CT1	Analysis and synthesis ability
CT15	Ability to apply knowledge in practice
CT17	Sensitivity towards environmental issues

Learning outcomes

Learning outcomes	Competences		
To describe global cycles of the elements, including the input and output processes.	CB1	CE1	CT1
	CB2	CE2	
	CB3	CE6	
	CB4	CE18	
	CB5		

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 develop 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

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

- I. Bodek, W.J. Lyman, W.F. Reehl y D.H. Rosenblatt, **Environmental Inorganic Chemistry**, Pergamon Press, 1988
R.P. Schwarzenbach, P.M. Gschwend, D.M. Imboden, **Environmental Organic Chemistry**, 2, John Wiley & Sons Inc, 2003
R. Chang, **Química**, 11, Mc Graw Hill, 2013
P. Yurkanis Bruice, **Química Orgánica**, 5, Prentice Hall México, 2007

Complementary Bibliography

- S. E. Manahan, **Environmental chemistry**, 9, CRC Press, 2009
H. G. Seiler, H. Sigel, A. Sigel, **Handbook on toxicity of inorganic compounds**, Marcel Dekker, 1988
J. W. Moore, **Inorganic Contaminants of Surface Water**, Springer, 1991
Paul M. Dewick, **Medicinal natural products: A biosynthetic approach**, 3, John Wiley & Sons Inc, 2009
J. B. McClintock, B.J. Baker, **Marine chemical ecology**, CRC Press, 2001
M.A. Martínez Grau, A.G. Csáky, **Técnicas experimentales en síntesis orgánica**, 2, Síntesis, 2012

Journal of Natural Products,

Natural Products Reports,

Marine Chemistry,

Marine Pollution Bulletin,

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	
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
CB4	Students can communicate information, ideas, problems and solutions to both specialist and non-specialist audiences
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
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
CT1	Analysis and synthesis ability
CT6	Problem management and solving skills

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	
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
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
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
CE5	Basic knowledge of research methodology in oceanography
CE6	Ability to identify and understand the problems in the field of oceanography
CE12	To be able to operate the instrumental techniques applied to sea
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
CE38	Technical use of renewable energies
CT4	Basic computing skills related to the field of study
CT15	Ability to apply knowledge in practice

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 objetives and purpose of the seminar. The students will have a guide on the TEMA platform describing all que exercises and questions required.The exercises can be solved individually or in small groups, but a personalised report is required. At the end of this seminar a 15 minute multiple option quest will be fulfilled.
Studies excursion	The teacher will describe the tasas to do, explain the different instruments and technic, and monitors the students' use of such instruments
Mentored work	The teacher presents several real problems to salve and offers guiding 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 examen 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**Basic Bibliography**

Kirk, J.T.O, **Ligth and photosynthesis in aquatic ecosystems**, Cambridge Press, 2011

Varios autores, **Ocean circulation**, Open University Course Team, 1999

Varios autores, **Waves, tides and shallow-water processes**, 2, Open University Course Team, 1999

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

Pickard, GL y Emery, W, **Descriptive Physical oceanography**, 6, Pergamon Press, 2011

Sverdrup, HU; Johnson, MW y Fleming, RH, **The Oceans. Their physics, chemistry and general biology**, 2, Prentice-Hall, 1946

Varela, R y Rosón, G, **Métodos en oceanografía Física**, 1, Anthia., 2008

Complementary Bibliography

Beer, T, **Environmental Oceanography. An introduction to the behavior of coastal waters**, Pergamon Press, 1983

Newman, G y Pierson, Jr, WJ, **Principles of Physical Oceanography**, Prentice-Hall, 1966

Kennish, MJ, **Practical handbook of Marine Science**, 3, CRC Press, 2001

Recommendations**Subjects that 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	
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
CB4	Students can communicate information, ideas, problems and solutions to both specialist and non-specialist audiences
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
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
CE5	Basic knowledge of research methodology in oceanography
CE6	Ability to identify and understand the problems in the field of oceanography
CE8	To understanding the fundamentals of the laws that regulate the use of the marine environment and its resources
CE9	To be familiar with the public and private, national and international organizations and institutions related to the Marine Sciences
CE12	To be able to operate the instrumental techniques applied to sea
CE13	To acquire, evaluate, process and interpret oceanographic data within the theories currently in use
CE14	To recognize and analyze new problems and to propose problem-solving strategies
CE15	To recognize and implement good scientific practice in measurement and experimentation, both in the field and in the laboratory
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
CE18	To transmit writing, verbal and graphical information for audiences of various types
CE20	To find and evaluate marine resources of various kinds
CE26	To plan, direct and write technical reports on marine issues
CT2	Organization and planning skills
CT7	Decision making
CT15	Ability to apply knowledge in practice

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 UNIT IV-: MARINE SEISMIC SURVEYING	THEME 5.- Marine Seismic surveying: conceptual aspects. THEME 6.- Description of the diferents equipment and collected records
THEMATIC UNIT V-: MARINE GRAVIMETRY SURVEYING	THEME 7.- Gravimetry surveying and its application to marine research.
THEMATIC UNIT -VI-: MARINE MAGNETIC SURVEYING	THEME 8.- Magnetic surveying and its application to marine research.
THEMATIC UNIT-VII-: MARINE GEOTHERMAL FLOW	THEME 9.- Geothermal flow and its application to marine research.
THEMATIC UNIT -VIII: ELECTROMAGNETIC AND RADIOMETRIC SURVEYING IN MARINE ENVIRONMENTS	THEME 10.- Electromacnetic and radiometric surveying and its application to marine research.
THEMATIC UNIT IX-: SAMPLING SEDIMENTS AND ROCKS METHODS IN SHELF AND DEEP SEA ENVIRONMENTS.	THEME 11.- Sampler methods for Particulate Suspended Matter and bottom sediment samples at deep environments.
GEOTHECNICS TECHNICS	THEME 12.- Deep sea coring technics. methods. Ocean Drilling Projects. THEME 13.- Geophysical observation into the corers.
THEMATIC UNIT X-: OCEANOGRAPHY INFRASTRUCTURES	THEME 14.: Sampler platforms in geological oceanography. THEME 15: New technology in submarine observatoties.
THEMATIC UNIT -XI: PLANNING OCEANOGRAPHIC SURVEYS	THEME 16.: Project and planification of oceanographic surveys.

Planning

	Class hours	Hours outside the classroom	Total hours
Introductory activities	1	0	1
Lecturing	24	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

	Description
Introductory activities	Detailed introduction about the content of the subject and the methodology followed aswell as the form of evaluation, field trips, practical classes and seminars. The materials necessary to follow lecturesrs ans practical sessions and references will be presented.
Lecturing	This include the theoretical contents about all methods used in Oceanography Geology surveys, including selected aplicated examples. The student will be evaluated about this content in a final exam.
Laboratory practical	Laboratory practices consist of three 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 there ability to work as a team and his ability to make an oral presentation on a scientific topic. In the ensuing discussion, the capacity for synthesis and understanding of the proposed topic will be evaluated. The activity is MANDATORY.

Seminars	<p>The seminars that students will have to hold and deliver, consists of three sessions:</p> <ol style="list-style-type: none"> 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. <p>These activities are MANDATORY.</p>
Studies excursion	<p>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.).</p> <p>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".</p> <p>Some of the collected data will be worked out in practical sessions.</p> <p>The activity is MANDATORY.</p>

Personalized assistance

Methodologies	Description
Introductory activities	<p>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.</p>
Lecturing	<p>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.</p>
Laboratory practical	<p>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.</p>
Studies excursion	<p>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 achieved and collected data.</p>
Mentored work	<p>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.</p>
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
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
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
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

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

Hailwood, E.A., Kidd, R., **Marine Geological Surveying and Sampling. Marine geophysical Researches.**, Kluwer academic Publishers. 12:169pp,

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

Jones, E.J.W., **Marine Geophysics**, John Wiley & Sons, LTD. Chichester. 466 pp.,

Kearey, Ph. Brooks, M., Hill, I., **An Introduction to Geophysical exploration Third edition**, Blacwell Scientific Publications, 262 pp.,

Lowrie, W., **Fundamentals of Geophysics. Second Edition.**, Cambridge University Press, 354 pp.,

Mudroch, A. y Azcue, J.M., **Handbook of Techniques for Aquatic Sediments Sampling. Second Edition.**, Lewis Publishers. London. 256 pp.,

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

NOAA - National Geophysical Data Center, <http://www.ngdc.noaa.gov/mgg/mggd.html>,

Complementary Bibliography

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

Kennet, J., **Marine geology**, Prentice-Hall, inc., 813 pp,

Lillie, R.J., **Whole Earth Geophysicist. An introductory textbook for Geologist & Geophysicists.**, Prentice Hall, Inc. 361 pp.,

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

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

Mienert, J., Weaver, P., (Eds), **European margin sediment dynamics. Side scan sonar and seismic images.**, Springer.,

Rebesco M, Camerlenghi A (eds), **Contourites**, Developments in Sedimentology, 60, Elsevier, pp 688,

Reynolds, J.M., **An Introduction to Applied and Environmental Geophysics.**, John Wiley, Chichester.,

Seibold, E. y Berger, W.H., **The Sea Floor. An Introduction to Marine geology. 3rd edition.**, Springer Verlag, 369 pp.,

Shanmugam, G., **Deep-Water Processes and Facies Models: Implications for Sandstone Petroleum Reservoirs: 5 (Handbook of Petroleum Exploration and Production).**, Elsevier Science, 496 pp.,

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

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

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

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

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

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

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

Recommendations

Subjects that continue the syllabus

Applied marine geology/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	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. 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.			

Competencies

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
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
CB4	Students can communicate information, ideas, problems and solutions to both specialist and non-specialist audiences
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
CE3	Critical understanding of the history and current status of the Marine Sciences
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
CE5	Basic knowledge of research methodology in oceanography
CE6	Ability to identify and understand the problems in the field of oceanography
CE8	To understanding the fundamentals of the laws that regulate the use of the marine environment and its resources
CE9	To be familiar with the public and private, national and international organizations and institutions related to the Marine Sciences
CE12	To be able to operate the instrumental techniques applied to sea
CE13	To acquire, evaluate, process and interpret oceanographic data within the theories currently in use
CE14	To recognize and analyze new problems and to propose problem-solving strategies
CE15	To recognize and implement good scientific practice in measurement and experimentation, both in the field and in the laboratory
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
CE18	To transmit writing, verbal and graphical information for audiences of various types
CE22	To control marine pollution problems
CE27	To understand the operation details of enterprises linked to the marine environment, and to recognize their specific problems and solutions
CE30	Identify and assess environmental impacts in the marine environment

CE32 Quality control of seafood

CE35 Water quality control in water treatment plants

CT1 Analysis and synthesis ability

CT3 Written and oral communication in the official languages of the University

CT6 Problem management and solving skills

CT17 Sensitivity towards environmental issues

Learning outcomes

Learning outcomes	Competences		
Recognise the main characteristics of the wastewater. Classify the wastewater depending on their origin.	CB1	CE1	CT1
	CB2	CE8	CT17
	CB3	CE27	
	CB4	CE35	
Knowing the main technologies used for wastewater treatment and choosing the suitable one depending on the wastewater properties.	CB1	CE14	CT1
	CB2	CE18	CT17
	CB3	CE22	
	CB4	CE27	
		CE35	
Elaborate scientific documents with own data obtained by means of a simulation software	CB1	CE1	CT1
	CB2	CE8	CT3
	CB3	CE14	
	CB4	CE18	
	CB5	CE35	
Recognise the main methodologies of sea water desalination	CB1	CE1	CT1
	CB3	CE3	CT17
	CB4	CE8	
		CE9	
		CE14	
		CE27	
Knowing the potential of the marine environment as a source of marketable products by means of biotechnological processes	CB1	CE1	CT1
	CB2	CE3	
	CB3	CE8	
	CB4	CE9	
	CB5	CE14	
		CE27	
Enumerate the most important points regarding the setup of a control plan about marine pollution.	CB2	CE1	CT3
	CB4	CE3	CT6
	CB5	CE5	CT17
		CE6	
		CE13	
		CE14	
		CE16	
		CE18	
		CE22	
		CE30	
	CE35		
Choose and use the suitable material for sediments sampling. Choose the most important sentinel organisms for studying marine pollution.	CB3	CE1	CT3
	CB4	CE4	CT6
	CB5	CE5	CT17
		CE6	
		CE12	
		CE13	
		CE15	
		CE16	
		CE17	
		CE18	
		CE22	
	CE30		

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

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		
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
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
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
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
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 aswered. 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

Other comments on the Evaluation

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

<http://mar.uvigo.es/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 rouel R., **Hydrologie des  cosyst mes marins: param tres et analyses**, Editions Quae, 2004

Garc a Est vez J.M., Olabarr a C., P rez S., Rol n  lvarez E., Ros n G., **M todos y T cnicas en Investigaci n Marina**, Tecnos-Anaya, 2011

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

Complementary Bibliography

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

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

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

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

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

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

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

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

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

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

Recommendations

Subjects that it is recommended to have taken before

Chemical oceanography I/V10G060V01304

Chemical oceanography II/V10G060V01403

Chemistry applied to the marine environment I/V10G060V01505

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	
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
CB4	Students can communicate information, ideas, problems and solutions to both specialist and non-specialist audiences
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
CE13	To acquire, evaluate, process and interpret oceanographic data within the theories currently in use
CE14	To recognize and analyze new problems and to propose problem-solving strategies
CE16	To plan, design and implement applied research from the recognition stage to the final evaluation of results and discoveries
CE18	To transmit writing, verbal and graphical information for audiences of various types
CE19	To map and characterize the seabed and the underground in marine and coastal areas
CT1	Analysis and synthesis ability
CT6	Problem management and solving skills
CT15	Ability to apply knowledge in practice

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
Interpretation of paleoceanographic proxies	CB3 CB4	CE1 CE2 CE5 CE14 CE18	CT1 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 se-level oscillation 4.3. Sequences and models of sequences.
SUBJECT 5. PALEOCEANOGRAPHY AND PALAEOCLIMATOLOGY	5.1. Palaeoceanography and plaeoclimatology proxies 5.2. Natural mechanisms of climatic and oceanographic changes

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	18	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. Paleocceanographic 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

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
Seminars	Reports of Seminars	30		CE5 CE13 CE14 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

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

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

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

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

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

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

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

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

Complementary Bibliography

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

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

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**Bioloxía de peixes e mariscos**

Subject	Bioloxía 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	
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.
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.
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.
CB4	Que os estudantes poidan transmitir información, ideas, problemas e solución a un público tanto especializado coma non especializado.
CB5	Que os estudantes desenvolvan aquelas habilidades de aprendizaxe necesarias para emprender estudos posteriores cun alto grao de autonomía.
CE4	Coñecer as técnicas básicas de mostraxe na columna de auga, organismos, sedimentos e fondos, así como de medida de variables dinámicas e estruturais
CE8	Comprender os principios das leis que regulan a utilización do medio mariño e os seus recursos
CE10	Coñecer a problemática e os principios básicos da sustentabilidade en relación coa utilización e explotación do medio mariño
CE11	Planificar usos do litoral e do medio mariño e xestión sustentable dos recursos
CE13	Tomar datos oceanográficos, avalialos, procesalos e interpretalos con relación ás teorías en uso
CE17	Saber traballar en campañas e en laboratorio de xeito responsable e seguro, fomentando as tarefas en equipo
CE18	Transmitir información de forma escrita, verbal e gráfica para audiencias de diversos tipos
CE19	Caracterizar, clarificar e cartografiar fondos mariños, subsolos mariños e áreas litorais
CE20	Buscar e avaliar recursos de orixe mariña, de diversas clases
CT1	Capacidade de análise e síntese
CT3	Comunicación oral e escrita nas linguas oficiais da Universidade
CT6	Resolución de problemas
CT8	Capacidade de traballar nun equipo

Resultados de aprendizaxe

Learning outcomes	Competences		
Capacidade de aplicar os coñecementos na práctica	CB1	CE4	CT1
	CB2	CE8	CT3
	CB3	CE10	CT6
	CB4	CE11	
	CB5	CE13	
		CE17	
		CE18	
		CE19	
		CE20	

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

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. Migracións. 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 Reproducción 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

	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 aclararánse dúbidas, e no terceiro orientarase o traballo de exposición. Nas tutorías avaliarase o traballo independente dos alumnos. Os temas para a realización do traballo serán variados, admitiéndose temas suxeridos polos alumnos.

Lección maxistral	O profesor fará aa 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 audiovisuales 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 bon 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 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.
Prácticas de laboratorio	Ao comenzo de cada práctica explícanse 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		
Prácticas de laboratorio	Examen	15	CB1	CE4	CT1
			CB2	CE8	CT3
			CB3	CE18	CT6
			CB4	CE20	CT8
			CB5		
Seminario	Traballo redactado ou expositivo	10	CB1	CE4	CT1
			CB2	CE8	CT3
			CB3	CE18	CT6
			CB4	CE20	CT8
			CB5		
Lección maxistral	Examen	75	CB1	CE4	CT1
			CB2	CE8	CT3
			CB3	CE18	CT6
			CB4	CE20	CT8
			CB5		
Resolución de problemas e/ou exercicios	Exame tipo test	40	CB1	CE4	CT1
Exame de preguntas obxectivas	Preguntas curtas	30	CB1	CE4	CT1
			CB2	CE18	CT3
			CB3		CT6
			CB4		
Exame de preguntas de desenvolvemento	Temas a desenvolver	30	CB1	CE4	CT1
			CB2	CE18	CT3
			CB3		
			CB4		

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

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

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

	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	
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
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	

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

GARCIA DELGADO, J.KL; MYRO, R., **Economía Española. Una Introducción**, 2012

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

GARZA, M.D., Coord., **La actividad pesquera a escala mundial**, 2008

VARELA, M., COORD., **Unha estratexia marítima para Galicia**, 2010

GONZÁLEZ LAXE, F., **Lecciones de Economía Pesquera**, 2008

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

INSTITUTO NACIONAL DE ESTADÍSTICA Anuario estadístico de España, España en cifras, otras publicación, www.ine.es, 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	
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
CE1	To know the vocabulary, codes and concepts inherent to the oceanographic scientific field
CE3	Critical understanding of the history and current status of the Marine Sciences
CE5	Basic knowledge of research methodology in oceanography
CE6	Ability to identify and understand the problems in the field of oceanography
CE9	To be familiar with the public and private, national and international organizations and institutions related to the Marine Sciences
CE11	To manage the use of littoral and coastal region and their resources in a sustainable way
CE12	To be able to operate the instrumental techniques applied to sea
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
CE18	To transmit writing, verbal and graphical information for audiences of various types
CE19	To map and characterize the seabed and the underground in marine and coastal areas
CE26	To plan, direct and write technical reports on marine issues
CE37	Technical advice or assistance on issues related to the marine and coastal environment
CT1	Analysis and synthesis ability
CT5	Information technology skills (search and data analysis)

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	Qualification	Evaluated 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

Complementary Bibliography

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

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

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	
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
CT2	Organization and planning skills
CT11	Ability to learn independently and continuously

Learning outcomes			
Learning outcomes	Competences		
Hability to calculate ocean dynamic solutions using numerical simulation models.	CB3	CE29	CT2
	CB5		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	
CE11	To manage the use of littoral and coastal region and their resources in a sustainable way
CE17	Ability to survey in the field and to work in the laboratory responsibly and safely, encouraging team work
CE18	To transmit writing, verbal and graphical information for audiences of various types
CE20	To find and evaluate marine resources of various kinds
CE22	To control marine pollution problems
CE23	To design, control and manage recovery centers for threatened marine species
CE26	To plan, direct and write technical reports on marine issues
CE27	To understand the operation details of enterprises linked to the marine environment, and to recognize their specific problems and solutions
CE30	Identify and assess environmental impacts in the marine environment
CE32	Quality control of seafood
CE33	Fisheries control
CE34	To design, control and manage aquaculture production plants
CE35	Water quality control in water treatment plants
CE36	aquariology
CT8	Teamwork ability
CT15	Ability to apply knowledge in practice

Learning outcomes

Learning outcomes	Competences	
Acquire basic knowledge of Parasitology and identify the main pathogenic parasite groups of marine organisms.	CE18	CT8
	CE22	CT15
	CE23	
	CE26	
	CE27	
	CE30	
	CE32	
	CE33	
	CE34	
	CE35	
	CE36	

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. PROTROZOOLOGY	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

Rohde, K., **Marine Parasitology**, 2005

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

J.M. Willey; L.M. Sherwood & C.J. Woolverton, **Prescott Microbiology**, 10, 2017

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

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

Complementary Bibliography

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

L. Roberts J. Janovy, Jr. & S. Nadler, **Foundations of Parasitology**, 9, 2013

Williams, H. & Jones, A., **Parasitic Worms of Fish**, 1994

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

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

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

Austin, B., **Infectious Disease in Aquaculture**, 2012

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

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	
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
CB4	Students can communicate information, ideas, problems and solutions to both specialist and non-specialist audiences
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
CE8	To understanding the fundamentals of the laws that regulate the use of the marine environment and its resources
CE10	To know the problems and the basic principles of sustainability in relation to the use and exploitation of the marine environment
CE12	To be able to operate the instrumental techniques applied to sea
CE14	To recognize and analyze new problems and to propose problem-solving strategies
CE15	To recognize and implement good scientific practice in measurement and experimentation, both in the field and in the laboratory
CE17	Ability to survey in the field and to work in the laboratory responsibly and safely, encouraging team work
CE18	To transmit writing, verbal and graphical information for audiences of various types
CE20	To find and evaluate marine resources of various kinds
CE24	To participate and carry out training and outreach programs on the marine and coastal environments
CE32	Quality control of seafood
CE33	Fisheries control
CE36	aquariology
CT6	Problem management and solving skills
CT11	Ability to learn independently and continuously

Learning outcomes

Learning outcomes	Competences
-------------------	-------------

To. Specific:	CB5	CE1 CE2 CE5 CE6 CE8 CE10 CE12 CE14 CE15 CE17 CE18 CE20 CE24 CE32 CE33 CE36	CT6 CT11
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			
To. Specific:	CB3	CE1 CE2 CE10 CE12 CE17 CE18 CE20 CE24 CE32 CE33 CE36	
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			
To. Specific:	CB5	CE20 CE36	CT11
Actitudinales (be): Autonomous; Able to design experiments			
B. Transversal/Generic:	CB4		CT6 CT11
- Personal: critical Reasoning; Work in team			
- Others: capacity to apply the theoretical knowledges in the practice; use of Internet like media and like source of information			

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
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 CE8 CE14 CE32 CE33 CE36	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

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

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

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

Complementary Bibliography

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

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	
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
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
CT4	Basic computing skills related to the field of study
CT5	Information technology skills (search and data analysis)

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.
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.	2.5.1.- Absorption. 2.5.2.- Dispersion. 2.5.3.- Broadcast.

3.- ELEMENTS OF A SYSTEM OF Objective

TELEDETECTION:

In this unit enters to the student in the characteristics that define to a sensor and space platform as well as the steps required from the capture of an image by a sensor until his application and utilisation by part of an user. Finally they describe the most used satellites.

Contents:

3.1. System of reception of images
 Elements of the system
 Platform and sensor
 Orbits
 Resolution of a sensor
 Types of sensors
 Platforms

4.- *ANALISIS And DIGITAL TREATMENT OF Objective

IMAGES:

In this unit establish the principles of visual and digital interpretation as well as the processing of the information with the object to delete errors (correction), improve some appearance of the information obtained (enhance) or obtain other parameters from the data of radiance (transformations). Finally it will enter to the student in the digital classification and the integration of information in systems of geographic information.

Contents:

4.1. Visual analysis
 4.1.1. Criteria of Interpretation
 4.2. Digital treatment
 4.2.1. Digital image
 4.2.2. Corrections
 4.2.3. It enhance
 4.2.4. Transformations

5.- APPLICATIONS

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	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		
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
Lecturing	The lesson *magistral is the method mainly employee, using in the measure of the possible the lesson had a conversation.	0	CB1 CB2		
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>