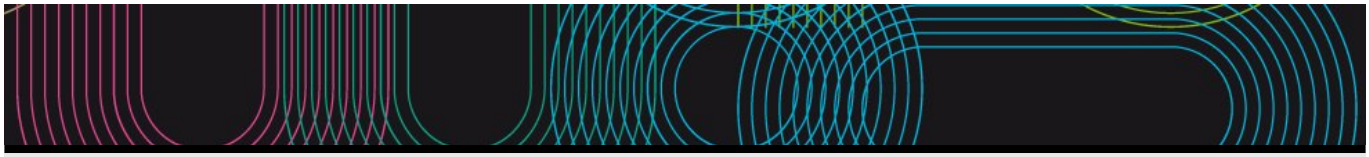

IDENTIFYING DATA				
Biological oceanography II				
Subject	Biological oceanography II			
Code	V10G060V01601			
Study programme	(*)Grao en Ciencias do Mar			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	3rd	2nd
Teaching language	Spanish			
Department				
Coordinator	Marañón Sainz, Emilio			
Lecturers	Marañón Sainz, Emilio Martínez García, Sandra 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	
A1	Students have demonstrated knowledge and understanding in a field of study that builds upon their general secondary education, and is typically at a level that, whilst supported by advanced textbooks, includes some aspects that will be informed by knowledge of the forefront of their field of study
A2	Students can apply their knowledge and understanding in a manner that indicates a professional approach to their work or vocation, and have competences typically demonstrated through devising and sustaining arguments and solving problems within their field of study
A3	Students have the ability to gather and interpret relevant data (usually within their field of study) to inform judgments that include reflection on relevant social, scientific or ethical issues
A4	Students can communicate information, ideas, problems and solutions to both specialist and non-specialist audiences
C1	To know the vocabulary, codes and concepts inherent to the oceanographic scientific field
C2	To know and understand the essential facts, concepts, principles and theories related to oceanography
C6	Ability to identify and understand the problems in the field of oceanography
C13	To acquire, evaluate, process and interpret oceanographic data within the theories currently in use
D1	Analysis and synthesis ability
D6	Problem management and solving skills

Learning outcomes			
Expected results from this subject	Training and Learning Results		
Know and understand how organisms and communities drive the cycling of matter in the ocean, linking the physiological and ecological traits of key functional groups with their biogeochemical role.	A1 A3	C1 C2	D1
Ability to connect the different physical, chemical and biological processes that determine the role of the ocean within the Earth system.	A1 A2 A3 A4	C1 C2 C6	D1
Know and understand the natural and anthropogenic variability in pelagic ecosystems and marine biogeochemical cycles, as well as their response to processes of global environmental change.	A1 A3	C1 C2 C6	D1

Ability to interpret biological oceanography data.	A3	C13	D1 D6
Ability to use computing applications to run mathematical models of biogeochemical processes.		C13	D6
Ability to use specialised bibliography	A3		D1

Contents	
Topic	
Unit 1. Introduction	Distribution and abundance of chemical elements in the sea. Metabolic pathways and key plankton functional groups. Properties of element cycles.
Unit 2. Production of organic matter.	Variability and control of primary production. Stoichiometry of phytoplankton production. Dynamics of dissolved organic matter. New and regenerated production. Trophic organization and biogeochemical functioning of the ecosystem.
Unit 3. Remineralization.	Distributions of nutrients and oxygen. Oxygen utilization rates. Stoichiometric relations. Heterotrophic processes: quantification and variability. Photosynthesis respiration balance. Balance between N2 fixation and denitrification. Global nitrogen cycle.
Unit 4. Export.	The biological pump. Methodological issues. Spatio-temporal variability in export. Attenuation of vertical fluxes: controlling factors. Shallow and deep sedimentation. Coast-ocean gradients.
Unit 5. Biogeochemical processes in the sediments.	Physical structure of the sediment. Coast-ocean gradients. Reactions of organic matter oxidation. Redox potential. Spatio-temporal variability in benthic fluxes. Global carbon budget in the sediments.
Unit 6. The global carbon cycle.	Chemistry of dissolved inorganic carbon (DIC). Distribution and abundance of main DIC forms. CO2 fluxes between ocean and atmosphere. The biological pump and the solubility pump. Global C cycle: current unbalances.
Unit 7. The calcium carbonate cycle.	CaCO3 oceanic budget. Carbonate saturation. Production, export and redissolution of CaCO3. Distribution of carbonates in the sediments. Pelagic calcification: coccolithophore blooms and biogeochemical impacts.
Unit 8. Global change and the biology of the ocean.	Multiple environmental stressors. Warming. Acidification. Deoxygenation. Eutrophication. Impacts on species, communities, ecosystems and biogeochemical cycles. Global feedback processes.
Seminar program.	Biomass, production and growth of phytoplankton. Ecological and biogeochemical role of iron. Distribution patterns of diatoms and coccolithophores. Ocean acidification. Designing observations and experiments for hypothesis testing.
Practical session program.	Data analysis of phytoplankton cell size, abundance and metabolism. Modelling the global carbon cycle using computer models. Case analysis.

Planning			
	Class hours	Hours outside the classroom	Total hours
Lecturing	22.5	49.5	72
Seminars	10	15	25
Problem solving	10	25	35
Practices through ICT	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 exlored in detail. Subjects tackled include, amongst others, the ecology and biogeochemical role of diatoms and coccolithophores, the ecological and biogeochemical importance of iron, and ocean acidification.
Problem solving	Practical cases are solved using real data presented numerically and graphically.
Practices through ICT	Numerical modelling of the carbon biogeochemical cycle. Analysis of data on the size-scaling of phytoplankton abundance, biomass and metabolism.

Personalized assistance	
Methodologies	**Description**

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

Assessment

	Description	Qualification	Training and Learning Results		
Seminars	Students write a short assay in which they provide a critical synthesis of a scientific article. The clarity and correctness of the writing, as well as the rigour in the use and application of scientific concepts, are particularly valued. The mark obtained is conserved for the July call. Upon consultation with the course's coordinator, students may resubmit this work for the July call.	20	A2 A3 A4	C13	
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.	20	A2 A4		D6
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.	60	A1 A2	C1 C2 C6	D1 D6

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, Kircvhman (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

Biological oceanography I/V10G060V01502
Physical oceanography I/V10G060V01503

Contingency plan

Description

=== EXCEPTIONAL PLANNING ===
Given the uncertain and unpredictable evolution of the health alert caused by COVID-19, the University of Vigo establishes an extraordinary planning that will be activated when the administrations and the institution itself determine it, considering safety, health and responsibility criteria both in distance and blended learning. These already planned measures guarantee, at the required time, the development of teaching in a more agile and effective way, as it is known in advance (or well in advance) by the students and teachers through the standardized tool.

=== ADAPTATION OF THE METHODOLOGIES ===
* Teaching methodologies maintained

All methodologies are maintained, with modifications, when needed, for online implementation.

* Teaching methodologies modified

The computer-based modelling of the carbon cycle is modified so that the use of restricted software will not be necessary.

* Non-attendance mechanisms for student attention (tutoring)

Students can request, via e-mail, personalised tutoring sessions, which will take place online using the Camus Remoto application.

* Modifications (if applicable) of the contents

* Additional bibliography to facilitate self-learning

* Other modifications

=== ADAPTATION OF THE TESTS ===

All tests remain unchanged. The only difference is that, if needed, the exam will be conducted online using Faitic.