



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	Choose	Year	Quadmester
	6	Mandatory	3rd	2nd
Teaching language	Spanish Galician			
Department				
Coordinator	Moldes Moreira, Diego Leao Martins, Jose Manuel			
Lecturers	Calle González, Inmaculada de la Leao Martins, Jose Manuel Moldes Moreira, Diego			
E-mail	leao@uvigo.es diego@uvigo.es			
Web				
General description	<p>The student will acquire competences and skills on several topics of the chemistry in the marine environment. In the first part of the subject, students will tackle important application such as wastewater treatment, desalination and marine biotechnology.</p> <p>In the second part will acquire theoretical and practical competences in the analysis of chemical contaminants as well as other compounds of interest in the marine environment. In this case they will learn to use simple techniques for sample preparation prior to the measurement step and their applications in the compartments of the marine environment. The students will get knowledge about the relevance of the control of the environmental quality.</p>			

Competencies

Code	
A1	Students have demonstrated knowledge and understanding in a field of study that builds upon their general secondary education, and is typically at a level that, whilst supported by advanced textbooks, includes some aspects that will be informed by knowledge of the forefront of their field of study
A2	Students can apply their knowledge and understanding in a manner that indicates a professional approach to their work or vocation, and have competences typically demonstrated through devising and sustaining arguments and solving problems within their field of study
A3	Students have the ability to gather and interpret relevant data (usually within their field of study) to inform judgments that include reflection on relevant social, scientific or ethical issues
A4	Students can communicate information, ideas, problems and solutions to both specialist and non-specialist audiences
A5	Students have developed those learning skills that are necessary for them to continue to undertake further study with a high degree of autonomy
C1	To know the vocabulary, codes and concepts inherent to the oceanographic scientific field
C3	Critical understanding of the history and current status of the Marine Sciences
C4	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
C5	Basic knowledge of research methodology in oceanography
C6	Ability to identify and understand the problems in the field of oceanography
C8	To understanding the fundamentals of the laws that regulate the use of the marine environment and its resources
C9	To be familiar with the public and private, national and international organizations and institutions related to the Marine Sciences
C12	To be able to operate the instrumental techniques applied to sea
C13	To acquire, evaluate, process and interpret oceanographic data within the theories currently in use
C14	To recognize and analyze new problems and to propose problem-solving strategies

C15	To recognize and implement good scientific practice in measurement and experimentation, both in the field and in the laboratory
C16	To plan, design and implement applied research from the recognition stage to the final evaluation of results and discoveries
C17	Ability to survey in the field and to work in the laboratory responsibly and safely, encouraging team work
C18	To transmit writing, verbal and graphical information for audiences of various types
C22	To control marine pollution problems
C27	To understand the operation details of enterprises linked to the marine environment, and to recognize their specific problems and solutions
C30	Identify and assess environmental impacts in the marine environment
C32	Quality control of seafood
C35	Water quality control in water treatment plants
D1	Analysis and synthesis ability
D3	Written and oral communication in the official languages of the University
D6	Problem management and solving skills
D17	Sensitivity towards environmental issues

Learning outcomes

Expected results from this subject	Training and Learning Results		
Recognise the main characteristics of the wastewater. Classify the wastewater depending on their origin.	A1 A2 A3 A4	C1 C8 C27 C35	D1 D17
Knowing the main technologies used for wastewater treatment and choosing the suitable one depending on the wastewater properties.	A1 A2 A3 A4	C14 C18 C22 C27 C35	D1 D17
Elaborate scientific documents with own data obtained by means of a simulation software	A1 A2 A3 A4 A5	C1 C8 C14 C18 C35	D1 D3
Recognise the main methodologies of sea water desalination	A1 A3 A4	C1 C3 C8 C9 C14 C27	D1 D17
Knowing the potential of the marine environment as a source of marketable products by means of biotechnological processes	A1 A2 A3 A4 A5	C1 C3 C8 C9 C14 C27	D1
Enumerate the most important points regarding the setup of a control plan about marine pollution.	A2 A4 A5	C1 C3 C5 C6 C13 C14 C16 C18 C22 C30 C35	D3 D6 D17

Choose and use the suitable material for sediments sampling. Choose the most important sentinel organisms for studying marine pollution.	A3	C1	D3
	A4	C4	D6
	A5	C5	D17
		C6	
		C12	
		C13	
		C15	
		C16	
		C17	
		C18	
		C22	
		C30	
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.	A2	C1	D1
	A3	C3	D3
	A4	C5	D6
	A5	C6	D17
		C12	
		C13	
		C14	
		C15	
		C16	
		C17	
		C18	
		C22	
		C30	
		C32	
Being able to determine the concentration of a chemical compound in the marine environment depending on the analytical technique employed.	A2	C4	D1
	A3	C5	D3
	A4	C6	D6
	A5	C12	
		C13	
		C15	
		C16	
		C18	
		C22	
		C32	
		C35	
Apply the fundamental concepts of quality control in an analytical laboratory.	A2	C1	D1
	A3	C4	D3
	A5	C5	D6
		C9	D17
		C13	
		C15	
		C16	
		C17	
		C18	
		C22	
		C32	
		C35	

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 biotoxins.	Chemical structure of marine biotoxins. Toxicity of marine biotoxins. 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
Practices through ICT	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
Report of practices, practicum and external practices	0	2	2
Essay questions exam	1.5	3	4.5

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

Methodologies

	Description
Introductory activities	The syllabus will be presented to the students (mainly aims, competences and evaluation criteria). Moreover the activities of the semester will be presented.
Lecturing	The professor will make an exhibition of the contents of the syllabus to develop, where the professor can pose some question to the students for his resolution in class. Likewise, the students can ask to the professor the questions that go arising along the exhibition. The material of the presentation will be available for the students before the session and will have to assist to her with said material. At the end of each subject, or of each group of subjects, will have to make a questionnaire that will resolve individually.
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 and approved them in the previous course.
Laboratory practical	The students will make some lab practices regarding the analysis of environmental pollutants and will present the corresponding report that will be evaluated in agreement to the criteria published in the platform FAITIC. They do not have obligation to make these practices those students that already made them and approved in the previous course.
Practices through ICT	The students will make some practices of computer on the treatment of residual waters. They will consist in the utilisation of a simulator in which it will study the effect of diverse parameters in the process of treatment of the residual waters. The students will have to take data of the different parameters studied, which will be employed for the preparation of the Supervised Works.
Studies excursion	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
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Introductory activities	Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation
Mentored work	Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation
Presentation	Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation
Laboratory practical	Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation
Practices through ICT	Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation
Studies excursion	Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation
Lecturing	Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation

Assessment

	Description	Qualification	Training and Learning Results		
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, may conserve their qualifications.	2.5	A3 A4 A5	C5 C12 C13 C15 C16 C17 C18 C22	D1 D3 D6 D17
Studies excursion	The students will visit a wastewater treatment facility. After that, a brief questionnaire must be answer.	5	A1 A3	C9 C22 C27 C35	D17
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	A3 A4	C1 C4 C5 C6 C12 C13 C14 C15 C16 C17 C18 C22 C30 C32	D1 D3 D17
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	A2 A3 A4 A5	C1 C8 C14 C22 C30	D1
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	A2 A3 A4 A5	C13 C18 C22	D1 D3 D6 D17

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, may conserve their qualifications.	30	A2 A3 A4 A5	C1 C5 C6 C12 C13 C14 C16 C18 C22 C32	D1 D3 D6 D17
Report of practices, practicum and external practices	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, may conserve their qualifications.	10	A2 A3 A4 A5	C1 C5 C12 C13 C15 C18 C22 C32	D1 D3 D6 D17
Essay questions exam	When finalising lessons 1 to 3, as well as in the final examination (for these lessons), some questions should be answered by the students. This exam will count for 10% of the final qualification. At the end of the subject, some questions about the methodologies used in chemical analysis will be answered. It will count for 12,5% of the final qualification.	22.5	A2 A4	C1 C4 C6 C8 C9 C12 C13 C15 C18 C22 C27 C30 C32 C35	D1 D3 D17

Other comments on the Evaluation

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

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

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

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

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

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

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

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

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

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

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

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

Complementary Bibliography

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

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

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

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

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

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

Chemistry applied to the marine environment I/V10G060V01505

Contingency plan

Description

=== EXCEPTIONAL MEASURES SCHEDULED ===

In front of the uncertain and unpredictable evolution of the sanitary alert caused by the *COVID-19, the University of Vigo establishes an extraordinary planning that will activate in the moment in that the administrations and the own institution determine it attending to criteria of security, health and responsibility, and guaranteeing the teaching in a no face-to-face stage or partially face-to-face. These already scheduled measures guarantee, in the moment that was prescriptive, the development of the teaching of a more agile and effective way when being known in advance (or with a wide *antelación) by the students and the *profesorado through the tool normalised and institutionalised of the educational guides.

=== ADAPTATION OF THE METHODOLOGIES ===

* Educational Methodologies that will be kept

Introductory Activities

Lectures

Works

Practice with ICT support

Presentations

These methodologies will not be modified, but they will be adapted to the extraordinary situation by means of the utilisation of telematic tools like videoconferences through Campus Remoto, or similar, as well as the utilisation of FAITIC platform, although the utilisation of other tools could be possible in order to guarantee and facilitate the access of the students to the learning contents.

* Educational methodologies that modify

Visits: a virtual visit using Remote Campus will be performed; one of the most important wastewater treatment plants of the region can be visited by Google Maps; a virtual by using this tool, with explanations of the teacher, will be performed; also he or she will show photos of visits of previous years.

Lab Practices: the classes of laboratory will be substituted by short videos of the conventional lab practices. Later, the student will have to perform the activities programmed and indicated in the conventional syllabus.

* Mechanism of no face-to-face attention to the students (*tutorías)

The student will receive attention through the tool available at the Universidade of Vigo (Remote Campus) or similar, as well as by means of email, forums of Faitic, etc. The office hours will be previously booked.

* Modifications (if they proceed) of the contents to give

The contents will not suffer modifications.

* Additional bibliography to facilitate the car-learning

Recent articles will be provided related with the different topics showed in the subject. This activity, although it comes carrying out of general form, will have more importance in the plan of contingency.

* Other modifications

will be able to exist lower modifications in the contents and/or methodologies described in function of the progress of the students in the course using the telematic tools, always with the aim to guarantee the acquisition of competitions by part of the students of the most effective form possible.

=== ADAPTATION OF THE EVALUATION ===

* Test slopes that keep

Examination of questions of development (examination theory - Chemical Engineering): [previous Weight 10%] [Weight Proposed 20%]

Examination of objective questions (examination test theory - Chemical Engineering): [previous Weight 15%] [Weight Proposed 0%]

Visit questionnaire/virtual visit (Chemical Engineering): [previous Weight 5%] [Weight Proposed 5%]

Work - scientific article (Chemical Engineering): [previous Weight 20%] [Weight Proposed 25%]

Examination of objective questions (examination test theory - Chemical Analytical): [previous Weight 0%] [Weight Proposed 10%]

Examination of questions of development (examination theory - Chemical Analytical): [previous Weight 12,5%] [Weight Proposed 0%]

Resolution of problems and/or exercises (Analytical Chemistry): [previous Weight 12,5%] [Weight Proposed 10%]

Work *tutelado (Analytical Chemistry): [previous Weight 10%] [Weight Proposed 12,5%]

Report of practices of laboratory (Analytical Chemistry): [previous Weight 12,5%] [Weight Proposed 15%]

Presentation (Analytical Chemistry): [previous Weight 2,5%] [Weight Proposed 2,5%]

* Proofs that modify

[Examination of objective questions (Chemical Engineering)] => [Examination of questions of development (Chemical Engineering)]

[Examination of questions of development (Analytical Chemistry)] => [Examination of objective questions (Analytical Chemistry)]

* additional Information

This subject gives in two big blocks by part of two university departments different: Chemical Engineering and Analytical Chemistry, being manager, each one of them, of 50% of the educational allocation and of 50% of the evaluation. It specifies , by clarity, to which block corresponds each proof in the previous sections.
