Information about the subject

Degree: Bachelor of Degree in Marine Sciences

Faculty: Faculty of Veterinary Medicine and Experimental Sciences

Code: 273008 **Name:** Chemical Oceanography

Credits: 6,00 **ECTS Year:** 3 **Semester:** 1

Module: Professional

Subject Matter: Oceanography **Type:** Compulsory

Department: Oceanography and Environment

Type of learning: Classroom-based learning

Languages in which it is taught: Spanish

Lecturer/-s:

273A	Carolina Padron Sanz **(Responsible Lecturer)**	carolina.padron@ucv.es

Module organization

Professional

Subject Matter	ECTS	Subject	ECTS	Year/semester
Oceanography	36,00	Chemical Oceanography	6,00	3/1
		Geological Oceanography	6,00	3/1
		Marine Biology and Biological Oceanography	6,00	3/1
		Methods in Oceanography I: Physical and Geological	6,00	3/2
		Methods in Oceanography II: Chemical and Biological	6,00	3/2
		Physical Oceanography	6,00	3/1
Marine living resources	12,00	Aquaculture	6,00	3/2
		Fisheries	6,00	3/2
Marine and Coastal Management	18,00	Coastal Planning and Management	6,00	4/1
		Legislation and Economy	6,00	4/1
		Marine Pollution	6,00	4/1

Recommended knowledge

General chemistry basics: oxidation-reduction reactions, pH definition, acid-base equilibria and buffer solutions,

Learning outcomes

At the end of the course, the student must be able to prove that he/she has acquired the following learning outcomes:

R1	The student knows the chemical composition and speciation of seawater, with the mechanisms of entry, disposal and recycling of the elements and factors that affect its distribution.
R2	The student understands the equilibrium of chemical species and dissolved gases in ocean waters.
R3	The student understands the transfer mechanisms of elements between the interfaces: atmosphere-ocean and sediment-ocean.
R4	The student knows the most relevant biogeochemical cycles in oceanography: Carbon Cycle, Nutrient Cycle, Trace Metal Cycle.

Competencies

Depending on the learning outcomes, the competencies to which the subject contributes are (please score from 1 to 4, being 4 the highest score):

BASIC		Weighting			
		1	2	3	4
CB2	Students are able to apply knowledge to their work in a professional way and have the competences enabling them to state and defend views and opinions as well as perform problem-solving tasks in their field of study.		x		
CB4	Command of a foreign language			x	
CB5	Students develop the necessary learning skills to undertake further studies with a high level of autonomy.			x	

GENERAL		Weighting			
		1	2	3	4
CG1	Capacity to analyze and synthesize			x	
CG2	Capacity to organize and plan		x		
CG3	Mastering Spanish oral and written communication			x	
CG5	Knowing and applying Basic ITC skills related to marine science		x		
CG6	Capacity to manage information (capacity to look for and analyze information coming from different types of sources)				x
CG7	Decision making			x	
CG8	Capacity to work in interdisciplinary and multidisciplinary team				x
CG9	Interpersonal skills			x	
CG10	Critical and self-critical capacity				x

CG11	Capacity to learn			x	
CG12	Capacity to adapt to new situations		x		
CG13	Capacity to produce new ideas (creativity)		x		
CG16	Capacity to apply theoretical knowledge				x
CG17	Research skills			x	
CG18	Sensibility to environmental issues.				x

SPECIFIC		Weighting			
		1	2	3	4
CE1	Knowing and understanding contents, principles and theories related to Oceanography				x
CE2	Knowing basic sampling techniques of water column, organisms, sediment and sea-bottoms as well as basic techniques of dynamic and structural variable measurement				x
CE6	Applying marine instrument techniques			x	
CE7	Collecting, assessing, processing and interpreting oceanographic data, following the most recent theories				x
CE8	Identifying and analyzing new problems and proposing solution strategies			x	
CE9	Knowing how to carry out experiments and measurements both in the laboratory and during sample collection				x
CE10	Knowing how to use planning, designing and implementing research tools while surveying and assessing results			x	
CE11	Knowing how to do fieldwork and laboratory experiments in a safe and responsible way, promoting teamwork				x

Assessment system for the acquisition of competencies and grading system

Assessed learning outcomes	Granted percentage	Assessment method
R1, R2, R3, R4	50,00%	Written test with theoretical and practical questions
R1, R2, R3, R4	20,00%	Delivery of guided assignments, whose objectives and contents will be proposed by the teacher
R1, R2, R3, R4	20,00%	Laboratory test
R1, R2, R3, R4	10,00%	Oral presentation

Observations

According to the general evaluation and qualification regulations, the preferred evaluation system will be by means of continuous evaluation. Specifically:
There will be a series of activities to monitor theoretical and practical learning (through both individual -10%- and group work -10%-) which will be carried out throughout the semester.
The final written exam will have two parts: a theoretical part (70%) and a practical part (30%).
IMPORTANT: In order to obtain an average, students must have obtained at least a 5 out of 10 in each of the evaluation instruments.

MENTION OF DISTINCTION:
In accordance with the regulations governing the assessment and grading of subjects in force at UCV, the distinction of "Matrícula de Honor" (Honours with Distinction) may be awarded to students who have achieved a grade of 9.0 or higher. The number of "Matrículas de Honor" (Honours with Distinction) may not exceed five percent of the students enrolled in the group for the corresponding academic year, unless the number of enrolled students is fewer than 20, in which case a single "Matrícula de Honor" (Honours with 9 Distinction) may be awarded. Exceptionally, these distinctions may be assigned globally across different groups of the same subject. Nevertheless, the total number of distinctions awarded will be the same as if they were assigned by group, but they may be distributed among all students based on a common criterion, regardless of the group to which they belong. The criteria for awarding "Matrícula de Honor" (Honours with Distinction) will be determined according to the guidelines stipulated by the professor responsible for the course, as detailed in the "Observations" section of the evaluation system in the course guide.

Learning activities

The following methodologies will be used so that the students can achieve the learning outcomes of the subject:

M1 Teacher presentation of contents, analysis of competences, explanation and in-class display of skills, abilities and knowledge.

M2 Group work sessions supervised by the professor. Case studies, diagnostic tests, problems, field work, computer room, visits, data search, libraries, on-line, Internet, etc. Meaningful construction of knowledge through interaction and student activity.

M3 Activities carried out in spaces with specialized equipment.

M4 Supervised monographic sessions with shared participation.

M5 Application of multidisciplinary knowledge.

M6 Personalized and small group attention. Period of instruction and/or guidance carried out by a tutor to review and discuss materials and topics presented in classes, seminars, readings, papers, etc.

M8 Set of oral and/or written tests used in initial, formative or additive assessment of the student.

M9 Group preparation of readings, essays, problem-solving, seminars, papers, reports, etc. to be presented or submitted in theoretical , practical and/or small-group tutoring sessions. Work done on the university e-learning platform (www.plataforma.ucv.es)

M10 Student's study: Individual preparation of readings, essays, problem-solving, seminars, papers, reports, etc. to be presented or submitted in theoretical, practical and/or small-group tutoring sessions. Work done on the university e-learning platform (www.plataforma.ucv.es).

IN-CLASS LEARNING ACTIVITIES

	LEARNING OUTCOMES	HOURS	ECTS
ON-CAMPUS CLASS M1	R1, R2, R3, R4	30,00	1,20
PRACTICAL CLASSES M2	R1, R2, R3, R4	10,00	0,40
LABORATORY M3	R1, R2, R3, R4	10,00	0,40
SEMINAR M4	R1, R2, R3, R4	2,00	0,08
GROUP PRESENTATION OF ASSIGNMENTS M5	R1, R2, R3, R4	3,00	0,12
TUTORIAL M6	R1, R2, R3, R4	3,00	0,12
ASSESSMENT M8	R1, R2, R3, R4	2,00	0,08
TOTAL		**60,00**	**2,40**

LEARNING ACTIVITIES OF AUTONOMOUS WORK

	LEARNING OUTCOMES	HOURS	ECTS
GROUP WORK M9	R1, R2, R3, R4	40,00	1,60
INDEPENDENT WORK M10	R1, R2, R3, R4	50,00	2,00
TOTAL		**90,00**	**3,60**

Description of the contents

Description of the necessary contents to acquire the learning outcomes.

Theoretical contents:

Content block	Contents
INTRODUCTION TO CHEMICAL OCEANOGRAPHY.	Relevance of the chemistry on the Oceanographical sciences. Historical review of the Chemical Oceanography. Origin of seawater.
SEAWATER COMPOSITION	Transport of elements through rivers, atmosphere and hidrotermal vents. Major elements. Marcet Principle. Minor elements. Water column profiles. Historical review of seawater definitions.
OCEAN-ATMOSPHERE INTERFACE	Chemical aspects of the atmosphere. Stagnant boundary layer. Transference processes through the interface. Non reactive gasses: Solubility, interchange, distribution. Oxygen. Weiss equation. Oxygen distribution in the water column. Other dissolved gasses: CO2, H2, CH4 y N2.
SEDIMENT-WATER INTERFACE	Chemical diagenesis and redox processes in marine sediments. Interstitial waters. Changes in major and minor elements.
BIOGEOCHEMICAL CYCLES	Global carbon cycle. Nutrient cycle: Nitrogen, Phosphorus and Silicate.

Organization of the practical activities:

	Content	Place	Hours
PR1.	Hidrothermal vents	Lecture room	4,00
PR2.	Oxygen puzzle	Lecture room	2,00
PR3.	Seawater sampling. Physico-chemical description of the water column by using a multiparameter profiler	Boat	2,00
PR4.	Nitrate analysis from seawater samples	Laboratory	4,00
PR5.	Phosphate analysis from seawater samples	Laboratory	3,00
PR6.	Silicate analysis from seawater samples	Laboratory	3,00
PR7.	Data interpretation ("in situ" and lab data)	Lecture room	2,00

Temporary organization of learning:

Block of content	Number of sessions	Hours
INTRODUCTION TO CHEMICAL OCEANOGRAPHY.	3,00	6,00
SEAWATER COMPOSITION	8,00	16,00
OCEAN-ATMOSPHERE INTERFACE	6,00	12,00
SEDIMENT-WATER INTERFACE	6,00	12,00
BIOGEOCHEMICAL CYCLES	7,00	14,00

References

MILLERO, F.J. 2013. Chemical Oceanography. Fourth Edition. CRC Press, Boca Raton, Florida.

CHESTER, R. 2012. Marine Geochemistry. Third Edition. Blackwell Science, Oxford.

BROWN, E.; COLLING, A.; PARK, D.; PHILLIPS, J.; ROTHERY, D.; WHRIGHT, J. 1999. Sea Water: Its Composition, Properties and Behaviour. The Open University.

BROWN, J.; COLLING, A.; PARK, D.; PHILLIPS, J.; ROTHERY, D.; WHRIGHT, J. 1999. Ocean Chemistry and deep-sea sediments. The Open University.

CIFUENTES, J. L.; TORRES, M.P.; FRÍAS, M. “El océano y sus recursos II. Las ciencias del mar: Oceanografía Geológica y Oceanografía Química” Editorial Fondo De Cultura Económica (Fce). 170pp.

HORNE, R.A. "Marine Chemistry. The Structure of Water and the Chemistry of Hydrosphere” 1969. New York-London-Sydney-Toronto: Wiley-Interscience, A Division of John Wiley & Sons. 568 pp.

MURRAY, J. W. ”Chapter 1. Introduction” 9/27/04. University of Washington. 27pp.

PÉREZ GALVÁN, F.J.; TORRES PADRÓN, M. E. (2004). Métodos en Oceanografía II: Parte Química. Prácticas de Laboratorio. Las Palmas. Servicio de Publicaciones de la Universidad de Las Palmas de Gran Canaria.