Information about the subject

Degree: Bachelor of Science Degree in Marine Sciences

Faculty: Faculty of Veterinary Medicine and Experimental Sciences

Code: 273006 **Name:** Physical 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:

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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

Physics and Fluids Mechanics knowledge.

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 and applies in practical cases the fundamentals of physical oceanography.
R2	The student applies the general knowledge of physical oceanography.
R3	The student solves problems related to the temperature and salinity of seawater. TS Diagrams.
R4	The student knows the physical process and marine dynamics, waves, currents and tides.
R5	The student knows and applies the oceanographic data processing software.

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	
CG14	Leadership abilities.	x			
CG17	Research skills				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
CE15	Identifying and proposing monitoring means for problems of marine pollution	x			
CE17	Developing training programs for marine and coastal areas	x			

Assessment system for the acquisition of competencies and grading system

Assessed learning outcomes	Granted percentage	Assessment method
R1, R2, R3, R4	40,00%	Written test with theoretical and practical questions
R1, R2, R3, R4, R5	40,00%	Delivery of guided assignments, whose objectives and contents will be proposed by the teacher
R1, R2, R3, R5	10,00%	Problem-solving and issues related to the use of specific software
R1, R2, R4	10,00%	Oral presentation

Observations

In order to average a minimum mark of 5 out of 10 is required on the written test and in the other assessment methods. If a final mark of 5 points in each section is not obtained and it is only passed one of them, the subject will be failed although the weighted average will be equal to or greater than 5. The weighted average is also subjected to the presentation of all the work requested. Late delivery will lead toa penalty of 10% in the score.
Work delivery types will be individual and group. The percentage of evaluation of this assessment method is broken down into 20% for individual (or in pairs) deliveries and 20% for group work delivery. The minimum mark in both types of work should be at least 5 points.
The written test will consist on short questions and problems.
This item “Troubleshooting and issues related using specific software” corresponds to the ODV assessment.
The oral presentation should be delivered to teacher previously, on the date specified, for approval. Spelling mistakes may lower the mark by up to 10%. This, however, shall not apply to international exchange students.

MENTION OF DISTINCTION:
According to Article 22 of the Regulations governing the Evaluation and Qualification of UCV Courses, the mention of "Distinction of Honor" may be awarded by the professor responsible for the course to students who have obtained, at least, the qualification of 9 over 10 (“Sobresaliente”). The number of "Distinction of Honor" mentions that may be awarded may not exceed five percent of the number of students included in the same official record, unless this number is lower than 20, in which case only one "Distinction of Honor" may be awarded.

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	34,00	1,36
PRACTICAL CLASSES M2	R1, R2, R3, R4, R5	17,00	0,68
SEMINAR M4	R1, R2, R4	2,00	0,08
GROUP PRESENTATION OF ASSIGNMENTS M5	R1, R2, R4	2,00	0,08
TUTORIAL M6	R1, R2, R3, R4, R5	2,00	0,08
ASSESSMENT M8	R1, R2, R3, R4, R5	3,00	0,12
TOTAL		**60,00**	**2,40**

LEARNING ACTIVITIES OF AUTONOMOUS WORK

	LEARNING OUTCOMES	HOURS	ECTS
GROUP WORK M9	R1, R2, R3, R4, R5	40,00	1,60
INDEPENDENT WORK M10	R1, R2, R3, R4, R5	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
UNIT 1. PHYSICAL PROPERTIES OF SEAWATER	**Lesson 1.Temperature** 1.1 Heat balance 1.2 Definitions, units and magnitudes 1.3 Spatial distribution and in the water column of the temperature 1.4 Mixed layer formation processes **Lesson 2.Salinity** 2.1 Definitions, units and magnitudes 2.2 Spatial distribution and in the water column of the temperature 2.3 Salinity variations due to local conditions **Lesson 3.Density** 3.1 Definitions, units and magnitudes 3.2 Spatial distribution and in the water column of the density. 3.3 Equation of state (TEOS-10) 3.4 Effect of the temperature and salinity on the seawater density. **Lesson 4.Sound and sea ice** 4.1 Sound in the sea 4.2 Seawater freezing point 4.3 Freezing processes 4.4 Density and thermodynamics of sea ice 4.5 Brine rejection 4.6 Polynyas
UNIT 2. WATER MASSES	**Lesson 5. Water masses** 5.1 Types of water masses and their characteristics 5.2 TS-diagrams 5.3 Caballing 5.4 Vertical stability of water masses

UNIT 3. OCEAN CIRCULATION	**Lesson 6. Thermohaline circulation and wind response circulation** 6.1 Thermohaline circulation 6.2 Wind response circulation 6.2.1 Forces 6.2.2 Atmospheric circulation 6.2.3 Main oceanic currents 6.2.4 Western intensification. Inertial currents. 6.2.5 Langmuir circulation. 6.2.6 Ekman surface and bottom layer 6.2.7 Vertical circulation 6.2.6.1 Upwelling 6.2.8 Geostrophic flow
UNIDAD 4. WAVES, TIDES AND COASTAL OCEANOGRAPHY	**Lesson 7.Waves** 7.1 Airy theory 7.2 Wave formation 7.3 Wind 7.4 Sea and swell 7.5 Wave approximation 7.6 Storm surge. 7.7 Tsunamis. 7.8 Data base and measuring instruments **Lesson 8. Internal waves** 8.1. Characteristics 8.2. Layer model **Lesson 9. Tides** 9.1 Generation forces 9.2 Datum or reference level 9.3 Tide prediction 9.4 Form factor **Lesson 10. Estuaries** 10.1 Definition 10.2 Classifications 10.3 Estuarine circulation 10.4 Removal time

Organization of the practical activities:

	Content	Place	Hours
PR1.	Representation and interpretation of temperature, salinity and density profiles and sections using Ocean Data View software (ODV).	Computer	4,00
PR2.	Physical parameters sampling.	Boat	1,00
PR3.	Physical parameters sampling.	Marine station	2,00
PR4.	Representation and interpretation of TS diagrams using ODV and identification of water masses.	Computer	2,00
PR5.	Representation of the Ekman layer.	Lecture room	2,00
PR6.	Representation and interpretation of geostrophic currents (ODV).	Computer	2,00
PR7.	Form factor (F) exercises.	Lecture room	1,00
PR8.	Estuarine circulation exercises.	Lecture room	2,00

Temporary organization of learning:

Block of content	Number of sessions	Hours
UNIT 1. PHYSICAL PROPERTIES OF SEAWATER	9,00	18,00
UNIT 2. WATER MASSES	6,00	12,00
UNIT 3. OCEAN CIRCULATION	11,00	22,00
UNIDAD 4. WAVES, TIDES AND COASTAL OCEANOGRAPHY	4,00	8,00

References

BASIC:

Dijkstra, H.A. (2010). Dynamical oceanography. Utrech: Springer. 407 pp.

Karnauskas, K. (2020). Physical Oceanography and Climate. Cambridge: Cambridge University Press. 247 pp.

Knauss, J.A., (2000). Introduction to Physical Oceanography. Estados Unidos: Pearson Educación. 309 pp.

Pond, S. and Pickard, GL., (2003). Introductory Dynamical Oceanography. 2ª Edición, Reino Unido: Butterworth. 329 pp.

Siedler, G., Griffies, S.M., Gould, J., and Church, J.A. (2013). Ocean circulation and climate: A 21st Century perspective. Amsterdam: Academic Press. 868 pp.

Stewart, R. H., (2004). Introduction to Physical Oceanography. Texas: Texas University

Talley, L.D., Pickard, G.L., Emery, W.J. and Swift, J.H., (2011). Descriptive Physical Oceanography: An Introduction, 6ª edición. Londres: Elsevier. 555 pp.

COMPLEMENTARY:

Brown, E., Colling, A., Park, D., Phillips, J., Rothery, D. and Wright, J., (2002). Waves, tides and shallow-water processes. Reino Unido: The Open University. 227 pp.

Brown, E., Colling, A., Park, D., Phillips, J., Rothery, D. and Wright, J., (2002). Ocean Circulation. Reino Unido: The Open University. 286 pp.

Brown, E., Colling, A., Park, D., Phillips, J., Rothery, D. and Wright, J., (2002). Seawater: its composition, properties and behaviour. Reino Unido: The Open University. 168 pp.

Castelló, M., (2007). Escribir y comunicarse en contextos científicos y académicos. Barcelona: Graó. 224 pp.

Garrison, T., (2009). Essentials of Oceanography. Belmont, CA: Brooks/Cole Cengage Learning, 434 pp.

Grasshoff, K., Krembling, K., and Ehrhardt, M., (2002). Methods of Seawater Analysis.Tercera edición. Koln (Colonia): Wiley. 600pp.

Rosón Porto, G. and Varela, R. A., (2008). Métodos en Oceanografía Física. Barcelona: Anthias. 126 pp.

Sendiña, I., and Pérez, V., (2006). Fundamentos de meteorología. Santiago de Compostela: Servizio de Publicacións da Universidade de Santiago de Compostela. 194 pp.

Tomczak, M. and Godfrey, J.F., (2003). Regional Oceanography: an Introduction, 2ª edición, Delhi: Daya Publishing House.

Trujillo, A.P., and Thurman, H.V., (2010). Essentials of Oceanography. Boston: Pearson Prentice Hall, 551pp.

WEBSITES

LIBROS ELECTRÓNICOS: http://ww2.icm.csic.es/oce/es/content/electronic-books

HERRAMIENTAS PARA REPRESENTAR: http://www.physocean.icm.csic.es

ECUACIÓN DE ESTADO, TEOS-10: http://www.teos-10.org/

OCEAN DATA VIEW: http://odv.awi.de/

Addendum to the Course Guide of the Subject

Due to the exceptional situation caused by the health crisis of the COVID-19 and taking into account the security measures related to the development of the educational activity in the Higher Education Institution teaching area, the following changes have been made in the guide of the subject to ensure that Students achieve their learning outcomes of the Subject.

Situation 1: Teaching without limited capacity (when the number of enrolled students is lower than the allowed capacity in classroom, according to the security measures taken).

In this case, no changes are made in the guide of the subject.

Situation 2: Teaching with limited capacity (when the number of enrolled students is higher than the allowed capacity in classroom, according to the security measures taken).

In this case, the following changes are made:

1. Educational Activities of Onsite Work:

All the foreseen activities to be developed in the classroom as indicated in this field of the guide of the subject will be made through a simultaneous teaching method combining onsite teaching in the classroom and synchronous online teaching. Students will be able to attend classes onsite or to attend them online through the telematic tools provided by the university (videoconferences). In any case, students who attend classes onsite and who attend them by videoconference will rotate periodically.

In the particular case of this subject, these videoconferences will be made through:

[X] Microsoft Teams

[X] Kaltura

Situation 3: Confinement due to a new State of Alarm.

In this case, the following changes are made:

1. Educational Activities of Onsite Work:

All the foreseen activities to be developed in the classroom as indicated in this field of the guide of the subject, as well as the group and personalized tutoring, will be done with the telematic tools provided by the University, through:

[X] Microsoft Teams

[X] Kaltura

Explanation about the practical sessions:

In the case of confinement due to a new alarm state, the practical sessions (boat and marine station) will be moved to a new date as soon as the health situation allows. As an alternative, a virtual seminar on instrumentation and data analysis will be held.
The practical sessions with ODV will be carried out online.

2. System for Assessing the Acquisition of the competences and Assessment System

ONSITE WORK

Regarding the Assessment Tools:

[X] The Assessment Tools will not be modified. If onsite assessment is not possible, it will be done online through the UCVnet Campus.

[ ] The following changes will be made to adapt the subject's assessment to the online teaching.

Course guide		Adaptation	
Assessment tool	Allocated percentage	Description of the suggested changes	Platform to be used

The other Assessment Tools will not be modified with regards to what is indicated in the Course Guide.

Comments to the Assessment System:

The "Written test with theoretical and practical questions" will consist of a questionnaire including short questions, problems and multiple choice questions. At the end of the test, a task will be enabled for you to upload the problem procedure.

The Assessment tool "Problem-solving and issues related to the use of specific software (ODV)" will consist of a questionnaire with questions and problems using the ODV software. At the end of the test, a task will be enabled to upload the results requested in the questionnaire.