



Information about the subject

Degree: Bachelor of Degree in Marine Sciences

Faculty: Faculty of Veterinary Medicine and Experimental Sciences

Code: 271107 **Name:** Fluid Mechanics

Credits: 6,00 **ECTS Year:** 1 **Semester:** 2

Module: Fundamental Science

Subject Matter: Physics **Type:** Basic Formation

Field of knowledge: Sciences

Department: -

Type of learning: Classroom-based learning

Languages in which it is taught: Spanish

Lecturer/-s:

271A Amanda Sancho Garcia (**Responsible Lecturer**) amanda.sancho@ucv.es



Module organization

Fundamental Science

Subject Matter	ECTS	Subject	ECTS	Year/semester
Physics	12,00	Fluid Mechanics	6,00	1/2
		Physics	6,00	1/1
Mathematics	6,00	Mathematics	6,00	1/1
Chemistry	12,00	Chemistry	6,00	1/1
		Chemistry of Aqueous Solutions	6,00	1/2
Biology	12,00	Biochemistry	6,00	1/2
		Biology	6,00	1/1
Geology	6,00	Geology	6,00	1/2

Recommended knowledge

Mathematics and Physics.



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 is capable of solving problems about the content of the subjects through a well-founded approach, a clear development and a resolution coinciding with the expected result.
- R2 The students knows the concept of fluid, its properties, dimensions and units.
- R3 The student knows the fundamentals of fluid statics and the situations which includes.
- R4 The student correctly uses equations and physical formulas of primary interest in fluid mechanics.
- R5 The student is capable of resolving problems which show how flows are described and classified.
- R6 The student is capable of seeking information form different sources and knows how to analyse it.



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
CB1	Students acquire and understand knowledge in their field of study based on general secondary education but usually reaching a level that, although supported on advanced text books, also includes aspects involving state-of-the-art knowledge specific to their area.			X	
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	
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	
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

SPECIFIC		Weighting			
		1	2	3	4
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	
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, R5	45,00%	Written test with theoretical and practical questions
R1, R2, R3, R4, R5, R6	30,00%	Delivery of guided assignments, whose objectives and contents will be proposed by the teacher
R1, R2, R3, R4, R5	15,00%	Problem-solving and issues related to the use of specific software
R2, R3, R4, R5	10,00%	Oral presentation

Observations

To pass the course a mark **equal or higher to 5** in each section is required. In case of not to get the minimum mark required, although the weighted averaged were equal or higher to 5, the subject will not be passed. The weighted average is also subjected to the presentation of all the work requested.

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.
- 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, R5	39,00	1,56
PRACTICAL CLASSES M2	R1, R2, R3, R4, R5, R6	14,00	0,56
GROUP PRESENTATION OF ASSIGNMENTS M5	R2, R3, R4, R6	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, R6	20,00	0,80
INDEPENDENT WORK M10	R1, R2, R3, R4, R5, R6	70,00	2,80
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. FLUID STATICS

Lesson 1. Introduction to Fluid Mechanics

- 1.1 Fluid definition
- 1.2 Basic properties of a fluid
- 1.3 Flow classification
- 1.4 Conservation laws

Lesson 2. Fluid statics

- 2.1 Pressure
- 2.2 Pascal Principle
- 2.3 Fluid static equation
- 2.4 Hydrostatic buoyancy
- 2.5 Buoyancy and submergence



UNIT 2. FLUID DYNAMICS

Lesson 3. Introduction to fluid motion

- 3.1 Fluid motion
- 3.2 Description of the fluid motion
 - 3.2.1 Lagrangian and eulerian description
 - 3.2.2 Flow lines
- 3.3 Acceleration
- 3.4 Angular velocity and vorticity

Lesson 4. Ideal fluids

- 4.1 Continuity equation
- 4.2 Bernoulli equation
- 4.3 Torriceli theorem
- 4.4 Flow discharge
- 4.5 Differential equations of flow
 - 4.5.1 Differential form of the continuity equation
 - 4.5.2 Equation of motion
 - 4.5.3 Euler equation

Lesson 5. Real fluid

- 5.1 Viscosity
- 5.2 Reynolds number
- 5.3 Navier Stokes equation
- 5.4 Ekman layer
- 5.5 Poiseuille's Law

UNIT 3. SURFACE TENSION Y CAPILLARITY. EXTERNAL FLOWS

Lesson 6. Surface tension and capillarity

- 6.1 Surface tension
- 6.2 Tate's Law
- 6.3 Capillarity phenomena
- 6.4 External flows
 - 6.4.1 Drag Force
 - 6.4.1.1 Pressure and friction drag force
 - 6.4.1.2 Stokes' Law
 - 6.4.1.3 Fluid velocity limit
 - 6.4.2 Lift



Organization of the practical activities:

	Content	Place	Hours
PR1.	Exercises: fluid properties	Lecture room	1,00
PR2.	Density and sound velocity calculation using TEOS-10 equation. Profiles representation.	Computer	2,00
PR3.	Seawater properties (salinity, density and speed velocity)	Marine station	1,00
PR4.	Exercises: hydrostatic force on a plane surface.	Lecture room	1,00
PR5.	Exercises: hydrostatic force on a curve surface.	Lecture room	1,00
PR6.	Exercises: buoyancy and stability.	Lecture room	1,00
PR7.	Exercises: acceleration, vorticity and angular momentum.	Lecture room	1,00
PR8.	Exercises: Bernoulli's equation.	Lecture room	1,00
PR9.	Exercises: Euler's equation.	Lecture room	2,00
PR10.	Exercises: Navier-Stokes's equation.	Lecture room	1,00
PR11.	Exercises: Poiseuille's Law.	Lecture room	1,00
PR12.	Exercises: surface tension and external flow.	Lecture room	2,00



Temporary organization of learning:

Block of content	Number of sessions	Hours
UNIT 1. FLUID STATICS	10,00	20,00
UNIT 2. FLUID DYNAMICS	15,00	30,00
UNIT 3. SURFACE TENSION Y CAPILARITY. EXTERNAL FLOWS	5,00	10,00

References

- Batchelor, G.K, (2000). An introduction to fluid dynamics, Cambridge: Cambridge University Press. 615 pp.
- Çengel Y.A., and Cimbala, J.M., (2018). Mecánica de fluidos: Fundamentos y aplicaciones, 4ª edición, 1026 pp.
- Feria, R., (2011). Mecánica de fluidos. Málaga: Servicio de Publicaciones de la Universidad de Málaga. 623 pp.
- Feria, R., (2010). Problemas resueltos de mecánica de fluidos. Málaga: Servicio de Publicaciones de la Universidad de Málaga. 223 pp.
- González-Santander, J.L, and Castellano, G., (2014). Fundamentos de mecánica de fluidos. San Vicente (Alicante): Club Universitario. 504 pp.
- Kundu P. K., Cohen I. M. and Dowling D., (2016). Fluid mechanics, 6ª edición, Amsterdam: Academic Press. 921 pp.
- Landau L.D., (2001). Física Teórica. Mecánica de Fluidos (Volumen 6), Sevilla: Reverté. 623 pp.
- Mott, R.L, and Untener, J.A., (2016). Mecánica de fluidos, 7ª edición, México: Pearson. 552 pp.
- Potter M.C., and Wiggert, D. C., (2004). Mecánica de fluidos, 3ª edición, Madrid: Thomson.
- Ryszard, S., (1999). Fluid Mechanics for Marine Ecologists, Berlin: Springer. 566pp.
- Streeter V.L., (2000). Mecánica de fluidos, 9ª edición, Madrid: McGraw-Hill. 741 pp.
- Timmons, M.B., Ebeling, J.M., and Piedrahita, R.H., (2009). Acuicultura en sistemas de recirculación. Ithaca, NY: Cayuga Aqua Ventures. 959 pp.
- White, F., (2004). Mecánica de fluidos. 5ª Edición, Madrid: McGraw-Hill. 896 pp.

WEBSITES

University of Colorado (2020): Interactive simulations. Available in: <https://phet.colorado.edu/es/>



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:

☒ Microsoft Teams

☒ 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:

☒ Microsoft Teams

☒ Kaltura

Explanation about the practical sessions:

In case of confinement due to a new state of alarm, the practical sessions (boat and marine station) will be moved to a new date as soon as the health situation allows. As an alternative, they will be replaced by online simulations (or video-presentation) and subsequent exercises using a software through Flexilabs (Apps UCV).



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

ONSITE WORK

Regarding the Assessment Tools:

☒ 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:



In order to pass the course it will be necessary to obtain, at least, a grade equal or superior to 5.0 points in each of the evaluation systems. If a final grade of 5 points is not obtained in each section and only one of them has been passed, the course will be passed, even if the weighted average is equal to or higher than 5. The weighted average will also depend on the presentation of all the work requested.

The written test with theoretical and practical questions will consist of an online questionnaire (or questionnaires) with problems and multiple choice questions. At the end of the test, a task will be enabled to upload the procedure of all the calculations made to answer the numerical questions, either test type or problems. Even if the answers are correct but the procedure supporting the result is not attached, the answer will not be valid.