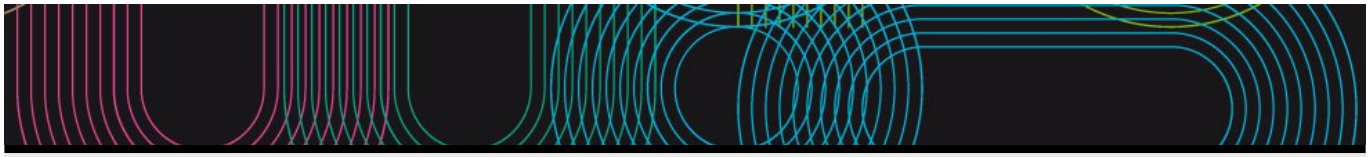

IDENTIFYING DATA				
(*)Simulación de biofluídos en enxeñaría biomédica				
Subject	(*)Simulación de biofluídos en enxeñaría biomédica			
Code	V04M192V01203			
Study programme	Máster Universitario en Ingeniería Biomédica			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	4.5	Mandatory	1st	2nd
Teaching language	Spanish Galician			
Department				
Coordinator	Vence Fernández, Jesús			
Lecturers	Vence Fernández, Jesús			
E-mail	jvence@uvigo.es			
Web				
General description	Application of numerical methods to solve problems applied to biofluid dynamics			

Training and Learning Results	
Code	
A1	Knowledge and understanding that provide a basis or opportunity for originality in developing and / or applying ideas, often in a research context.
A4	Students can communicate their conclusions, and the knowledge and rationale underpinning these, to specialist and non-specialist audiences clearly and unambiguously.
B3	Knowledge in basic and technological subjects that will enable students to learn new methods and theories, and provide them the versatility to adapt to new situations.
B4	Ability to solve problems with initiative, decision making, creativity, critical reasoning and to communicate and transmit knowledge, abilities and skills in the field of biomedical engineering.
B5	Knowledge to carry out measurements, calculations, assessments, appraisals, surveys, studies, reports, work plans and other similar works.
C9	Knowledge of the biophysical foundation, the theoretical analysis and modeling of the mechanical aspects of biological fluids.

Expected results from this subject	
Expected results from this subject	Training and Learning Results
To know the principles of biofluid analysis in biomedical engineering	A1 B3 B5 C9
To apply knowledge of biofluid analysis in biomedical engineering.	A4 B3 B4 B5 C9
To know the fundamentals of fluid dynamic simulation of biofluids	A1 B3 C9

Contents
Topic

1. Introduction to biofluids, properties and fundamentals.	Characteristics, equations and models used to solve biofluid dynamics problems.
2. Computer tools for medical image processing	Visualization and treatment of medical images. Extraction of geometric models. Preparation of simulation domains
3. Macrocirculation. Hemodynamic simulations.	Equations and models. Simulation of blood flow in aneurysms.
4. Airway simulations. Microcirculation.	Study of airflows in the respiratory system. Aerosol dispersion simulation in the respiratory tract
5. Fluid-structure interaction. Mass transport.	Simulation of systems with geometric deformation by adjusting the fluid-structure behavior in applications in the field of biofluids
6. Modeling of medical devices.	Introduction to the analysis of fluid flows in machinery and devices of sanitary applications

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	16.7	33.3	50
Practices through ICT	13.3	26.7	40
Problem solving	4.5	9	13.5
Objective questions exam	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	Introduction and description of the different concepts and technical related with the subject
Practices through ICT	Resolution of problems of biofluids by means of the use of software of numerical simulation
Problem solving	Put in practice of the knowledge acquired in the subject by means of his application to the resolution of problems of biomedical engineering

Personalized assistance

Methodologies	Description
Lecturing	In group or individual office hours, to reinforce knowledge and supervise the proposed activities
Practices through ICT	In group or individual office hours, to reinforce knowledge and supervise the proposed activities
Problem solving	In group or individual office hours, to reinforce knowledge and supervise the proposed activities

Assessment

	Description	Qualification	Training and Learning Results		
Practices through ICT	It will evaluate the quality of the solutions contributed in the reports of the activities proposed.	35	A4	B4	C9
Problem solving	It will evaluate the quality of the solutions collected in the reports of the proposed activities and/or projects.	35	A4	B4	C9
Objective questions exam	It will evaluate in a partial final/examination the concepts given in the sessions of classroom and laboratory	30		B4 B5	C9

Other comments on the Evaluation

The assessment of the subject is divided into the following sections:

- Multiple-choice exam: 30% of the total grade.
- Practical exercises with ICT support (submission of practice reports and other tasks proposed by the teaching staff): 35% of the total grade.
- Problem-solving (submission of reports or assignments on hypothetical scenarios proposed by the teaching staff): 35% of the total grade.

To pass the subject, students must obtain a minimum score of 20% in each assessment section.

By default, the assessment will be conducted through Continuous Assessment for all students. Any student who wishes to do so can opt out of this assessment method by requesting it within the specified time frame determined by the School.

For students who choose the Continuous Assessment method and fail the course in the First Opportunity exam (May), in order to pass the course in the Second Opportunity exam (July), the course instructors will provide them with the

submissions or assignments they need to complete in order to be evaluated in that exam.

Students who opt out of the Continuous Assessment method will be evaluated based on a single test with 100% of the grade. In this case, the student must notify the course instructors with sufficient notice, who will then provide the evaluation methodology.

Ethical Commitment:

Students are expected to demonstrate appropriate ethical behavior. In the event of detecting unethical behavior (copying, plagiarism, use of unauthorized electronic devices, among others), it will be considered that the student does not meet the necessary requirements to pass the course. In this case, the overall grade for the current academic year will be a failing grade (0.0).

Sources of information

Basic Bibliography

Jiri Blazek, **Computational Fluid Dynamics: Principles and Applications**, Elsevier, 2015

T. Kajishima, K. Taira, **Computational fluid dynamics: Incompressible turbulent flows**, Springer, 2017

Complementary Bibliography

Anderson et al., **Computational fluid dynamics: An introduction**, Springer, 2099

Jesús Manuel Fernández Oro, **Técnicas numéricas en ingeniería de fluidos**, Reverté, 2012

García Navarro et al., **Introducción a la mecánica de fluidos computacional**, Universidad de Zaragoza, 2021

Y. A. Çengel and J. M. Cimbala, **Mecánica de fluidos: Fundamentos y aplicaciones**, McGraw-Hill, 2006

Recommendations