1. BASIC INFORMATION

Course	Fluid Mechanics I
Degree program	Degree in Aerospace Engineering of aircrafts
School	Arquitectura, Ingeniería y Diseño
Year	Second course
ECTS	6 ECTS
Credit type	Compulsory
Language(s)	English
Delivery mode	Face-to-face
Semester	Second
Academic year	2024 / 2025
Coordinating professor	Ana Medina
Professors	Ana Medina

2. PRESENTATION

This course belongs to the "Motopropulsion I" module, made up of the following subjects:

- Thermodynamics and Heat Transfer (6 ECTS, Year 2)
- Fluid Mechanics I (6 ECTS, Year 2)
- Propulsion Systems (6 ECTS, Year 3)

The course of Fluid Mechanics I covers the following topics: basic introduction to fluid mechanics, fluidstatics, conservation laws of mass, momentum and energy in integral form, Navier-Stokes equations, and an introduction to computacional fluid mecannics (CFD). The objectives of the course are:

- 1. Learn the basic principles of fluid mechanics and their basic equations.
- 2. Learn and develop an intuitive understanding of the physics happening in fluid mechanics problems.
- 3. Participate in some real examples of engineering to see how the fluid mechanics is applied to engineering practice.
- 4. Understand the basics of the conservation laws and its application in the study of the turbomachinery.

3. COMPETENCIES AND LEARNING OUTCOMES

Core competencies:

- CB2: That students can apply their knowledge to their work or vocation in a professional manner and have competences typically demonstrated through devising and sustaining arguments and solving problems within their field of study.
- CB4: To allow students to communicate information, ideas, problems and solutions both to a specialized and non-specialized audiences.

Cross-curricular competencies:

- CT14 (N3): problem solving with initiative, decision making, creativity, and critical thinking, professionally, and the preparation and defense of arguments (Troubleshooting).
- CT15 (N2): compile and interpret data to make judgments that include relevant social, scientist, and ethical issues, taking fundamental rights respect into consideration, as well as the democratic principles, gender equality, solidarity, environment protection, universal accessibility and design for all, and culture of peace (consultancy).
- CT20 (N2): Take decisions, in advance, on what needs to be done, who should do it, and how it should be done (planning).

Specific competencies:

- CE16: Appropriate knowledge applied to engineering of: concepts and laws that manage the processes of energy transfer, the movement of fluids, the mechanisms of heat transfer and mass exchange, and their influence on main systems of aerospace propulsion.
- CE18: Appropriated knowledge applied to engineering of: basics of fluid mechanics; basic principles of flight control and automation; main characteristics and physical and mechanical properties of materials.

Notes: UNIQUE LEVEL: Competence developed at one level. Level 1 (N1): awareness about the importance of competences and basic application of it to several situations. Level 2(N2): int interiorization and skillful handling of competences. Level 3 (N3): Full interiorization and handling of competences at any needed situatio

Learning outcomes:

- LO24: To propose and design a set of models, as input data to fluid dynamics simulators.
- LO20: To conduct studies by integrating the technologies and engineering procedures which are developed in the competencies of this modules.
- LO21: To conceptualize an enegineering problem from a series of requirements and prior information, proposes an approach to solve it, and obtain the better solution. All this related to the competencies of this module.
- LO22: To transfer some parts of an engineering problem to the laboratory, and utilize this resource as support to resolve it.

The table below shows the relation between the competencias developed during the course and the envisaged learning outcomes:

Competencies	Learning outcomes	
CB1, CT16, CE18	LO20	
CB3, CB5, CT12, CT16, CE16, CE18	LO21	
CB3, CT12, CT18, CE18	LO22	
CT20, CE18	LO24	

4. CONTENT

The subject consists of different topics that will be developed throughout the semester:

- Introduction to the mechanics of fluids.
- Kinematics
- Governing equations of fluid mechanics
- Fluid static
- Flow through turbomachinery
- Discontinuity surfaces
- Introduction to the turbulent motion
- Introduction to aerospace propulsion systems.
- Basics performs of fluid dynamics simulators.



5. TEACHING-LEARNING METHODOLOGIES

The types of teaching-learning methodologies used are indicated below:

- Master class.
- Cooperative learning (teamwork).
- Self-study.
- Mentooring, academic monitoring and assesment.

6. LEARNING ACTIVITIES

Listed below are the types of learning activities and the number of hours the student will spend on each one:

Campus-based mode:

Learning activity	Number of hours
Lecture-based classes	20
Team work	60
Autonomous study.	50
Mentoring, academic monitoring, and assessment.	20
TOTAL	150 h

7. ASSESSMENT

Listed below are the assessment systems used and the weight each one carries towards the final course grade:

Campus-based mode:

Assessment system	Weight
Exams, quizzes and other tests of knowledge	30-35%
Preparation of articles, assessments, or reports	15-30%
Alternative evaluation techniques	15-30%
Field experiences, conferences, and visits	10%
Transversal competences (rubrics)	10-15%

When you access the course on the *Campus Virtual*, you'll find a description of the assessment activities you have to complete, as well as the delivery deadline and assessment procedure for each one.



7.1. First exam period (Ordinary Call)

To pass the course in the first exam period, you must obtain:

- Obtain a grade greater than or equal to 5.0 out of 10 in the group project.
- Obtain a grade (average) greater than or equal to 5.0 out of 10 in the homework activities.
- Obtain a grade greater than or equal to 5.0 out of 10.0 in the final exam.
- 50% attendance

When the minimum required to carry out the weighted average of the evaluable activities is not met (the minimum is not reached in any of the previous points), the final grade will be:

- The weighted mean if its value is less than or equal to 4.
- Equal to 4 if the value of the weighted mean is greater than 4.

The grade in the first exam period will be considered as NP (Not Presented) when the student has not delivered any evaluable activity of those that are part of the weighted average.

7.2. Second exam period (extraordinary call)

The failed assignments, homework or lab reports during the academic year must be submitted on extraordinary session. To pass the course, each group of assignment shall have, at least, five points out of ten and it is mandatory to pass all the groups of assignments (exam, homework and group project).

To pass the course in the second exam period, you must obtain:

- Obtain a grade greater than or equal to 5.0 out of 10 in the subject project.
- Obtain a grade (average) greater than or equal to 5.0 out of 10 in the individual activities.
- Obtain a grade greater than or equal to 5.0 out of 10.0 in the final exam.

When the minimum required to carry out the weighted average of the evaluable activities is not met (the minimum is not reached in any of the previous points), the final grade will be:

- The weighted mean if its value is less than or equal to 4.
- Equal to 4 if the value of the weighted mean is greater than 4.



The grade in this second call will be considered as NP (Not Presented) when the student has not delivered any evaluable activity of those that are part of the weighted average.

8. SCHEDULE

This section indicates the (tentative) schedule with delivery dates for evaluable activities of the subject:

Asseassable Activity	Due date
Individual Activity. Introduction to Fluids and Fluids-Statics	Week 3-4
Class Activity. Control Volume	Week 6
Individual Activity. Kinematics and governing equations	Week 11-12
Self study and Class Activity. Dimensional Analysys	Week 9-10
Laboratory session	Week 7-8
Group Project development	During the course
Group Project presentation/exam/peer- review	End of semester
Final exam	End of semester

This schedule may be modified (both in dates and in the type of activities) for logistical reasons based on the teaching development of the subject. Any modification will be notified to the student in a timely manner through the Virtual Campus.

9. **BIBLIOGRAPHY**

Here is the recommended bibliography:

- Frank M. White. *Fluid Mechanics* McGraw-Hill, 5th edition.
- B. R. Munson, D. F. Young and T. H. Okiishi . *Fundamentals of Fluid Mechanics*. Addison-Wesley Iberoamericana. 2002
- Yunus A. Çengel and John M. Cimbala, *Fluid Mechanics Fundamentals and Applications* First edition, editorial Mc Graw Hill, 2006



10. EDUCATIONAL GUIDANCE AND DIVERSITY UNIT

From the Educational Guidance and Diversity Unit we offer support to our students throughout their university life to help them reach their academic achievements. Other main actions are the students inclusions with specific educational needs, universal accessibility on the different campuses of the university and equal opportunities.

From this unit we offer to our students:

- 1. Accompaniment and follow-up by means of counselling and personalized plans for students who need to improve their academic performance.
- 2. In terms of attention to diversity, non-significant curricular adjustments are made in terms methodology and assessment for those students with specific educational needs, pursuing an equal opportunities for all students.
- 3. We offer students different extracurricular resources to develop different competences that will encourage their personal and professional development.
- 4. Vocational guidance through the provision of tools and counselling to students with vocational doubts or who believe they have made a mistake in their choice of degree.

Students in need of educational support can write to us at:

orientacioneducativa@universidadeuropea.es

11. ONLINE SURVEYS

Your opinion matters!

The Universidad Europea encourages you to participate in several surveys which help identify the strengths and areas we need to improve regarding professors, degree programs and the teaching-learning process.

The surveys will be made available in the "surveys" section in virtual campus or via e-mail. Your assessment is necessary for us to improve.

Thank you very much for your participation.