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	2025 / 2026
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 mecahnics (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. KNOWLEDGE, SKILLS AND COMPETENCES

Knowledges:

- CON14 CO10: Adequate knowledge applied to Engineering: Concepts and laws governing energy transfer processes, fluid motion, heat transmission mechanisms, and the change of matter and their role in the analysis of major aerospace propulsion systems.
- Specific knowledge of the subject: Define the principles of fluid mechanics, kinematics, and the general equations of fluid mechanics.

Skills:

HAB01 FB01. Ability to solve mathematical problems that may arise in engineering. Aptitude to apply knowledge of: linear algebra; geometry; differential geometry; differential and integral calculus; differential and partial differential equations; numerical methods; numerical algorithms; statistics, and optimization.

Specific skills of the subject:

- Establish models as input for fluid dynamics simulators.
- Conduct studies involving technologies and engineering procedures related to the competencies of this module.
- Conceptualize an engineering problem, outline the approach to solving it, and find the optimal solution based on a set of requirements and previous information, all related to the competencies of this module.
- Transfer parts of an engineering problem to the laboratory and use this resource as support for resolution.
- Solve problems in fluid statics, fluid dynamics, and flow through turbomachinery.
- Analyze surfaces of discontinuity.
- Evaluate basic concepts of turbulent motion.
- Analyze major aerospace propulsion systems.
- Conduct basic practices with fluid dynamics simulators.

Competencies:

- **CP02**. Appropriate 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.
- **CP03**. Applied knowledge of: the science and technology of materials, mechanics and thermodynamics, fluid mechanics, aerodynamics and flight mechanics, navigation and air traffic, aerospace technology, theory of structures, air transport, economy and production projects; impact on environment.
- **CP12**. Generate new ideas and concepts from known ideas and concepts, reaching conclusions or solving problems, challenges, and situations in an original way in the academic and professional environment.
- **CP13**. Convey messages (ideas, concepts, feelings, arguments), both orally and in writing, strategically aligning the interests of the various parties involved in communication in the academic and professional environment in the field of aerospace engineering.

- **CP14**. Employ information and communication technologies for data search and analysis, research, communication, and learning in the field of aerospace engineering.
- **CP15**. Influence others to guide and lead them towards specific objectives and goals, taking into consideration their viewpoints, especially in professional situations arising from the volatile, uncertain, complex, and ambiguous (VUCA) environments of the current world.
- **CP16**. Collaborate with others in achieving a shared academic or professional objective, actively participating, demonstrating empathy, and practicing active listening and respect for all team members.
- **CP17.** Integrate analysis with critical thinking in an evaluation process of different ideas or professional possibilities and their potential for error, relying on evidence and objective data that lead to effective and valid decision-making.
- **CP18**. Adapt to adverse, unexpected situations that cause stress, whether personal or professional, overcoming them and even turning them into opportunities for positive change.
- **CP19**. Demonstrate ethical behavior and social commitment in the performance of professional activities, as well as sensitivity to inequality and diversity.

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

The following table shows, for each learning activity: ***i***) the total time the student will spend, ***ii***) the time distribution between in-class and off-class time, and ***iii***) the course policy about the use of artificial intelligence (AI) in that activity:

Learning activity	Total time	In-class Time	Use of AI
Lectures / masterclasses	30 hours	30 hours (100%)	Allowed
Problem-solving sessions	18 hours	18 hours (100%)	Not Allowed
Group research and integrative group work	42 hours	12 hours (28%)	Assessed
Self-study	60 hours	0 hours (0%)	Promoted
TOTAL	**150 hours**	**60 hours (40%)**	

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	Use of IA
SE01 Exams, quizzes and other tests of knowledge	30-35%	Not allowed
SE02 Preparation of articles, assessments, or reports	15-30%	Promoted or assessed
SE03 Alternative evaluation techniques	15-30%	Not allowed
SE04 Field experiences, conferences, and visits (*)	10%	promoted
SE05 Transversal competences (performance)	10-15%	-

(*) If these activities could not be carried out, the corresponding weight would split evenly between systems SE02 and SE03.

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:

Assessable Activity	Due date
Individual Activity. Introduction to Fluids, Fluids-Statics and kinematics	Week 4-5
Class Activities. Peer Review	Week 3-12

Individual Activity. CFD quizz	Week 5-6
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.

USE OF AI REGULATION

The student must be the author of his/her work/activities.

The use of Artificial Intelligence tools (AI) must be authorized by the teacher in each assignment/activity, indicating in what way it uses is permitted. The teacher will inform in advance in which situations AI tools may be used to improve spelling, grammar and editing in general. The student is responsible for clarifying the information given by the tool and duly declaring the use of any AI tool, according to the guidelines given by the teacher. The final decision on the authorship of the work and the appropriateness of the reported use of an AI tool rests with the lecturer and those responsible for the degree.