Universidad Europea

# 1. BASIC INFORMATION

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|---|---|
| **Course** | Fluid mechanics I |
| **Degree program** | Degree in Aerospace Engineering of aircrafts |
| **School** | Arquitectura, Ingeniería y Diseño |
| **Year** | Third |
| **ECTS** | 6 |
| **Credit type** | Compulsory |
| **Language(s)** | English |
| **Delivery mode** | Face to face |
| **Semester** | Second |
| **Academic year** | 2019-20 |
| **Coordinating professor** | Jose Omar Martinez Lucci |

# 2. PRESENTATION

This course belongs to the "Motopropulsion I" module:

- Thermodynamics and Propulsion 6 ECTS (second year)
- Fluid Mechanics I 6 ECTS (second year)

In the Fluid Mechanics I subject the following topics are covered: Basic introduction to fluid mechanics, conservation laws of mass, momentum and energy, Navier-Stoke equations, and introduction to computational fluid dynamics

The objectives of the course are:

1, to learn the basic principles and the fluid mechanics equations.

2, to learn and develop an intuitive understanding of the mechanics of fluids with emphasis physics with Visual examples to bolster you knowledge of physics.

3, the student participates in various real examples of engineering to see how the fluid mechanics is applied to engineering practice

4, to know the basics of the laws of conservation of mass, time and energy and its application in the study de the turbomachinery.

5, to know, by the laboratory, the importance of the computational fluid dynamics. Also, to know how to use this tool to solve complex problems of mechanics of fluids. The student will learn the use of the application of CFD rather than the use of algorithms to do the simulations.

## 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 audience

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 is need to be done, who should do it, and how it should be done.

Specific competencies:

- CE16: Appropriate knowkedge 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: Appropriate knowkedge applied to engineering of: basics of fluid mechanics; basic principles of flight control and automatitation; main characteristics and phisical 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): interiorization and skillful handling of competences. Level 3 (N3): Full interiorization and handling of competences at any needed situation.*

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. From a series of requirements, and prior information, to conceptualize an engineering problem, 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 competencies developed during the course and the envisaged learning outcomes:

| Competencies | Learning outcomes |
|---|---|
| CB1, CT16(N3), CE8 | LO20. To conduct studies by integrating the technologies and engineering procedures which are developed in the competencies of this modules |
| CB3, CB5, CT12(N2), CT16(N3), CE8, CE19 | LO21. From a series of requirements, and prior information, to conceptualize an engineering problem, proposes an approach to solve it, and obtain the better solution. All this related to the competencies of this module |
| CB3, CT12(N2), CT18(N2), CE8 | LO22. To transfer some parts of an engineering problem to the laboratory, and utilize this resource as support to resolve it. |

## 4. CONTENT

- 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:

- Lecture-based class
- Integration of team work
- Self-study
- Mentoring, academic monitoring and assessment

# 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:**

| Type of educational activity | Number of hours |
|---|---|
| Lecture-based class | 20 h |
| Integration of team work | 60 h |
| Self-study | 50 h |
| Mentoring, academic monitoring and assessment | 20 h |
| **TOTAL** | **150 h** |

# 7. ASSESSMENT

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

| Assessment criteria | Weight (%) |
|---|---|
| • 1. Exam, test and other type of assessment. | 30%-35% |
| • 2. Reports, articles and informs. | 15%-30% |
| • 3. Alternative system of assessment. | 15%-30% |
| • 4. Conferences, company-tour visit and experiences in situ | 10%-10% |
| • 6. Transversal skills (rubric) | 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

- Exams, tests and other test and alternative techniques of assessment 35%
- Writing of articles, reports and project and Transversal skills 35% of the final grade
- Homework 30% of the final grade

To pass the course in the first exam period, you must obtain a final course grade of at least 5 out of 10 (weighted average). Minimums needed to pass:

- To obtain 5 points over 10 points of the final exam.
- To obtain 5 points over 10 points of the final project.
- To obtain 5 points over 10 points of the homework.
- In order to be evaluated you must have a minimum of 50% attendance (ATTENDANCE IS VALID ONLY REGISTERED IN THE GRP SYSTEM)

The failed assignments, homework or lab reports during academic year can be submitted on extraordinary session. To pass the course, each assignment shall have, at least, five points out of ten and it is mandatory to pass all assignments, activities and exams. If the student fails or does not submit some activities these activities will not be considered for the average of the final grade.

In the case, when the student do not reached the minimum required to pass any evaluable activity. The final grade will be:

• The mean average when the mean value is less than or equal to 4

• 4 if the value of the mean average is greater than 4

The grade will be considered as NP (Not Presented) when the student has not delivered any evaluable activity of which they are part of the weighted average.

## 7.2. Second exam period

Assessment activities:

- Realization of different tasks, problems and practical exercises, individually 20%
- Realization of laboratory practices and report 10%
- Realization of a project 20%
- Oral presentations presentation of the project 15%.
- Final exam 35%

To pass the course in the second exam period, you must obtain a final grade of at least 5 out of 10 (weighted average).

In the case, when the student do not reached the minimum required to pass any evaluable activity. The final grade will be:

• The mean average when the mean value is less than or equal to 4
• 4 if the value of the mean average is greater than 4

The grade will be considered as NP (Not Presented) when the student has not delivered any evaluable activity of which they are part of the weighted average.

# 8. SCHEDULE

This table shows the delivery deadline for each assessable activity in the course:

| Assessable activities | Deadline |
|---|---|
| Activity 1 .Self-study – I Introduction to fluid mechanics and fluid properties | Week 3-4 |
| Activity 2 Self-study - Fluid static and hydrostatic forces. | Week 6-7 |
| Activity 3 Self-study- Kinematic and dynamic of fluid and introduction to turbomachinery | Week 9-10 |
| Activity 4 Integration of team work and Mentoring, academic monitoring and assessment - laboratories and team project | Week 13 |
| Activity 5 Final exam | Last week |
| | |
| | |

This schedule may be subject to changes for logistical reasons relating to the activities. The student will be notified of any change as and when appropriate.

## 9. BIBLIOGRAPHY


- Fluid Mechancs Fundamentals and applications. Yunus A. Çengel and John M. Cimbala, First edition, editorial Mc Graw Hill, 2006


## 10. DIVERSITY MANAGEMENT UNIT

Students with specific learning support needs:

Curricular adaptations and adjustments for students with specific learning support needs, in order to guarantee equal opportunities, will be overseen by the Diversity Management Unit (UAD: Unidad de Atención a la Diversidad).

It is compulsory for this Unit to issue a curricular adaptation/adjustment report, and therefore students with specific learning support needs should contact the Unit at unidad.diversidad@universidadeuropea.es at the beginning of each semester.

## WORK PLAN OF THE SUBJECT

## HOW TO COMMUNICATE WITH YOUR PROFESSOR

Whenever you have a question about the content or activities, don't forget to post it to your course forum so that your classmates can read it.

You might not be the only one with the same question!

If you have a question that you only want to ask your professor, you can send him/her a private message from the Campus Virtual. And if you need to discuss something in more detail, you can arrange an advisory session with your professor.

It's a good idea to check the course forum on a regular basis and read the messages posted by your classmates and professors, as this can be another way to learn.

## DESCRIPTION OF THE ASSESSEABLE ACTIVITIES

Activity 1.Self-study –Introduction to fluid mechanics and fluid properties:

Fluid definition and classification of the flow of fluids, No slip condition, history of the fluid mechanics, system and volume control and fluid properties

Activity 2. Self-study – Fluid static and hydrostatic forces.

Pressure, pressure gauge, barometer and atmospheric pressure, fluid static, hydrostatic forces on plane surfaces and curvilinear surfaces, stability of immersion and floating bodies

Activity 3. Self-study- Kinematic and dynamic of fluid and introduction to turbomachinery.

Lagrangian and Eulerian descriptions, flow visualization, types of movement and deformation of the elements of fluids, theorem of Reynolds, conservation of mass transport, Navier-Stokes equation and energy.

Application of Navier-Stokes equations. Introduction, airflow, laminar and turbulent in tubular systems, entrance region and pressure lost.

Classifications and terminology, centrifugal and axial pumps, turbines, positive displacement, dynamic, impulse and reaction turbines

Activity 4. Integration of team work and Mentoring, academic monitoring and assessment - laboratories and team project

Introduction and fundamentals of computational fluid dynamics, application to laminar and turbulent flow and heat transfer fluid simulations.

Activity 5. Final exam

## RUBRICS OF THE ASSESSING ACTIVITIES

**Activity 4. Oral presentation and report of the team Project.**

In relation to collaborative activities. The rubric used for the assessment of this activity is exposed in this section.

Type of activity: Individual and group evaluation. Peer to peer evaluation. The members of your group will evaluate your contribution in the project.

This activity computes 35% of the total amount of the subject. The percentage of this activity is divided in 20% oral presentation and 80% written report.

When do you have to submit the activity? You have submit the final report and oral presentation at the end of the course.

How the activity is assessed? The activity is assessed by using the following rubrics.

Rubric 1- Oral presentation

| **Oral presentation of the work done.** | **0 to 0.25 points** | **0.25 to 0.5 points** | **0.5 to 1 points** | **1 to 1.5 points** |
|---|---|---|---|---|
| | The information is not clearly stated, the content is read, it is very difficult to follow the oral presentation, and / or the presentation time exceeds the planned. The choice of words is not adequate (to the topic, to the audience or to the objectives of the work). | Understanding the presentation, or to follow it at certain times, is difficult. The presentation time exceeds the planned one. The choice of words is not adequate (to the topic, to the public or to the objectives of the work). | Good presentation (easy to follow, in time) sometimes lack enthusiasm and / or captivate the listener. No adequate support means are used. | Clear, original and enthusiastic presentation that captures the listener from beginning to end, using the appropriate means. |
| **Answer to the questions posed** | **0 to 0.725 points** | **0.75 to 1.475 points** | **1.5 to 1.975 points** | **2 to 2.5 points** |
| | The student doesn't correctly answer to none of the posed questions. | The student just answers correctly to some of the posed questions, or he doesn't do it clearly and well explained. | The student answers correctly, clearly and well justified to most of the posed questions, convincing the audience. | The student answers correctly, clearly and well justified to all the posed questions, convincing the audience. |
| **Planning and teamwork** | **0 to 0.25 points** | **0.25 to 0.5 points** | **0.5 to 0.75 points** | **0.75 to 1 points** |
| | It is late, does not respect deadlines or late delivery. It does not plan its objectives. His attitude in the group is very individualistic. | He delivers it almost on time. The student has planned his goals, but some of his goals is not realistic. Although his attitude is individualistic, he tries to participate appropriately in the group. | He delivers it on time. The student has planned his objectives. Mobilize and unite the group appropriately. | It anticipates the deadlines of the task carried out, in order to facilitate revisions and to be able to face possible contingencies. The student has planned his objectives setting goals. |

Rubric 2. Final Project report

| Criteria | Bad | Not too bad | Competent | Very Competent |
|---|---|---|---|---|
| **Structure of the Report: format, writing, organization of information** | **0 to 0.5 points** | **0.5 to 1.25 points** | **1.25 to 2 points** | **2 to 2.5 points** |
| | Poor structure Missing relevant chapters (index, bibliographical references, etc.). The information is not organized in a coherent manner and / or insufficient synthesis capacity. | It contains all the parts of a report, but it lacks rigor. Low synthesis capacity and / or the information is not written clearly, and / or the information is not related correctly. It does not contain references. | Meets all points of the content of a report correctly. Good classification of the information, although the organization and / or synthesis of it could be improved. | The report is well structured, and the documentation provided is relevant and well assigned. High capacity for synthesis and organization of information. |
| **Analysis of the information necessary to justify the results of the proposed examples. Results explanations and simulations.** | **0 to 0.5 points** | **0.5 to 1.25 points** | **1.25 to 2 points** | **2 to 2.5 points** |
| | There is no analysis of the information or it is incorrect (It does not support the results obtained). | Unsupported or insufficient analysis. It includes, but does not adequately explain the aerodynamics characteristics of the airfoils and the simulation results are Insufficient bibliography. Does not support the theory exposed. | There is sufficient analysis of information related to the topic and endorse the results. It does Include, but explains only superficially, the results of the simulations. Correct Bibliography. The results of the simulations are good. | An analysis of all the required information on the subject of work is carried out. It includes and adequately explains the results of the simulations. Supports all the results obtained. Relevant and updated bibliography. The result of the simulations is good. |

# Amendment 1 INSTITUTIONAL ASSESSMENT OF LEARNING OUTCOMES PLAN

## Covid-19

## TEACHING AND EVALUATION ACTIVITIES

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|---|
| **Course/Module Fluid Mechanics I** |
| **Degree Program Aerospace in Aircraft Engineering** |
| **Year (1º-6º) Second** |

| Group (s) M21 |
| --- |
| Professor Jose Martinez Lucci |
| Coordinating professor Alicia Paez<br>(Degree Coordinator, Internship coordinator, End of Degree Project, Master´s Degree Program) |

| Teaching Activity described in the syllabus | Adapated activity in distance learning |
| --- | --- |
| Lecture-based class | Lecture-based class. The lecture will be teaching in online mode |
| Integration of team work | Integration of team work. The team work will be done in online mode. |
| Self-study | Self-study. |
| Mentoring, academic monitoring and assessment | Mentoring, academic monitoring and assessment. These activities will be done in online mode. |
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| Evaluation Activity that was planned in the Syllabus for face to face instruction | | NEW virtual evaluation activity (adapted) | |
|---|---|---|---|
| **Description of original fase to face evaluation activity** | Activity 4 Integration of team work and Mentoring, academic monitoring and assessment - laboratories and team project | **Description of new activity** | Activity 4 Integration of team work and Mentoring, academic monitoring and assessment - These activities will be performed in online mode laboratories and team project. The activity will be developed by using the software of Fluent that is in MYLABS. |
| **Content to be assessed** | Introduction to fluid mechanics<br>Kinematic<br>Governing equations of the Fluid Mechanics<br>Fluid statics<br>Fluid dynamics<br>Basics performs of fluid dynamics simulators | | |
| **Learning Outcomes to be assessed** *(Please check Syllabus of the course/module)* | **LO20: To transfer some parts of an engineering problem to the laboratory, and utilize this resource as support to resolve it.**<br><br>**LO22: -From a series of requirements, and prior information, to conceptualize an engineering problem, proposes an approach to solve it, and obtain the better solution. All this related to the competencies of this module** | | |
| **Duration** | 15 minutes oral presentation of the final project. | **Approximate duration** | **15 minutes oral presentation of the final project.** |
| **Weight in evaluation** | 35% | **Weight in evaluation** | **35%** |
| **Please note:** | | | |

| Evaluation Activity that was planned in the Syllabus for face to face instruction | | NEW virtual evaluation activity (adapted) | |
|---|---|---|---|
| **Description of original fase to face evaluation activity** | Activity 5 Final exam | **Description of new activity** | **Activity 5 Final exam. The final exam will be done by the students in online mode.** |
| **Content to be assessed** | Introduction to the mechanics of fluids.<br>Kinematics<br>Governing equations of fluid mechanics<br>Fluid static<br>Flow through turbomachinery<br>Discontinuity surfaces<br>Introduction to the turbulent motion<br>Introduction to aerospace propulsion systems | | |
| **Learning Outcomes to be assessed** ***(Please check Syllabus of the course/module)*** | :<br>**LO21. From a series of requirements, and prior information, to conceptualize an engineering problem, proposes an approach to solve it, and obtain the better solution. All this related to the competencies of this module**<br><br>**LO22: To conduct studies by integrating the technologies and engineering procedures which are developed in the competencies of this modules** | | |
| **Duration** | 2 Hours | **Approximate duration** | **2 Hours** |
| **Weight in evaluation** | 35% | **Weight in evaluation** | **35%** |
| **Please note:** | | | |