Universidad Europea

1. BASIC INFORMATION

Course	Aerodynamic and aeroelasticity
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

Aerodynamic concepts as aerodynamic forces and torques, classical theories, aeroelasticity and CFD (Computational Fluid Dynamics).

The objectives of the course are:
1, to know and develop an intuitive understanding of the mechanics of fluids when the inertial effect of the fluid is negligible compared with the term viscous around the aircraft.

2, to acquire an intuitive knowledge of the physical phenomena governing the forces of the dynamics of fluid around objects and understand the fundamentals of the flow on aerodynamic aerofoil and calculate the resistance and lift force acting in the aerofoil.

3, to know, by the laboratory, the importance 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 CFD rather than the use of algorithms which are applied for the simulation.

3. COMPETENCIES AND LEARNING OUTCOMES

Core competencies:

- CB3: That students have the ability to gather and interpret relevant data (usually within their field of study) to make judgments that include reflection on relevant social, scientific or ethical

Cross-curricular competencies:

- CT12: Knowledge of basic subjects and technologies, enabling the student to learn new methods, theories and technologies, and endowed it with great versatility to adapt to new situations (autonomous learning).
- CT21: Self-acknowledgement for achieving high levels of performance in one's work, with a positive influence in substantially improving the results (Self Confidence).

Specific competencies:

- CE22: Adequate and applied knowledge to engineering field: Fluid mechanics fundamentals that describe the flow in all regimes to determine the pressure and force distributions on aircraft.
- CE25: Adequate knowledge and applied to Engineering of: Calculation methods Design and Program Management of aircraft; the use of experimental aerodynamics and the most significant parameters in the theoretical application; the management of experimental techniques, equipment and measuring instruments discipline; the simulation, design, analysis and interpretation of experimental and flight operations; the maintenance systems and certifications of aircraft
- CE26: Applied knowledge of: aerodynamics, mechanics, and thermodynamics, flight mechanics, engineering of aircrafts (fixed and rotatory wings), and theory of structures.

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:

- LO26. To establish models, as input data to the simulators of MEF and CFD
- LO27. To design diverse parts and elements of aerospace vehicles.
- 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
CT12, CT21	LO26. To establish models, as input data to the simulators of MEF and CFD
CE22, CE26	LO27. To design diverse parts and elements of aerospace vehicles.
CB3	LO20. To conduct studies by integrating the technologies and engineering procedures which are developed in the competencies of this modules
CT12, CT21, CE22, CE26	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
CE25	LO22. To transfer some parts of an engineering problem to the laboratory, and utilize this resource as support to resolve it.

4. CONTENT

- Aerodynamics Forces and Moments
- Velocity field, lift and drag
- Static aeroelasticity.
- Dynamic aeroelasticity
- Fundamentals of Computational Fluid Dynamics

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 – Introduction to aerodynamics, application of Navier-Stokes equation	Week 3-4
Self-study – Aerodynamics of airfoils and wings	Week 6-7
Activity 3 Self-study- Aeroelasticity	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

1. Fundamentals of Aerodynamics John Anderson
2. Aerodynamics for engineering Students E.L. Houghton P.W. Carpenter
3. Introduction to Structural Dynamics and Aeroelasticity, Dewey H. Hodges and G. Alvin Pierce

Reference

1. Fluid Mechanics Fundamentals and Applications. Yunus A. Çengel and John M. Cimbala, First edition, editorial Mc Graw Hill, 2006
2. Viscous Fluid Flow, Frank m. White. Third edition, editorial Mc Graw Hill, 2006
3. Computational Fluid Dynamics, the basics with applications, John Anderson, Jr., First edition, editorial Mc Graw Hill, 1995.
4. Fundamentals of turbulence Modellig, Ching Chen, Shenq-Yuh Jaw. First edition, editorial Taylor and Francis Ltd. 1998.

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.

Amendment 1 INSTITUTIONAL ASSESSMENT OF LEARNING OUTCOMES PLAN Covid-19

Universidad Europea

TEACHING AND EVALUATION ACTIVITIES

Course/Module Aerodynamics and Aeroelasticity
Degree Program Aerospace in Aircraft Engineering
Year (1º-6º) Third
Group (s) T31
Professor Jose Martinez Lucci
Coordinating professor Alicia Paez (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.

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	The content to be addressed in each evaluation activity should be the same. • Aerodynamics Forces and Moments • Velocity field, lift and drag • Fundamentals of Computational Fluid Dynamics		
Learning Outcomes to be assessed *(Please check Syllabus of the course/module)*	The Learning Outcomes that are addressed are the same: specify: **LO26: To establish models, as input data to the simulators of MEF and CFD** **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.**		
Duration	15 minutes oral presentation for the final project	**Approximate duration**	**15 minutes oral presentation for 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	The content to be addressed in each evaluation activity should be the same. • Aerodynamics Forces and Moments • Velocity field, lift and drag • Static aeroelasticity. • Dynamic aeroelasticity		
Learning Outcomes to be assessed ***(Please check Syllabus of the course/module)***	The Learning Outcomes that are addressed are the same: specify: **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** **LO27: To design diverse parts and elements of aerospace vehicles**		
Duration	2 Hours	**Approximate duration**	**2 hours**
Weight in evaluation	35%	**Weight in evaluation**	**35%**
Please note:			