1. BASIC INFORMATION

Course	Resistance of Materials and Mechanical Elasticity
Degree program	Degree on Aerospace Engineering of Aircrafts
School	School of Architecture, Engineering and Design
Year	Second Year
ECTS	6
Credit type	Compulsory
Language(s)	English
Delivery mode	Face to face
Semester	2nd
Academic year	2024-2025
Coordinating professor	Rafael Escalera Rivas

2. PRESENTATION

The course provides fundamentals of the analysis of the internal forces within materials and the deformations that result from those forces, it is essential for the design of aircraft structures and components. The course starts with an introduction to continuum mechanics and elasticity of materials, then the course study deeply different basic stresses as axial loading, shearing, torsion, bending, and buckling. The course finishes with an introduction to aircraft structures calculus.

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.

Cross-curricular competencies:

- CT13: Ability to use tools to search for library resources or information (information retrieval).
- CT15: 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 2 equality, solidarity, environment protection, universal accessibility and design for all, and culture of peace (consultancy).
- CT20: Take decisions, in advance, on what needs to be done, who should do it, and how it should be done.

Specific competencies:

- CE7: Understanding of the behavior of structures under stress in service conditions and limit situations.

- CE11: Understanding of technological performance, optimization techniques of materials and material properties change by treatments.
- CE18: 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.

Learning outcomes:
- 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 following table shows the relationship between the competencies developed during the course and the learning outcomes pursued:

Competencies	Learning outcomes
CB2, CT13, CT15, CT20	LO20
CT15, CT20, CE7, CE11, CE18	LO21
CE7, CE11, CE18	LO22

4. CONTENT

- Introduction to the mechanics of continuous media
- Introduction to elasticity
- Material resistance (bending, tension, torsion, deformation)
- Calculation of structures

5. TEACHING-LEARNING METHODOLOGIES

The types of teaching-learning methodologies used are indicated below:
- Objectives and surveys of interests
- Lecture-Based Class
- Research and problem-solving by groups
- Practical case study

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 class	20
Integration of team work	60
Self-study	50
Mentoring, academic monitoring and assessment	20
TOTAL	**150**

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, tests and other test knowledge	30-35%
Elaboration of articles or reports	15-30%
Alternative assessment techniques	15-30%
Field experiences, conferences and visits	10%
Transversal-disciplinary skills	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

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).

In any case, you will need to obtain a grade of at 4.0 in the final exam in order for it to count towards the final grade along with all the grades corresponding to the other activities.

7.2. Second exam period

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 any case, you will need to obtain a grade of at 4.0 in the final exam in order for it to count towards the final grade along with all the grades corresponding to the other activities.

The student must deliver the activities not successfully completed in the first exam period after having received the corresponding corrections from the professor, or those that were not delivered in the first place.

8. SCHEDULE

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

Assessable activities	Deadline
Case Study 1 – Safety factor	Feb. 24th
Case Study 2 – Stress concentration	Mar. 3rd
Case Study 3 – Riveted joint	Mar. 17th
Practical Session 1 – Torsion stress	Mar. 31st
Practical Session 2 – Bending stress	Ap. 21st
Practical Session 3 – Buckling stress	May. 5th
Project – Aircraft Structures	May 19th
Final Exam	June 9th

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

The recommended Bibliography is:

- Aircraft structures for engineering students; Megson T.H.G., Butterworth-Heinemann, 2007.
- Introduction to Composite Materials; Tsai, S.W., and Hahn, H.T., Technomic Publishing Co., Westport, CT, 1980.
- Airframe Structural Design; Michael Chun-Yung Niu; Practical Design Information and Data on Aircraft Structures. Conmilit, 2006.
- Elements of spacecraft design (2002). Charles D. Brown. AIAA Education Series.
- Resistencia de Materiales; Luis Ortiz Berrocal; McGraw-Hill, 2010.
- Strength of Materials, 3e Vol. I: Elementary Theory and Problems Paperback. S. Timoshenko. December 1, 2004.
- Strength of Materials, Part 1 and Part 2 3rd Edition. S. Timoshenko.
- Mechanics of Materials, 2e. A. Bedford, K.M. Liechti. Springer. 2000.
- Mechanics of Materials, 8e. F.P. Beer, E.R. Johnston, Jr, J.T. DeWolf, D.F. Mazurek.. McGrawHill Education. 2020.

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.

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.

12. USE OF IA 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 are 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.