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	On-Campus
Semester	S4
Academic year	2025-2026
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 studies deeply different basic stresses such as axial loading, shearing, torsion, bending, and buckling. The course finishes with an introduction to aircraft structures calculus.

3. KNOWLEDGE, SKILLS AND COMPETENCIES

Knowledge

CON05 CO01. Understanding the behavior of structures under loads in service conditions and limit situations.

CON09 CO05. Understanding technological capabilities, material optimization techniques, and the modification of properties through treatments.

Specific knowledge of the subject:

- Identify the principles of continuum mechanics and elasticity.

Skills

HAB04 HAB06. Use computer tools to search for bibliographic or information resources (Information Search).

Specific skills of the subject:

- Evaluate material strength (bending, tension, torsion, deformation).
- Perform structural calculations.
- Conduct studies involving technologies and engineering procedures related to the competencies of this module.
- Based on a set of requirements and previous information, conceptualize an engineering problem, outline the approach to solving it, and find the optimal solution. All of this is relative to the competencies of this module.
- Transfer parts of an engineering problem to the laboratory and use this resource as support for resolution.

Competencies

CP02 CO12. 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 CO13. 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

- 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	30
Integration of team work	38
Self-study	70
In-person workshop and laboratory activities	12
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 4.0 in the final exam 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 4.0 in the final exam 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.