1. BASIC INFORMATION

Course	Materials science
Degree program	Bachelor's Degree in Aerospace and Aircraft Engineering
School	Architecture, Engineering and Design
Year	2th
ECTS	6 ECTS
Credit type	Mandatory
Language(s)	English
Delivery mode	Face to face
Semester	First semester
Academic year	2024-2025
Coordinating professor	Artemia Loayza argüelles

2. PRESENTATION

This course belongs to the “Materials and production I” module:
• Materials science 6 ECTS (second year)
• Materials elasticity and resistance 6 ECTS (second year)
• Aerospace production and projects 6 ECTS (third year)

The course topics are strictly linked to several subjects of the Aerospace Engineering Career: in the process of conceiving, designing, building, certifying, delivering and maintaining aero structures, materials science is crucial to understand the components of the aero structures and its behavior.

The Engineering market is requiring an ever-growing emphasis on concurrent engineering, especially between design, stress analysis and manufacturing, reducing the interaction with fellow departments and increasing their efficiency, resulting in shortening the timescale to certification. Best aerospace companies currently fund their success requiring their engineers a balanced mix of knowledge, experience and concurrent work in within and between departments. This course allows the future engineers to enhance their knowledge by a continuous class interaction.

The course contents are: Introduction to materials science and engineering; Structure of materials through atomic structure, interatomic bonding, the structure of crystalline solids and their imperfections, diffusion, phase diagrams and transformations; Properties of materials in terms of mechanics, thermic, optics, electrics, and magnetics; Performance of materials in service (failures of fatigue, fracture, and creep, corrosion and degradation of materials, economic, environmental, and societal issues in materials science); Aerospace materials: metals like steel, aluminum, or titanium, ceramic and polymers, composites; Materials applications, processing and selection.

3. COMPETENCIES AND LEARNING OUTCOMES

Core competencies:
CB1: That students have demonstrated knowledge and understanding in a field of study that part of the basis of general secondary education, and is usually found at a level that, while supported by advanced textbooks, includes some aspects that will knowledge of the forefront of their field of study.

Cross-curricular competencies:
CT17 (N2): Addressing the issues and challenges related to their area of expertise with flexibility, initiative, innovation, and dynamism (entrepreneurial profile).
CT19 (N2): Working in interdisciplinary teams, providing the most efficient on the basis of cooperation, assuming their role within the team, establishing good relationships and exchanging information (Teamwork).
CT21: Self-acknowledgement for achieving high levels of performance in one's work, with positive influence in substantially improving the results (Self Confidence).

Specific competencies:
CE15: Adequate knowledge and applied to engineering: The principles of continuum medium mechanics and technics for calculating its response
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.

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:
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.
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
CB1, CT21, CE15, CE18	LO20
CT17 (N2), CT19 (N2), CT21, CE15	LO21
CE15	LO22

4. CONTENT

- Mechanical properties
- Polymers
- Adhesives
- Crystal structure and geometry

- Phase diagrams
- Ceramics
- Application to Satellite Design (Carbon Fiber and Aluminum Alloys)

5. TEACHING-LEARNING METHODOLOGIES

The types of teaching-learning methodologies used are indicated below:

- Survey of objectives and interests
- Lecture-based class
- Laboratory practices
- Research by groups or problem solving by groups
- Designs
- Field experiences, conferences, visits to companies and institutions

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
Integrative 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
Exam, test and other type of assessment	30-35%
Reports, articles and informs	15-30%
Alternative system of assessment	15-30%

Conferences, company-tour visit and experiences in situ	10-10%
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).

To pass the course in the first exam period you should pass:

1. Exams, tests and other test knowledge: 40% (individual, 20% mid-course exam with a 5/10 minimum mark to be obtained, and 20% final exam with a 5/10 minimum mark with a 5/10 minimum mark to be obtained)

2. Elaboration of articles, reports, specialized software: 10% (individual and groups)

3. Course integrating project and presentations: 25% (groups)

4. Lab report and practices: 15% (individual)

5. Transversal-disciplinary skills (project presentations included): 10% (individual) A minimum mark of 5/10 is required in evaluation method 1 and 3 separately. A minimum mark of 5/10 is required in evaluation method 2, 4 and 5 globally. A minimum of 50% attendance is required to pass the subject.

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).

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.

To pass the course in the second exam period you should pass:

1. Exams, tests and other test knowledge: 40% (one and unique global exam)

2. Elaboration of articles, reports, specialized software: 10% (individual and groups)

3. Course integrating project and presentations: 25% (groups)

4. Lab report and practices: 15% (individual)

5. Transversal-disciplinary skills (project presentations included): 10% (individual) A minimum mark of 5/10 is required in evaluation method 1 and 3 separately. A minimum mark of 5/10 is required in evaluation method 2, 4, and 5 globally.

8. SCHEDULE

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

Assessable activities	Deadline
Laboratory session 1: crystalline structures	Week 1-3
Laboratory session 2 and 3: mechanical properties	Week 4-7
Activity mechanical properties of different materials Activity transport properties	Week 4-7
Activity phases diagrams	Week 7-10
Laboratory session 4 and 5: performance of materials	Week 11-13
Activity performance of materials and Activity composites	Week 11-13
Final Project	Week 14-15

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

Here is the recommended bibliography:

- Mechanical Behavior of Materials, Second Edition ©2000 | Courtney | McGraw-Hill Higher Education — USA.
- Aerospace Materials. Cantor, B. et. all. In Series in Materials Science and Engineering. Bristol: CRC Press. 2001.
- Introduction to Composite Materials; Tsai, S.W., and Hahn, H.T., Technomic Publishing Co., Westport, CT, 1980.
- Composites in aerospace industry. Source: Industrial Ceramics . Sep2009, Vol. 29 Issue 2, p119126. 8p. Author(s): Cavalier, J. C.; Berdoyes, I.; Bouillon, E.
- Materials science and engineering / William D. Callister, Jr., David G. Rethwisch. John Wiley & Sons | 2011 | 8th ed.
- Introduction to materials science for engineers / James F. Shackelford Shackelford, James F. 2005
- Materials science and technology: a comprehensive treatment / edited by R.W. Cahn, P. Haasen, E.J. Kramer Wiley-VCH | 1998.
- The behavior of sandwich structures of isotropic and composite materials / Jack R. Vinson Vinson, Jack R. (1929-) Technomic Publishing Company | 1999.
- Finite element analysis of composite materials using ANSYS / Ever J. Barbero Barbero, Ever J. Taylor & Francis | 2014 | 2nd ed
- An introduction to composite materials / D. Hull and T.W. Clyne Hull, Derek. Cambridge University | 1996 | 2nd. ed

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.