Universidad Europea

1. BASIC INFORMATION

Subject	Materials Science
Titulación	Degree in Aerospace and Aircraft Engineering
School/Faculty	School of Architecture, Engineering and Design
Year	Second Year
ECTS	6 ECTS
Type	Mandatory
Langauge/s	English
Format	Face-to-face
Semester	First Semester
Academic Year	2019/2020
Professor	Alicia Páez

2. PRESENTATION

This course belongs to the "Materials and production I" module:

- Materials science 6 ECTS (first 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 aero structure components and parts behavior.

The Engineering market is requiring an ever-growing emphasis on Concurrent Engineering, especially between Design, Stress Analysis and Manufacturing, reducing 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, 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 a 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.
- All this related to the competencies of this module LO3: To transfer an engineering problem to the laboratory, and to use this resource as support to solve it.
- 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, CT21, CE15, CE18	LO20
CT17 (N2), CT19 (N2), CT21, CE15	LO21
CE15	LO22

4. CONTENTS

- 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 following are the types of teaching-learning methodologies that will be applied:

- 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. TRAINING ACTIVITIES

The types of training activities to be carried out and the amount of hours devoted by the student to each of them are identified in the next table:

Training Activities	hours
Lecture-based class	20
Integrative team work	60
Self-study	50
Mentoring, academic monitoring and assessment	20
TOTAL	**150**

7. EVALUATION

In this section, the evaluation systems are related, as well as their weight on the total grade of the subject:

Evaluation 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%

In the Virtual Campus, when you access the subject, you will be able to consult in detail the evaluation activities that you must carry out, as well as the delivery dates and the evaluation procedures of each one of them.

7.1. Ordinary Session

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

1. Exams, tests and other test knowledge
2. Elaboration of articles, reports, specialized software
3. Course integrating project and presentations
4. Lab report and practices
5. Transversal-disciplinary skills (project presentations included)

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.

The grade in ordinary session will be considered as **NP** (not presented) when the student has not submitted any evaluable activity of those that are part of the weighted average.

7.2. Extraordinary Session

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

1. Exams, tests and other test knowledge
2. Elaboration of articles, reports, specialized software
3. Course integrating project and presentations
4. Lab report and practices

5. Transversal-disciplinary skills (project presentations included)

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.

The grade in extraordinary session will be considered as **NP** (not presented) in this session when the student has not submitted any new activity with respect to what was submitted in the ordinary session.

8. TIMELINE

This section indicates the timeline of the subject:

Evaluation Activities	Date
Unit 1	Week 1-3
Unit 2	Week 4-7
Unit 3 Midterm exam	Week 8-10
Unit 4	Week 11-13
Unit 5	Week 14-16
Unit 6 Final exam	Week 17-18

This schedule may undergo modifications for logistical reasons of the activities. Any modification will be notified to the student in a timely manner.

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, p119-126. 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 educational support needs:

Adaptations or curricular adjustments for students with specific educational support needs, in order to guarantee equal opportunities, will be guided by the Unidad de Atención a la Diversidad (UAD).

The issuance of a report of curricular adaptations/adjustments by said Unit will be essential, so that students with specific educational support needs should contact through: unidad.diversidad@universidadeuropea.es at the beginning of each semester.

Universidad Europea

INSTITUTIONAL ASSESSMENT OF LEARNING OUTCOMES PLAN Covid-19
TEMPLATE TO ADAPT TEACHING AND EVALUATION ACTIVITIES

Course/Module: Materials Science
Degree Program: Aerospace Engineering
Year (1º-6º): 2º
Group (s):
Professor: Alicia Páez
Coordinating professor **Degree Coordinator**

Teaching Activity described in the syllabus	Adapated activity in distance learning
Exams, tests and other test knowledge	Exams, tests and other test knowledge online
Elaboration of articles, reports, specialized software	Elaboration of articles, reports, specialized software online
Course integrating project and presentation	Course integrating project and presentation online
Lab report and practices	Lab report and practices online
Transversal-disciplinary skills (project presentations included)	Transversal-disciplinary skills (project presentations included) online

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	Course integrating project and presentations	**Description of new activity**	Students develop a theoretical work and present it through the virtual classroom
Content to be assessed	UA1. Introduction to materials science and engineering. UA2. Structure of materials. UA3. Properties of materials. UA4. Types of materials. UA5. Performance of materials. UA6. Materials applications, processing and selection		
Learning Outcomes to be assessed ***(Please check Syllabus of the course/module)***	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		
Duration	January-June	**Approximate duration**	January-June
Weight in evaluation	25%	**Weight in evaluation**	25%
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	Lab report and practices	**Description of new activity**	**Description of the equipment used in the laboratory through the Virtual Classroom. The class is recorded so that students can watch it if they cannot connect at class time. Students have to do a task consisting of the analysis of the results previously obtained in a real test and upload it to blackboard.**
Content to be assessed	UA3. Properties of materials. UA4. Types of materials. UA5. Performance of materials.		
Learning Outcomes to be assessed ***(Please check Syllabus of the course/module)***	LO22: To transfer some parts of an engineering problem to the laboratory, and utilize this resource as support to resolve it		
Duration	January-June	**Approximate duration**	**January-June**
Weight in evaluation	15%	**Weight in evaluation**	**15%**
Please note:			