Course Syllabus

Materials Resistance and Elasticity

Year: 2018/2019
Code: 9966001209
Coordinating professor: Fermín Navarro Medina
Degree program: Degree in Aerospace Engineering of aircrafts
School: Arquitectura, Ingeniería y Diseño
Languages: English

The mission of Universidad Europea de Madrid is to offer its students a holistic education, helping them become leaders and professionals capable of responding effectively to the needs of today's global world, adding value within their career fields, and contributing to social advancement through their entrepreneurial spirit and ethical integrity. We also strive to create and transfer knowledge through applied research, thus making our own contribution to progress and putting ourselves at the forefront of intellectual, scientific, and technological development.

Contents

1. Basic information on the course/module

ECTS	6
Credit type	Degree requirements
Language	English
Delivery mode	Face to face
Trimester/Semester	Second semester

2. Presentation of the course/module

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 aerostructures, the resistence of materiales under load conditions is crucial to understand aerostructure components and parts behaviour.

The Engineering market is requiring an evergrowing emphasys 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.

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 (N2): Ability to use tools to search for library resources or information (information retrieval).
- CT15 (N2): 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 equality, solidarity, environment protection, universal accessibility and design for all, and culture of peace (consultancy).
- CT20 (N2): Take decisions, in advance, on what is need 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 knowkedge applied to engineering of: basics of fluid mechanics; basic principles of flight control and automatitation; main characteristics and phisical 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.
- 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
CT13(N2), CT15(N2), CE7, CE11, CE18	LO20
CB2, CT13(N2), CT20(N2), CE7, CE11, CE18	LO21
CT13(N2), CT20(N2), CE7, CE11	LO22

The following table shows how the different types of activities are distributed and how many hours are assigned to each type:

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**

To develop the competencies and achieve the learning outcomes, you will have to complete the activities indicated in the table below:

Learning outcomes	Learning activity	Type of activity	Content
LO20. To perform studies where technologies, and engineering procedures related to competences of this module are involved.	Activity 1	Self-study	UA4. Introduction to finite element models with Nastran/Patran
	Activity 2	Integration of team work	UA 1. Introduction to aircraft and spacecraft structures UA 2. Introduction to materials elasticity UA 3. Materials resistance. UA4. Introduction to finite element models with Nastran/Patran
LO21. From previous requirements and information, conceptualize an engineering problem, raise an approach to solve it, and find the better solution, all related to the competences of this module.	Activity 3	Self-study	UA 1. Introduction to aircraft and spacecraft structures UA 2. Introduction to materials elasticity UA 3. Materials resistance.
	Activity 4	Integration of team work	
	Activity 5	Mentoring, academic monitoring and assessment	
	Activity 6	Mentoring, academic monitoring and assessment	
LO22. To transfer an engineering problem to the laboratory, and to use this resource as support to solve it.	Activity 7	Mentoring, academic monitoring and assessment	
	Activity 8	Self-study	

When you access the course on the *Virtual Campus,* you'll find a description of the activities you have to complete, as well as the deadline and assessment procedure for each one.

4. Monitoring and assessment

The following table shows the assessable activities, their respective assessment criteria, and the weight each activity carries towards the final course grade.

Assessable activity	Assessment criteria	Weight (%)
Activity 1	• Correct results are obtained for several load cases. • The results are analyzed, and compared with analytical results. • Conclusions are drawn to improve the structure.	5%
Activity 2	• Appropriate hypothesis has been considered. • Correct results are obtained for several load cases, which are coherent with the hypothesis considered. • The results are analyzed and conclusions extracted to improve the structure. • Studies of state of the art are included	20%
Activity 3	• Appropriate hypothesis has been considered. • The complete set of equations to solve the problem has been expound • Correct results are obtained according to the hypothesis considered. • The results are analyzed and conclusions are outlined.	15%
Activity 4	• Appropriate hypothesis has been considered. • The complete set of equations to solve the problem has been expound • Correct results are obtained according to the hypothesis considered. • The results are analyzed and conclusions are outlined. • Students cooperate to accomplish previous criteria.	10%
Activity 5	• Appropriate hypothesis has been considered. • The complete set of equations to solve the problem has been expound • Correct results are obtained according to the hypothesis considered. • The results are analyzed and conclusions are outlined.	35%
Activity 6	• Explanation is clear and concise • Presentation contents are correct • Presentation time is adjusting to required duration • Student can answer the questions of audience	10%
Activity 7	• Student attends the class • Student attitude is proactive	2.5%

Activity 8	• The format of the report is correct • All contents are included in the report • Technical conclusions are included, by using theoretical concepts	2.5%

When you access the course on the *Campus Virtual*, you'll find a description of the activities you have to complete, as well as the deadline and assessment procedure for each one.

4.1. First exam period

To pass the course in the first exam period you should

- Obtain a minimum mark of 5 over 10 in every evaluation method:
    - 1. Exam,
    - 2. Project and FEM practice,
    - 3. Problem solving, lab report and transversal-disciplinary skills.
- A class attendance of 50% is required.

4.2. Second exam period

To pass the course in the second exam period you should

- Obtain a minimum mark of 5 over 10 in every evaluation method:
    - 1. Exam,
    - 2. Project and FEM practice,
    - 3. Problem solving, lab report and transversal-disciplinary skills.

5. Bibliography

Here is the recommended bibliography:

- 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.

6. How to communicate with your professor

Whenever you have a question about the content or activities, don't forget to post it to your course forum so that your classmates can read it.

You might not be the only one with the same question!

If you have a question that you only want to ask your professor, you can send him/her a private message from the *Campus Virtual*. And if you need to discuss something in more detail, you can arrange an advisory session with your professor.

It's a good idea to check the course forum on a regular basis and read the messages posted by your classmates and professors, as this can be another way to learn.

7. Study recommendations

When you study at university, you need to plan and be consistent from the first week. It's very useful to exchange experiences and opinions with professors and other students, as this will help you develop core competencies such as flexibility, negotiating skills, teamwork, and, of course, critical thinking.

To help you, we recommend using a general method of study based on the following points:

- Study systematically and at a steady pace.
- Attend class and regularly check the course forum on the *Campus Virtual* so that you keep up to date with what's happening.
- Participate actively in the course by sharing your opinions, doubts and experiences relating to the topics covered and/or suggesting new topics of interest for discussion.
- Read the messages posted by your classmates and/or professors.

Active participation in physical and virtual classroom activities is of special interest and academic value. You can participate in many different ways: asking questions, giving your opinion, doing all the activities your professor suggests, taking part in collaborative activities, helping your classmates, etc. This way of working requires effort, but it will help you get better results as you develop your competencies.