

Course Syllabus

Aeronautical Structures and Vibration

Year: 2018/2019

Code: 9966001305

Coordinating professor: Rafael Pax Dolz del Castellar

Degree program: Degree in Aerospace Engineering of aircraft

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.

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1. Basic information on the course/module

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

2. Presentation of the course/module

This course belongs to the “Aerospace vehicles II” module:

- Aeronautical Structures and Vibration 6 ECTS (third year)
- Aerodynamics and Aeroelasticity 6 ECTS (third year)
- Space Vehicles and Missiles 6 ECTS (third year)
- Flight Mechanics 6 ECTS (third year)
- Aerospace Vehicle Maintenance and Certification 6 ECTS (third year)
- Aircraft design 6 ECTS (fourth year)

In the Aeronautical Structures and Vibration subject the following topics are covered:
Aeronautical structure analysis, finite element methods, and vibrations.

3. Competencies and learning outcomes

Core competencies:

- CB5: That students have developed those learning skills necessary to undertake further studies with a high degree of autonomy

Cross-curricular competencies:

- CT14: Problem Solving with initiative, decision making, creativity, and critical thinking, professionally, and the preparation and defense of arguments (Troubleshooting).
- CT18: Commit to the fulfillment of the tasks (Responsibility).

Specific competencies:

- CE20: Adequate knowledge and applied to Engineering: The fracture mechanics approaches continuum and dynamic fatigue of structural instability and aeroelasticity.
- CE26: Applied knowledge of: aerodynamics, mechanics, and thermodynamics, flight mechanics, engineering of aircrafts (fixed and rotatory wings), and theory of structures.

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:

- LO26. To establish models, as input data to the simulators of MEF and CFD
 - 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

The table below shows the relation between the competencies developed during the course and the envisaged learning outcomes:

Competencies	Learning outcomes
CE20, CE26	LO26
CT18, CE26	LO20
CB5, CT14, CE20, CE26	LO21

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 (columna H)	Learning activity (tus actividades)	Type of activity (columna M)	Content (tus contenidos)
<p>LO20. To conduct studies by integrating the technologies and engineering procedures which are developed in the competencies of this modules</p> <p>LO26. To establish models, as input data to the simulators of MEF and CFD</p>	Activity 1	Integration of team work	<p>1. Introduction to solid mechanics and Structures</p> <p>2. Beams under bending and torsion.</p> <p>3. Truss Structures</p> <p>4. Thin Wall structures</p> <p>5. Structural details analysis. Joints</p> <p>6. Stability. Buckling and diagonal tension</p> <p>7. Mechanical vibrations</p> <p>8. Introduction to fatigue and fracture mechanics</p> <p>9. FEA fundamentals</p>
	Activity 5	Self-study	
<p>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</p>	Activity 3	Self-study	<p>1. Introduction to solid mechanics and Structures</p> <p>2. Beams under bending and torsion.</p> <p>3. Truss Structures</p>
	Activity 2	Mentoring, academic monitoring and assessment	<p>4. Thin Wall structures</p> <p>5. Structural details analysis. Joints</p>
	Activity 4	Mentoring, academic monitoring and assessment	<p>6. Stability. Buckling and diagonal tension</p>
	Activity 6	Mentoring, academic monitoring and assessment	<p>7. Mechanical vibrations</p>

		8. Introduction to fatigue and fracture mechanics
		9. FEA fundamentals

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	<ul style="list-style-type: none"> • Appropriate hypothesis has been considered. • Reasonable structure idealization • 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 	15%
Activity 2	<ul style="list-style-type: none"> • Appropriate hypothesis has been considered. • The complete set of equations to solve the problem has been expound. Demonstrate understanding of what is being done. • Correct results are obtained according to the hypothesis considered. • The results are analyzed and conclusions are outlined. 	40%
Activity 3	<ul style="list-style-type: none"> • Appropriate hypothesis has been considered. • The complete set of equations to solve the problem has been expound. Demonstrate understanding of what is being done. • Correct results are obtained according to the hypothesis considered. • The results are analyzed and conclusions are outlined 	30%
Activity 4	<ul style="list-style-type: none"> • Appropriate hypothesis has been considered. • The complete set of equations to solve the problem has been expound. Demonstrate understanding of what is being done. • Correct results are obtained according to the hypothesis considered. • The results are analyzed and conclusions are outlined 	5%
Activity 5	<ul style="list-style-type: none"> • Attendance 	5%
Activity 6	<ul style="list-style-type: none"> • Student pay attention in the class • Student attitude is proactive 	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
- 3. Problem solving, 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 ,
- 3. Problem solving, and transversal-disciplinary skills.

5. Bibliography

- Megson, Aircraft Structures for Engineering Students
- Bruhn, Analysis and Design of Flight vehicle structures
- Niu, Airframe structural design
- Niu, Airframe stress analysis and sizing
- Roark, Roark's formulas for stress and strain
- Niu, composite airframe structures
- Shigley. Mechanical design

7. 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.

8. 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.