



Course guide

220306 - 220306 - Aerospace Vehicles

Last modified: 02/04/2024

Unit in charge: Terrassa School of Industrial, Aerospace and Audiovisual Engineering
Teaching unit: 220 - ETSEIAT - Terrassa School of Industrial and Aeronautical Engineering.

Degree: MASTER'S DEGREE IN AERONAUTICAL ENGINEERING (Syllabus 2014). (Compulsory subject).

Academic year: 2024 **ECTS Credits:** 7.5 **Languages:** Catalan, Spanish

LECTURER

Coordinating lecturer: Casamor Martinell, Oriol

Others: Esbri Rosales, Carlos

PRIOR SKILLS

"Elements Resistents en l'Aeronàutica" depending on the previous degree.

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:

CG01-MUEA. (ENG) Capacitat per a projectar, construir, inspeccionar, certificar i mantenir tot tipus d'aeronaus i vehicles espacials, amb els seus corresponents subsistemes.

CG04-MUEA. (ENG) Capacitat d'integrar sistemes aeroespacials complexos i equips de treball multidisciplinaris.

CG09-MUEA. (ENG) Competència en totes aquelles àrees relacionades amb les tecnologies aeroportuàries, aeronàutiques o espacials que, per la seva naturalesa, no siguin exclusives d'altres branques de l'enginyeria.

CE01. MUEA/MASE: An aptitude for designing, building, inspecting, certifying and maintaining all types of aircraft and space vehicles

CE04. MUEA/MASE: The ability to apply the knowledge acquired in various disciplines to solving complex aeroelasticity problems.

CE08. MUEA/MASE: Knowledge and skills in the analysis and structural design of aircraft and space vehicles, including the application of calculation programs and advanced structural design.

CE09. MUEA/MASE: The ability to design, execute and analyse ground and flight tests of aerospace vehicles and carry out their entire certification process.

CE10. MUEA/MASE: Sufficient knowledge of aircraft and space vehicle subsystems.

Basic:

CB06. Manage original concepts in research projects.

CB07. Student capacity to use their knowledge in new and multidisciplinary situations.

CB08. Generate decision from incomplete information assuming its social and ethical responsibilities.

CB09. Improve technical communication of results.

CB10. Improve self-learning capacity

TEACHING METHODOLOGY

The teaching methodology is based on the development of three complementary activities: theory classes, practical work classes in the computer classroom and evaluation tests.

In the theory classes the concepts are introduced, exercises are developed and the corresponding calculation algorithms are formulated.

The classes in the computer room seek to familiarize the student with the basic ideas through practical exercises. They will be solved with both analytical and numerical techniques (of own programming or of commercial use).

Assessment tests include exams, which measure the degree of knowledge acquired, and group work.



LEARNING OBJECTIVES OF THE SUBJECT

Learn the fundamental concepts of static and dynamic aeroelasticity. Know how to apply these concepts in both academic and real examples.

Understand the concepts of numerical methods to solve static and dynamic structural problems, and know how to use them through both own programming and commercial software.

Know the subsystems of spacecraft.

Understand the architecture of aircraft and their hydraulic, pneumatic, electrical, flight control and auxiliary systems.

Know the operation of aircraft and helicopter certification, as well as current regulations.

STUDY LOAD

| Type | Hours | Percentage |
|-------------------|-------|------------|
| Hours large group | 45,0 | 24.00 |
| Hours small group | 22,5 | 12.00 |
| Self study | 120,0 | 64.00 |

Total learning time: 187.5 h

CONTENTS

Module 1: Introduction to aeroelasticity

Description:

- Introduction to static aeroelasticity
- Introduction to dynamic aeroelasticity

Related activities:

- Activity 1: theory classes
- Activity 2: practical work classes
- Activity 3: practical project

Full-or-part-time: 50h

- Theory classes: 12h
- Laboratory classes: 6h
- Self study : 32h

Module 2: Numerical methods for structural analysis

Description:

- Numerical methods for static structural analysis
- Numerical methods for dynamic structural analysis
- Determination of natural modes

Related activities:

- Activity 1: theory classes
- Activity 2: practical work classes
- Activity 3: practical project

Full-or-part-time: 50h

- Theory classes: 12h
- Laboratory classes: 6h
- Self study : 32h



Module 3: Spacecraft subsystems

Description:

Introduction to spacecraft subsystems:

- Structural
- Power
- Propulsion
- Thermal and environmental control
- Others

Related activities:

Activity 1: theory classes

Activity 2: partial exam

Activity 3: final exam

Full-or-part-time: 12h 30m

Theory classes: 3h

Laboratory classes: 1h 30m

Self study : 8h

Module 4: Aircraft Architecture

Description:

- Hydraulic, pneumatic and electrical system
- Flight control systems
- Auxiliary systems

Related activities:

Activity 1: theory classes

Activity 2: partial exam

Activity 3: final exam

Full-or-part-time: 37h 30m

Theory classes: 9h

Laboratory classes: 4h 30m

Self study : 24h

Module 5: Certification of airplanes and helicopters

Description:

- Aircraft certification
- Certification of helicopters
- Applicable regulations

Related activities:

Activity 1: theory classes

Activity 2: partial exam

Activity 3: final exam

Full-or-part-time: 37h 30m

Theory classes: 9h

Laboratory classes: 4h 30m

Self study : 24h



GRADING SYSTEM

$$NF = 0,20 EP + 0,20 EF + 0,36 TP + 0,24 EC$$

NF : Final mark

EP : Partial exam

EF : Final exam

TP : Practical Projects

EC : Class exercise

EXAMINATION RULES.

The partial and final exams are carried out individually, in writing and on the dates set by the school. Projects and class exercises can be done in groups.

BIBLIOGRAPHY

Basic:

- Fung, Y. C. An introduction to the theory of aeroelasticity. Mineola, NY: Dover Publications, 2008. ISBN 9780486469362.
- Hughes, Thomas J. R. The finite element method: linear static and dynamic finite element analysis [on line]. Mineola, NY: Dover Publications, 2000 [Consultation: 09/07/2024]. Available on: <https://ebookcentral-proquest-com.recursos.biblioteca.upc.edu/lib/upcatalunya-ebooks/detail.action?pq-origsite=primo&docID=1894765>. ISBN 0486411818.
- Lombardo, David A. Aircraft systems. 2nd ed. New York: McGraw-Hill, 1999. ISBN 0070386056.
- Craig, Roy R; Kurdila, Andrew J. Fundamentals of structural dynamics [on line]. 2nd ed. New York: John Wiley & Sons, 2006 [Consultation: 13/02/2023]. Available on: <https://ebookcentral-proquest-com.recursos.biblioteca.upc.edu/lib/upcatalunya-ebooks/detail.action?pq-origsite=primo&docID=819002>. ISBN 9780471430445.
- García-Fogeda, Pablo; Arévalo, Félix. Introducción a la aeroelasticidad: conceptos generales con aplicaciones al perfil. Madrid: Ibergarceta Publicaciones, 2015. ISBN 9788416228379.

Complementary:

- Young, Warren C.; Budynas, Richard G.; Roark, Raymond J. Roark's formulas for stress and strain. 7th ed. New York [etc.]: McGraw-Hill, cop. 2002. ISBN 9780071210591.