



Course guide

220373 - 220373 - Fundamentals of Aircraft Design

Last modified: 19/04/2023

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). (Optional subject).

Academic year: 2023 **ECTS Credits:** 3.0 **Languages:** Catalan

LECTURER

Coordinating lecturer: ESTER COMELLAS SANFELIU

Primer quadrimestre:
ESTER COMELLAS SANFELIU - Grup: 1

Others:

PRIOR SKILLS

The student must arrive with knowledge of aerodynamics, flight mechanics and aerospace structures. During the course, you must also apply concepts related to economics and materials science. It is also recommended that students master technical English as it will be used throughout the course.

REQUIREMENTS

IMPORTANT: These subjects are complementary to the compulsory training received in the degree by non-GrETA students. Therefore, students from GrETA have already taken them in their curriculum and will not be able to take them as general optional subjects.

TEACHING METHODOLOGY

The teacher will review the fundamentals of aircraft design in the expository classes. Students must have read the material and performed the preparatory activities indicated in Atenea. During practical sessions, the syllabus will be further worked on through the development of key aspects of the group assignment, which will consist in the conceptual design of an airplane.

LEARNING OBJECTIVES OF THE SUBJECT

The main objective of this course is to bring students to the different aspects of the Aircraft design:

1. Economics and Planning. Project Phases.
2. Functional design of the different parts of an airplane. Integration and interferences.
3. Influence of the actions of the aircraft and aerodynamics in the design process.



STUDY LOAD

Type	Hours	Percentage
Self study	48,0	64.00
Hours large group	27,0	36.00

Total learning time: 75 h

CONTENTS

Introduction to airplane design

Description:

Unit 1: History of flight
Unit 2: Economical aspects
Unit 3: Project phases
Unit 4: General configuration

Full-or-part-time: 8h

Theory classes: 4h
Self study : 4h

Performances and global design

Description:

Unit 5: Weight and balance of the airplane
Unit 6: Methods for performance estimation
Unit 7: Preliminary sizing
Unit 8: Weight-range diagram
Unit 9: Drag

Full-or-part-time: 29h

Theory classes: 8h
Self study : 21h

Design of different functional blocks of an airplane

Description:

Unit 10: Fuselage design
Unit 11: Wing design
Unit 12: Tail design
Unit 13: Landing gear design

Full-or-part-time: 29h

Theory classes: 12h
Self study : 17h



Structural design of airplanes

Description:

Unit 14: Loads on the airplane
Unit 15: Airframe design

Full-or-part-time: 9h

Theory classes: 3h
Self study : 6h

ACTIVITIES

Graded activities

Description:

Graded activities that will be done throughout the course via Atenea and in the theoretical sessions in class.

Specific objectives:

Incentivise the preparation of material required previous to each theoretical session. Encourage autonomous learning.

Delivery:

Dates to be agreed at the beginning of the course.

Full-or-part-time: 13h

Theory classes: 2h
Self study: 11h

Mid term assignment delivery

Description:

First delivery of the assignment.

Specific objectives:

Assess the knowledge of modules 1 and 2. Encourage autonomous learning.

Delivery:

Date to be agreed at the beginning of the course.

Full-or-part-time: 15h

Self study: 15h

End term assignment delivery

Specific objectives:

Assess the knowledge of modules 3 and 4. Encourage autonomous learning.

Material:

End term assignment delivery.

Delivery:

Date to be agreed at the beginning of the course.

Full-or-part-time: 15h

Self study: 15h



Defense of group assignment

Description:

Each student will participate in at least one presentation of the assignment done in groups, where they will have to synthesize and defend the work done

Delivery:

Date to be agreed at the beginning of the course.

Full-or-part-time: 11h

Theory classes: 4h

Self study: 7h

In-person sessions

Full-or-part-time: 21h

Theory classes: 21h

GRADING SYSTEM

The grading system will consist of the graded activities completed throughout the course, a group assignment and two presentations of the group assignment. In the mid terms, the assignment (with the theory explained so far) and an oral presentation will be evaluated. At the end, the complete assignment will be delivered and a second presentation will be made. Each student must at least present once, either in mid term or at the end.

The evaluation final consists of the midterm hand-in of the group assignment 20%, the final hand-in of the group assignment 50%, the individual grade of the presentation 20% and the mean of the graded activities 15%.

BIBLIOGRAPHY

Basic:

- Sadraey, Mohammad H. Aircraft design: a systems engineering approach. West Sussex: John Wiley & Sons, 2013. ISBN 9781119953401.
- Torenbeek, Egbert; Wittenberg, H. Synthesis of subsonic airplane design: an introduction to the preliminary design of subsonic general aviation and transport aircraft, with emphasis on layout, aerodynamic design, propulsion and performance. Delft: Dordrecht, (etc.): Delft University Press; Kluwer Academic, 1982. ISBN 9024727243.
- Roskam, Jan. Airplane design. Lawrence: DARcorporation, 1986-2000. ISBN 188488542X.

Complementary:

- Fielding, John P. Introduction to aircraft design. 2nd ed. New York: Cambridge University Press, 2017. ISBN 9781107680791.
- Torenbeek, Egbert. Essentials of supersonic commercial aircraft conceptual design [on line]. Hoboken, NJ: John Wiley & Sons, 2020 [Consultation : 20/05/2022]. Available on : <https://onlinelibrary-wiley-com.recursos.biblioteca.upc.edu/doi/book/10.1002/9781119667063>. ISBN 9781119667001.
- Torenbeek, Egbert. Advanced aircraft design: conceptual design, analysis and optimization of subsonic civil airplanes [on line]. Wiley, 2013 [Consultation : 20/05/2022]. Available on : <https://onlinelibrary-wiley-com.recursos.biblioteca.upc.edu/doi/book/10.1002/9781118568101>. ISBN 9781118568118.
- Raymer, Daniel P. Aircraft design: a conceptual approach. 6th ed. Reston, Virginia: American Institute of Aeronautics and Astronautics, 2018. ISBN 9781624104909.
- Stinton, Darrol. The design of the airplane. 2nd ed. Reston: American Institute of Aeronautics and Astronautics, 2001. ISBN 1563475146.