

## Course guide

### 220373 - 220373 - Fundamentals of Aircraft Design

**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). (Optional subject).

**Academic year:** 2024    **ECTS Credits:** 3.0    **Languages:** Catalan

#### LECTURER

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**Coordinating lecturer:** ESTER COMELLAS SANFELIU

Primer quadrimestre:  
ESTER COMELLAS SANFELIU - Grup: 1

**Others:**

#### PRIOR SKILLS

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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

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**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

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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

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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

Self study: 7h

Theory classes: 4h

### 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:**

- 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.
- Sadraey, Mohammad H. Aircraft design: a systems engineering approach. West Sussex: John Wiley & Sons, 2013. ISBN 9781119953401.
- Roskam, Jan. Airplane design. Lawrence: DARcorporation, 1986-2000. ISBN 188488542X.

**Complementary:**

- Stinton, Darrol. The design of the airplane. 2nd ed. Reston: American Institute of Aeronautics and Astronautics, 2001. ISBN 1563475146.
- Fielding, John P. Introduction to aircraft design. 2nd ed. New York: Cambridge University Press, 2017. ISBN 9781107680791.
- Raymer, Daniel P. Aircraft design: a conceptual approach. 6th ed. Reston, Virginia: American Institute of Aeronautics and Astronautics, 2018. ISBN 9781624104909.
- 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.
- 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.