Course guide
220032 - DA - Aeroplane Design

Last modified: 05/05/2023

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

Degree: BACHELOR'S DEGREE IN AEROSPACE VEHICLE ENGINEERING (Syllabus 2010). (Compulsory subject).

Academic year: 2023 **ECTS Credits:** 4.5 **Languages:** Catalan

LECTURER

Coordinating lecturer: ESTER COMELLAS SANFELIU

Primer quadrimestre:
ESTER COMELLAS SANFELIU - Grup: 21

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.

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
CE25. Adequate knowledge and application to Aeronautical Engineering of: design and project calculation methods for aircraft; the use of aerodynamic experimentation and the most significant parameters in theoretical application; handling of experimental techniques, equipment and measurement instruments specific to the discipline; simulation, design, analysis and interpretation of experimentation and flight operations; aircraft maintenance and certification systems. (Specific Technology Module: Aircraft)

Transversal:
01 EIN N3. ENTREPRENEURSHIP AND INNOVATION - Level 3. Using knowledge and strategic skills to set up and manage projects. Applying systemic solutions to complex problems. Devising and managing innovation in organizations.
06 URI N3. EFFECTIVE USE OF INFORMATI0N RESOURCES - Level 3. Planning and using the information necessary for an academic assignment (a final thesis, for example) based on a critical appraisal of the information resources used.

TEACHING METHODOLOGY

The subject is taught following the principles of project-based learning. Students will learn the syllabus through the development of a group project, which will consist of the initial baseline design of an airplane, as well as through individual activities. In class, the teacher will review the basic principles of Aircraft Design and give instructions for activities to be carried out both in and out of class. The student must have completed the required reading and preparation activities indicated in Atenea beforehand.

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
Hours medium group	14,0	12.44
Hours large group	31,0	27.56
Self study	67,5	60.00

Total learning time: 112.5 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: 12h 30m
Theory classes: 5h
Practical classes: 3h
Self study : 4h 30m

Performances and global design

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

Full-or-part-time: 40h
Theory classes: 9h
Practical classes: 4h
Self study : 27h

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: 43h
Theory classes: 13h
Practical classes: 5h
Self study : 25h

Structural design of airplanes

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

Full-or-part-time: 17h
Theory classes: 4h
Practical classes: 2h
Self study : 11h

ACTIVITIES

Graded individual activities

Description:
Graded individual activities that will be done throughout the course via Atenea.

Specific objectives:
Incentivate the preparation of material required previous to each in-person session. Encourage autonomous learning.

Delivery:
Dates to be agreed at the beginning of the course.

Full-or-part-time: 17h 30m
Theory classes: 2h
Self study: 15h 30m

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.

Related competencies :
CE25-GREVA. Adequate knowledge and application to Aeronautical Engineering of: design and project calculation methods for aircraft; the use of aerodynamic experimentation and the most significant parameters in theoretical application; handling of experimental techniques, equipment and measurement instruments specific to the discipline; simulation, design, analysis and interpretation of experimentation and flight operations; aircraft maintenance and certification systems. (Specific Technology Module: Aircraft)
01 EIN N3. ENTREPRENEURSHIP AND INNOVATION - Level 3. Using knowledge and strategic skills to set up and manage projects. Applying systemic solutions to complex problems. Devising and managing innovation in organizations.
06 URI N3. EFFECTIVE USE OF INFORMATI0N RESOURCES - Level 3. Planning and using the information necessary for an academic assignment (a final thesis, for example) based on a critical appraisal of the information resources used.

Full-or-part-time: 22h
Self study: 22h

End term assignment delivery

Description:
End term assignment delivery.

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

Delivery:
Date to be agreed at the beginning of the course.

Related competencies :
CE25-GREVA. Adequate knowledge and application to Aeronautical Engineering of: design and project calculation methods for aircraft; the use of aerodynamic experimentation and the most significant parameters in theoretical application; handling of experimental techniques, equipment and measurement instruments specific to the discipline; simulation, design, analysis and interpretation of experimentation and flight operations; aircraft maintenance and certification systems. (Specific Technology Module: Aircraft)
01 EIN N3. ENTREPRENEURSHIP AND INNOVATION - Level 3. Using knowledge and strategic skills to set up and manage projects. Applying systemic solutions to complex problems. Devising and managing innovation in organizations.
06 URI N3. EFFECTIVE USE OF INFORMATI0N RESOURCES - Level 3. Planning and using the information necessary for an academic assignment (a final thesis, for example) based on a critical appraisal of the information resources used.

Full-or-part-time: 22h
Self study: 22h

Group activities

Description:
Activities that will be done throughout the course via Atenea and in the in-person sessions. Each student will participate in at least one oral presentation of the group results obtained, where they will have to synthesize and defend the work done.

Specific objectives:
Incentivate the preparation of material required previous to each theoretical session. Encourage project-based learning.

Delivery:
Date to be agreed at the beginning of the course.

Full-or-part-time: 12h
Theory classes: 4h
Self study: 8h

In-person sessions

Full-or-part-time: 39h
Theory classes: 25h
Practical classes: 14h

GRADING SYSTEM

The grading system will consist of the graded activities carried out throughout the course and a group project. During the midterm, a partial delivery of the project (with the sections of the theory explained up to that point) will be required, and at the end of the course, the complete project must be submitted. Throughout the course, groups will have to present their results several times, and each student must present at least once.
The final evaluation consists of the partial delivery of the group project (20%), the final delivery of the group project (40%), the average of the graded individual activities (25%), and the delivery of the group activities (15%).

BIBLIOGRAPHY

Basic:
- Torenbeek, Egbert. Synthesis of subsonic airplane design. Delft: Delft University Press, 1982. ISBN 9024727243.
- Roskam, Jan. Airplane design. Lawrence: DARcorporation, 1986-2000.
- Sadraey, Mohammad H. Aircraft design: a systems engineering approach. West Sussex: John Wiley & Sons, 2013. ISBN 9781119953401.

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.
- 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.
- 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.