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220055 - Aircraft Design

Coordinating unit: 205 - ESEIAAT - Terrassa School of Industrial, Aerospace and Audiovisual Engineering

Teaching unit: 220 - ETSEIAT - Terrassa School of Industrial and Aeronautical Engineering

Academic year: 2019

Degree: BACHELOR'S DEGREE IN AEROSPACE TECHNOLOGY ENGINEERING (Syllabus 2010). (Teaching unit Compulsory)

ECTS credits: 6 Teaching languages: Catalan, Spanish

Teaching staff

Coordinator: Aleix Baez

Others: Miquel Sureda

Degree competences to which the subject contributes

Specific:

1. GrETA - An adequate understanding of the following, as applied to engineering: calculation methods for aeronautical design and development; the use of aerodynamic experimentation and the most important parameters in theoretical application; the experimental techniques, equipment and measuring instruments used in the discipline; simulation, design, analysis and interpretation of in-flight experiments and operations; aircraft maintenance and certification systems.
2. GrETA - An adequate understanding of the following, as applied to engineering: aircraft systems and automatic flight control systems in aerospace vehicles.
3. GrETA - Applied knowledge of aerodynamics, mechanics and thermodynamics, flight mechanics, aircraft engineering (fixed-wing and rotary-wing), structural theory.

Transversal:

4. 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.
5. EFFECTIVE USE OF INFORMATION 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

Teacher will introduce basic fundamentals of aircraft design in the theory classes.
Practical exercises of each subject will be presented in the practical sessions.
Exams will consist on theoretical and practical part.

Learning objectives of the subject

The main objective of this course is to approach students to different aspects related with aircraft design:
1. Economic and planning items. Project phases
2. Functional design of the different parts of an airplane. Integration and interference.
3. Influence of the airplane performances and the aerodynamics on the design process
4. Identifying different elements and systems which compose a rotating wings aircraft (mainly the helicopter).
5. To understand physical principles of theory of the flight of rotatory wings aircraft.
6. To acquire knowledge which allow to design a helicopter and to know how to justify the techniques of a determinate design.

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Study load

Total learning time: 150h	Hours large group:	32h	21.33%
	Hours medium group:	14h	9.33%
	Hours small group:	14h	9.33%
	Self study:	90h	60.00%

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Content

Introduction to aircraft design	Learning time: 8h Theory classes: 2h Practical classes: 1h Laboratory classes: 1h Self study : 4h
Description:	

Design of different functional blocks of an aircraft	Learning time: 24h Theory classes: 4h Practical classes: 2h Laboratory classes: 2h Self study : 16h
Description:	

Performances and global design of aircraft	Learning time: 31h Theory classes: 6h Practical classes: 3h Laboratory classes: 4h Self study : 18h
Description:	

Structural design of aircraft	Learning time: 12h Theory classes: 2h Practical classes: 2h Laboratory classes: 2h Self study : 6h
Description:	

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General Concepts and Description of Helicopters	Learning time: 18h Theory classes: 4h Practical classes: 1h Laboratory classes: 1h Self study : 12h

Description:
(ENG) Tema 13. Introducció als helicòpters i les aeronaus diverses
Tema 14. Definició i descripció dels components d'un helicòpter

Theory of Helicopters	Learning time: 26h Theory classes: 6h Practical classes: 2h Laboratory classes: 2h Self study : 16h

Description:
(ENG) Tema 15. Teoria de la quantitat de moviment. Vol axial
Tema 16. Teoria de l'element de pala. Vol axial
Tema 17. Combinació de les dues teories
Tema 18. Rotors de velocitat induïda constant
Tema 19. Teoria de la quantitat de moviment. Vol endavant
Tema 20. Teoria de l'element de pala. Vol endavant
Tema 21. Equilibri de moments. Rotor antiparell

Performances of Helicopters	Learning time: 31h Theory classes: 8h Practical classes: 3h Laboratory classes: 2h Self study : 18h

Description:

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Planning of activities

THEORY CLASSES	Hours: 108h Theory classes: 28h Self study: 80h
PRACTICAL CLASSES	Hours: 24h Practical classes: 10h Laboratory classes: 14h
EXAM 1	Hours: 5h Theory classes: 2h Self study: 3h
EXAM 2	Hours: 5h Theory classes: 2h Self study: 3h
DELIVERABLE	Hours: 8h Practical classes: 4h Self study: 4h

Qualification system

The system of qualification will consist on 2 Partial Examinations and 1 Deliverable Exercises.

The Deliverable Exercise will be 1 Practical Exercises. They will be made in the Practical Classes (medium group).

Final qualification = 0.4 x (N_ex_p + N_ex_final) + 0.2 x N_deliverable exercise

In case of being unable to attend to the partial exam, not passing it or in case the student wanted to improve its grade, the student will have another exam to replace its grade, the day of the final exam. In case this day was not able for this exam, the professor would inform, via Atenea, of the alternative date.

Regulations for carrying out activities

The examinations will consist on theory and practical exercise. The theory will be evaluated with short questions. The problem will be one type exercise of class.
The deliverable exercises will be done in class (medium group).

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Bibliography

Basic:

Torenbeek, Egbert. Synthesis of subsonic airplane design. Delft: Delft University Press, 1982. ISBN 9024727243.

Leishman, J. Gordon. Principles of helicopter aerodynamics. 2nd ed. Cambridge: Cambridge University Press, 2006. ISBN 9780521858601.

Bramwell, A.R.S.; Done, G.; Balmford, D. Bramwell's helicopter dynamics. 2nd ed. Reston: American Institute of Aeronautics and Astronautics, 2001. ISBN 1563475006.

Padfield, Gareth D. Helicopter flight dynamics: the theory and application of flying qualities and simulation modeling. 2nd ed. Oxford: Blackwell Publishing, 2007. ISBN 9781563479205.