Last update: 05-10-2018

220350 - Aerospace Laboratories

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

Teaching unit: 748 - FIS - Department of Physics

Academic year: 2018

Degree: MASTER'S DEGREE IN AERONAUTICAL ENGINEERING (Syllabus 2014). (Teaching unit Optional)
MASTER'S DEGREE IN SPACE AND AERONAUTICAL ENGINEERING (Syllabus 2016). (Teaching unit Optional)

ECTS credits: 5 Teaching languages: English

Teaching staff

Coordinator: MANUEL SORIA GUERRERO

Others: Primer quadrimestre:
ARNAU MIRÓ JANÉ - 1
MANUEL SORIA GUERRERO - 1

Degree competences to which the subject contributes

Specific:

CEEVEHI3. MUEA/MASE: Applied knowledge of composite materials technology and a capacity for designing the basic elements of these materials (specific competency for the specialisation in Aerospace Vehicles).
CEEVEHI2. MUEA/MAS: Sufficient applied knowledge of the aeroelasticity and structural dynamics of aircraft (specific competency for the specialisation in Aerospace Vehicles).
CEEVEHI1. MUEA/MAS: Sufficient applied knowledge of advanced, experimental and computational aerodynamics (specific competency for the specialisation in Aerospace Vehicles).

Teaching methodology

The course Aerospace Laboratory is divided into theoretical and laboratory sessions. The theoretical sessions aim to provide students with the basic concepts behind the typical experimental techniques and procedures applied in low-speed aerodynamics. The main objective of the labs is to exemplify the application of experimental techniques and actual laboratory work by means of simple aerodynamic experiments. Under the supervision of the professors, the students will conduct the labs in an autonomous manner, working in small groups. To this end, a laboratory guide will be provided by the professors, specifying the objectives and the procedure to conduct the test. After performing the latter, each group must write a laboratory report according to specified requirements. Only for selected experiments, previously indicated by the professors, the report submission will be compulsory for all the groups (homework assignments). The grades obtained in these reports (over three during the course) will be taken into account to compute the final grade of the course (see Grading System).

Learning objectives of the subject

Experimental techniques play an essential role in all fields of science and technology. They contribute to the understanding of physical phenomena and facilitate the creation of models for study and analysis. In addition, experimental techniques are vital for the diagnosis, monitoring and control of processes, as well as for product evaluation and certification. The scope of experimental techniques is very extensive and varied, as are the different techniques used. Focusing in the field of low-speed aerodynamics, the main objective of Aerospace Laboratories is to provide students an overview of the most typical experimental techniques applied in sciences and engineering. The course is intended to help the students to acquire an adequate understanding of the principles of operation of the instruments and the methodology to conduct experimental procedures, and to develop their ability to generate and critically analyze experimental data.

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Study load

Total learning time: 125h	Hours large group:	30h	24.00%
	Hours small group:	15h	12.00%
	Self study:	80h	64.00%

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Content

Module 1

Learning time: 25h

Theory classes: 8h
Practical classes: 2h
Self study : 15h

Description:
Introduction to experimental aerodynamics.
Fluid governing equations. Dimensional analysis and approximation levels. Similarity requirements and scale effects.
Basics aspects of instrumentation and design of experiments.
Errors and uncertainties in measurements.
Overview of low-speed wind tunnels: constructive and operation features.

Related activities:
Laboratory experiments to be determined.

Module 2

Learning time: 60h

Theory classes: 12h
Practical classes: 8h
Self study : 40h

Description:
Pressure and temperature measurements: basic instrumentation, operation principles and applications.
Other typical measurements in fluid flows: velocity, volumetric flow, boundary layers and turbulence. Application of pitot-static probes and hot-wire techniques.
Flow visualization techniques: overview and typical applications

Related activities:
Laboratory experiments to be determined.

Module 3

Learning time: 40h

Theory classes: 10h
Practical classes: 5h
Self study : 25h

Description:
Measurement of aerodynamic forces. Basic principles.
Aerodynamic balances (internal and external). Indirect measurements (e.g. wake surveys).
Wind-tunnel interference effects and its correction. Model-support interference. Classic boundary corrections for open and closed-section wind-tunnels.

Related activities:
Laboratory experiments to be determined.

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Qualification system

The course will be graded according to:

NF = 0.4*N_EX1 + 0.4*N_EX2 + 0.2*N_HW

where NF is the final grade of the course, N_EX1 is the grade obtained in the first (mid-term) written exam, N_EX2 is the grade corresponding to the f
inal written exam, N_HW is the arithmetic mean of the grades obtained in the lab reports (homework assignments).
Both theoretical and practical (problems related to the laboratory work) aspects will be evaluated in the first and final written exams. Students who have not obtained a satisfactory grade in the first (mid-term) exam may repeat that test on the date scheduled for the final exam.

Students with a grade below 5.0 in any of the results, will be able to do an additional exam in order to compensate for the poor results. The new grade will replace the original only if it is higher. The maximum grade that can be obtained with this additional exam is 5.0.

For those students who meet the requirements and submit to the reevaluation examination, the grade of the reevaluation exam will replace the grades of all the on-site written evaluation acts (tests, midterm and final exams) and the grades obtained during the course for lab practices, works, projects and presentations will be kept.
If the final grade after reevaluation is lower than 5.0, it will replace the initial one only if it is higher. If the final grade after reevaluation is greater or equal to 5.0, the final grade of the subject will be pass 5.0.

Bibliography

Basic:

Barlow, J. B.; Rae, W. H.; Pope, A. Low-speed wind tunnel testing. 3rd ed. New York: John Wiley & Sons, 1999. ISBN 0471557749.

Complementary:

Goldstein, Richard J. Fluid mechanics measurements. New York: Taylor & Francis, 1996. ISBN 156032306X.