

Guia docent 205245 - ELF - Laboratoris Experimentals en Fluids

Última modificació: 02/04/2024

Unitat responsable: Unitat que imparteix:	Escola Superior d'Enginyeries Industrial, Aeroespacial i Audiovisual de Terrassa 729 - MF - Departament de Mecànica de Fluids.		
Titulació:	GRAU EN ENGINYERIA EN GRAU EN ENGINYERIA EN GRAU EN ENGINYERIA EN	TECNOLOGIES AEROESPACIALS (Pla 2010). (Assignatura optativa). TECNOLOGIES INDUSTRIALS (Pla 2010). (Assignatura optativa). VEHICLES AEROESPACIALS (Pla 2010). (Assignatura optativa).	
Curs: 2024	Crèdits ECTS: 3.0	Idiomes: Anglès	

PROFESSORAT					
Professorat responsable:	Raush Alviach, Gustavo Adolfo				
Altres:	Ouintana Vallmitjana, Marc				

METODOLOGIES DOCENTS

The teaching methodology is divided into three parts:

- In the exposition sessions, the faculty will introduce the theoretical bases of the syllabus, basic concepts of the methods and results examples to illustrate the interpretations of the same. The presentation will make interactive use of tools such as the use of Matlab and Python-based programs. Mostly, the general concepts and calculation procedure will be presented in the Jupyter-notebook Python environment. Nevertheless, students are allowed to be open-minded and proactive to use any other tools that will be considered helpful in the course to get the final results.

- In the laboratory work sessions, the faculty will guide the students in applying the theoretical concepts for the resolution of experimental setups, basing at all times the critical reasoning. Activities will be proposed to the students to solve in the classroom and out of the classroom to favor the contact and use of the basic tools necessary for the realization of an instrumentation system.

- Autonomously, the students have to work on the material provided by the teachers and the result of the laboratory work sessions to assimilate and fix the concepts. The faculty will provide a study plan and follow-up activities (ATENEA).

OBJECTIUS D'APRENENTATGE DE L'ASSIGNATURA

1. To have obtained the knowledge, understanding, application capacity, and analysis of the measurement processes applied in fluid mechanics.

2. To have the knowledge and understanding of the analysis of random series applied to the measurement of turbulent flow.

3. Knowledge, understanding, application and analysis of experimental techniques to measure pressure, temperature and velocity in open and closed flows.

4. To have the ability to choose, among different experimental tools, the most appropriate ones to obtain relevant information on a Fluid Mechanics problem.

5. Identify the limitations of the chosen techniques, the errors made and reported the results obtained, in a critical and self-sufficient way.

HORES TOTALS DE DEDICACIÓ DE L'ESTUDIANTAT

Tipus	Hores	Percentatge
Hores grup gran	30,0	40.00
Hores aprenentatge autònom	45,0	60.00

Dedicació total: 75 h



CONTINGUTS

Module 1: Pressures and Errors and Uncertainties

Descripció:

Errors Theory and uncertainty in measurement in fluid mechanics. Navier-Stokes equations: dimensionless parameters. Pressure measurements in open flows. Column, multicolumn and transducer pressure gauges. Static pressure measurements in models. Orifice dimensions and their configurations. Piezometric rings.

Activitats vinculades:

Individual deliverable work assigned to the content of the module. Ad-hoc laboratory session. Preparation of laboratory activity report. Examples of Activities in laboratory: Pressure measurements on dynamic probes. Density measurements of manometric fluids

Dedicació: 12h 30m Grup gran/Teoria: 5h Aprenentatge autònom: 7h 30m

Module 2: Velocity and Flow rate

Descripció:

Dynamic probes, Pitot tubes Hot-wire anemometry: Principles and applications Other thermal velocity probes: thermistors and vane probes. Flow rate measurements. Principle of orifices and contractions Flow measurements of free discharges and fan's flows

Activitats vinculades:

Individual deliverable work assigned to the content of the module.

Ad-hoc laboratory session. Preparation of laboratory activity report.

Examples of Activities in laboratory: Speed measurements with dynamic, thermal and turbine probes. Developing of calibration curves and their error analysis. Measurement of the flow rate of a rotodynamic pump and obtaining the characteristic curve. Flow measurements on the weir.

Dedicació: 12h 30m Grup gran/Teoria: 5h Aprenentatge autònom: 7h 30m

Module 3: Boundary Layer

Descripció:

Boundary Layer Concepts. Measurement techniques. Boundary layer smooth and rough plate. Transition zone. Types of dynamic probes.

Activitats vinculades:

Individual deliverable work assigned to the content of the module. Ad-hoc laboratory session. Preparation of laboratory activity report. Examples of Activities in laboratory: Measurement of the boundary layer profile. Analysis of conventional dynamic probes and Stanton probe

Dedicació: 12h 30m Grup gran/Teoria: 5h Aprenentatge autònom: 7h 30m



Module 4: Aerodynamic Forces and Moments

Descripció:

Measurements of forces and moments by direct measurements through aerodynamic balances: internal and external. Principles of operation. Coordinate systems and load cells as force sensing elements. Aerodynamic coefficients: drag, lift/downforce, moment. Betz's method: wake's momentum.

Activitats vinculades:

Individual deliverable work assigned to the content of the module.

Ad-hoc laboratory session. Preparation of laboratory activity report.

Examples of Activities in laboratory: Aerodynamic force measurements at wind tunnels using the methods of: momentum (Betz method) and aerodynamic balance.

Dedicació: 12h 30m Grup gran/Teoria: 5h Aprenentatge autònom: 7h 30m

Module 5: Flow Visualization

Descripció:

Definitions and their measurements. Wake method. Visualization by direct injection tracer techniques. Visualization by smoke. Particle imaging techniques, PIV/PTV, TPIV, SPIV. Principles, image processing tools. Pressure measurements by PIV techniques.

Activitats vinculades:

Individual deliverable work assigned to the content of the module. Ad-hoc laboratory session. Preparation of laboratory activity report. Examples of Activities in laboratory: Visualization of the flow detachment in aerodynamic bodies like: cylinder, airfoil, scale model of a passenger car, etc.

Dedicació: 12h 30m Grup gran/Teoria: 5h Aprenentatge autònom: 7h 30m

Module 6: Recap

Descripció: Complementation of masterclasses aimed at solving doubts and concepts.

Activitats vinculades: Oral presentations an recap old sessions.

Dedicació: 12h 30m Grup gran/Teoria: 5h Aprenentatge autònom: 7h 30m



SISTEMA DE QUALIFICACIÓ

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Penalties:

- The use of wrong dimensional and conceptual errors from previous subjects such as: fluid mechanics, fluid engineering, or similar. The students must to be careful and precise with concepts and principles used in the report writing and descriptions.

- the mistakes on reporting of results without units and wrong units of the measurement systems will be severely penalized.

The final score will be calculated as the following algorithm: - 25% of the grade will be assigned to the 5 individual deliverables that the teaching staff will publish in order to consolidate concepts and techniques necessary in the preparation of future reports. Each activity has a weight of 5% in the final grade. - 75% will be assigned to laboratory activities. Your contributions will be divided as follows: o Four activities will have a contribution of 15% on the final grade o The remainder has its composition in 5% in the report and 10% in the oral presentation of the group. The group note is common to its members.