Course guides
220124 - FDTV - Fluid Dynamic Technologies in Vehicles

Unit in charge: Terrassa School of Industrial, Aerospace and Audiovisual Engineering
Teaching unit: 729 - MF - Department of Fluid Mechanics.
Degree: BACHELOR'S DEGREE IN INDUSTRIAL TECHNOLOGY ENGINEERING (Syllabus 2010). (Optional subject).
Academic year: 2021
ECTS Credits: 3.0
Languages: English

LECTURER

Coordinating lecturer: PEDRO JAVIER GAMEZ MONTERO - ROBERTO CASTILLA LOPEZ - GUSTAVO RAUSH ALVIACH

Others:

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
1. An understanding of, and skills for, the calculation, design and testing of machines.
2. An understanding of the basic principles of fluid mechanics and their application in solving engineering problems. The ability to calculate pipes, channels and fluid systems.
3. Applied knowledge of the fundamentals of fluid-mechanics systems and machines.

TEACHING METHODOLOGY

The course is divided into parts:
Theory classes
Practical classes
Self-study for doing exercises and activities.
In the theory classes, teachers will introduce the theoretical basis of the concepts, methods and results and illustrate them with examples appropriate to facilitate their understanding.
In the practical classes (in the classroom), teachers guide students in applying theoretical concepts to solve problems, always using critical reasoning. We propose that students solve exercises in and outside the classroom, to promote contact and use the basic tools needed to solve problems.
Students, independently, need to work on the materials provided by teachers and the outcomes of the sessions of exercises/problems, in order to fix and assimilate the concepts.
The teachers provide the curriculum and monitoring of activities (by ATENEA).

LEARNING OBJECTIVES OF THE SUBJECT

At the end of the course, the student has to be able to:
Level 1 and 2:
- Describe the role of fluids on the road vehicles performance
- Explain the basic concepts associated with fluid technologies in road vehicles
Level 3
- Solve problems related to fluid flow in a road vehicle
- Use numerical and experimental tools for the analysis of fluid flows in a road vehicle
STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self study</td>
<td>45,0</td>
<td>60.00</td>
</tr>
<tr>
<td>Hours large group</td>
<td>30,0</td>
<td>40.00</td>
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</tbody>
</table>

Total learning time: 75 h

CONTENTS

Module 1: Introduction

Description:
1.1 Review of fundamentals fluid dynamics concepts
1.2 Fluids in a vehicle
1.3 Aerodynamics of a vehicle

Full-or-part-time: 15h
Theory classes: 5h
Self study : 10h

Module 2: Numerical techniques

Description:
2.1 Introduction to CFD
2.2 Main numerical methods
2.3 Modellization of turbulence
2.4 Meshing

Full-or-part-time: 32h
Theory classes: 12h
Self study : 20h

Module 3: Experimental techniques

Description:
3.1 Wind tunnel
3.2 Anemometry
3.3 PIV

Full-or-part-time: 28h
Theory classes: 10h
Self study : 18h
# ACTIVITIES

## ACTIVITY 1: EXERCISES PROPOSED IN THEORY CLASSES

**Description:**
Simple exercises and problems proposed in the course documentation.

**Full-or-part-time:** 30h  
Theory classes: 13h  
Self study: 17h

## ACTIVITY 2: CONTROL 1

**Description:**  
Control test made in theory class

**Full-or-part-time:** 5h  
Theory classes: 1h  
Self study: 4h

## ACTIVITY 3: CONTROL 2

**Description:**  
Control test made in theory class

**Full-or-part-time:** 5h  
Theory classes: 1h  
Self study: 4h

## ACTIVITY 4: EXAM

**Description:**  
Exam

**Full-or-part-time:** 11h  
Theory classes: 3h  
Self study: 8h

## ACTIVITY 5: LAB SESSION. INTRODUCTION TO CFD

**Description:**  
Lab session for introduction to CFD

**Material:**
- CFD software
- Computer
- Course notes
- Lab sessions guide

**Full-or-part-time:** 4h  
Theory classes: 2h  
Self study: 2h
ACTIVITY 6: LAB SESSION. AERODYNAMICS OF AN AIRFOIL

Description:
The aerodynamics forces over a 2D airfoil will be calculated

Material:
- CFD software
- Computer
- Course notes
- Lab sessions guide

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

ACTIVITY 7: LAB SESSION. AERODYNAMICS OF A VEHICLE

Description:
The aerodynamics forces over a 3D vehicle will be calculated

Material:
- CFD software
- Computer
- Course notes
- Lab sessions guide

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

ACTIVITY 8: LAB SESSION. MEASUREMENT OF AERODYNAMIC FORCES

Description:
The aerodynamic forces on a vehicle model in a wind tunnel will be measured by means of a balance

Material:
- Wind tunnel
- Aerodynamic balance
- Computer
- Course notes
- Lab sessions guide

Full-or-part-time: 4h
Theory classes: 2h
Self study: 2h
ACTIVITY 9: LAB SESSION. CTA ANEMOMETRY

Description:
The turbulence of an air jet will be measured

Material:
- Wind tunnel
- Wire probes
- Constant Temperature Anemometer
- Computer
- Course notes
- Lab sessions guide

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

ACTIVITY 10: LAB SESSION. PIV

Description:
The velocity field around a body will be measured

Material:
- Lab material for PIV
- Computer
- Course notes
- Lab sessions guide

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

GRADING SYSTEM

The final grade depends on the following assessment criteria:

- Exam, weight: 50 %
- Class works, weight: 10 %
- Controls, weight: 20 %
- Laboratory, weight: 20 %

BIBLIOGRAPHY

Basic:
Complementary: