Course guide
240245 - 240AU112 - Aerodynamics

Unit in charge: Barcelona School of Industrial Engineering
Teaching unit: 729 - MF - Department of Fluid Mechanics.
Degree: MASTER'S DEGREE IN INDUSTRIAL ENGINEERING (Syllabus 2014). (Optional subject).
MASTER'S DEGREE IN AUTOMOTIVE ENGINEERING (Syllabus 2019). (Optional subject).
Academic year: 2022
ECTS Credits: 4.5
Languages: Spanish

LECTURER

Coordinating lecturer: Jou Santacreu, Esteban
Others: Jou Santacreu, Esteban

TEACHING METHODOLOGY

Theory classes are held once a week in two-hour sessions. Three practical classes in two-hour sessions are held along course

LEARNING OBJECTIVES OF THE SUBJECT

The aim of the course is to introduce students to the world of aerodynamics applied to road vehicles. Aerodynamic effects of the features of actual vehicles is studied from a numerically and a qualitative point of view. Description of the operation of different elements both in the world of competition, as in cars and commercial vehicles. The contribution of the vehicle’s internal flow on aerodynamic forces is also studied. The course ends with an introduction to the flow simulation around vehicles.

STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self study</td>
<td>72,0</td>
<td>64.00</td>
</tr>
<tr>
<td>Hours small group</td>
<td>13,5</td>
<td>12.00</td>
</tr>
<tr>
<td>Hours medium group</td>
<td>27,0</td>
<td>24.00</td>
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</tbody>
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Total learning time: 112.5 h

CONTENTS

1. Introduction to automobile aerodynamics

Description:
Historic review of the vehicle aerodynamics, present and future trends. Basic principles and special features of vehicle aerodynamics

Full-or-part-time: 4h
Theory classes: 2h
Self study: 2h
2. Fundamentals of fluid mechanics

**Description:**
Plan of the basic equations of the Flow Mechanics and the phenomenon of the fluids related to the vehicles. 
External uncompressible flow. Effects of the viscosity. Study of laminar and turbulent boundary layer.

**Full-or-part-time:** 10h  
Theory classes: 2h  
Self study : 8h

3. Experimentation vs. Simulation

**Description:**
Experimental aerodynamic tests in track and wind tunnel. Comparison with CFD simulation. Knowledge of advantages and disadvantages of each technique, as well as their limitations.

**Full-or-part-time:** 11h  
Theory classes: 3h  
Practical classes: 2h  
Self study : 6h


**Description:**

**Full-or-part-time:** 9h  
Theory classes: 3h  
Self study : 6h

5. Competition cars

**Description:**
Study of the aerodynamic peculiarities of the different racing vehicles. Historical review Basic forms depending on competition type. Components description.

**Full-or-part-time:** 6h 30m  
Theory classes: 2h  
Self study : 4h 30m

6. Commercial vehicles

**Description:**
Study of the reduction of Drag forces in commercial vehicles. Aerodynamic forces in trucks and coaches.

**Full-or-part-time:** 8h  
Theory classes: 2h  
Self study : 6h
7. Interior Flow

**Description:**
Procedure description for the correct performance of aerodynamic simulations. Guidelines and recommendations on geometry, mesh, setup and solver configuration.

**Full-or-part-time:** 6h
Theory classes: 2h
Self study: 4h

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8. CFD introduction

**Description:**
Procedure description for the correct performance of aerodynamic simulations. Guidelines and recommendations on geometry, mesh, setup and solver configuration.

**Full-or-part-time:** 5h 30m
Theory classes: 1h 30m
Practical classes: 4h

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**GRADING SYSTEM**

Final Grade = 0.2*labs+0.35*partial exam+0.45*final exam

**EXAMINATION RULES.**

The realization of the labs is mandatory

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**BIBLIOGRAPHY**

**Basic:**