COMILLAS
UNIVERSIDAD PONTIFICIA
ICAI ICADE CIHS

**GUÍA DOCENTE**
**2025 - 2026**

# FICHA TÉCNICA DE LA ASIGNATURA

## Datos de la asignatura

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| **Nombre completo** | Aerodinámica y CFD |
| **Código** | DIM-M2S-501 |
| **Créditos** | 3,0 ECTS |
| **Carácter** | Obligatoria |
| **Departamento / Área** | Departamento de Ingeniería Mecánica |

## Datos del profesorado

### Profesor

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| **Nombre** | Fernando Martínez Domínguez |
| **Departamento / Área** | Departamento de Ingeniería Mecánica |
| **Correo electrónico** | fmdominguez@icai.comillas.edu |

### Profesor

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| **Nombre** | José Rubén Pérez Domínguez |
| **Departamento / Área** | Departamento de Ingeniería Mecánica |
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# DATOS ESPECÍFICOS DE LA ASIGNATURA

## Contextualización de la asignatura

### Aportación al perfil profesional de la titulación

**Specific Knowledge**: The course provides specific knowledge about aerodynamics and the use of Computational Fluid Dynamics (CFD) to analyze and solve aerodynamics-related problems. This knowledge is crucial for engineers working in industries such as automotive, aerospace, and the energy sector, where aerodynamics is paramount.

**Technical Skills**: Students will learn to use CFD tools and software to simulate and analyze fluid flows around objects and vehicles. These technical skills are highly valued in the industry and can be applied to a variety of projects and sectors.

**Enhanced Design**: Understanding aerodynamics is essential for efficiently designing vehicles, buildings, and other objects that interact with airflow. An engineer who has completed this course will be better equipped to design products and structures that are more aerodynamic and, therefore, more efficient.

**Problem Solving**: CFD is a powerful tool for problem-solving related to aerodynamics. Students will learn how to identify and address complex fluid flow problems, which can help improve the performance and safety of different systems and products.

**Competitiveness in the Job Market**: Having experience in aerodynamics and CFD can make an engineer more competitive in the job market, as many companies seek candidates with specialized skills in this area.

**Innovation and Development**: Aerodynamics and CFD play a significant role in innovation and the development of new products and technologies. An engineer who has completed this course will be better prepared to contribute to innovative projects in their field.

In summary, a course in aerodynamics and CFD can significantly enrich the professional profile of an engineer by providing specialized knowledge, valuable technical skills, and the ability to address complex aerodynamics-related problems across various industries

### Prerrequisitos

Course on Fluid Mechanics

## Competencias - Objetivos

## BLOQUES TEMÁTICOS Y CONTENIDOS

### Contenidos – Bloques Temáticos

- Aerodynamics
- CFD
- Real applications

## METODOLOGÍA DOCENTE

### Aspectos metodológicos generales de la asignatura

### Metodología Presencial: Actividades

Classes are structured to learn and practice a specific concept

### Metodología No presencial: Actividades

Students will be asked to solve application problems to work individually or in groups

## EVALUACIÓN Y CRITERIOS DE CALIFICACIÓN

- Final Exam
- Individual/group assignments
- The use of Artificial Intelligence is permitted exclusively for the completion of ASSIGNMENTS. Therefore, Level 2 of the Perkins et al. (2024) Evaluation Scale is established: AI may be used for pre-task activities such as brainstorming, outlining, and initial research. This level focuses on the effective use of AI for planning, synthesis, and ideation, but assessments should emphasize the ability to develop and refine these ideas independently.

### Calificaciones

Standard evaluation at the end of the term:

- 40% Final Exam
- 60 % individual/group assignments

Additional evaluation during June (Retake):

- 40% Final Exam
- 60% individual assignments

Failure to attend more than 15% of the classroom hours scheduled for this course may result in disqualification from taking the regular exam.

## PLAN DE TRABAJO Y CRONOGRAMA

| Actividades | Fecha de realización | Fecha de entrega |
|---|---|---|

| Session | Topic |
|---|---|
| AER_01 | Fundamentals of Aerodynamics |
| AER_02 | Aerodynamic Coefficients and Vehicle Characterization |
| AER_03 | Experimental and Computational Tools |
| AER_04 | Airfoils, Wings, and Ground Effect |
| AER_05 | Performance and Safety |
| AER_06 | Real Cases |
| CFD_01 | Introduction to CFD |
| CFD_02 | Geometry and Meshing |
| CFD_03 | Domains, Boundary Conditions and Sources |
| CFD_04 | Turbulence, solver settings and post-processing. |
| CFD_05 | Complete CFD workflow |
| CFD_09 | External Flows |
| CFD_10 | Transient flows and functions |
| CFD_12 | Fluid-structure interaction 1 |

## BIBLIOGRAFÍA Y RECURSOS

### Bibliografía Básica


- Aerodynamics of Road Vehicles, Fifth Edition. Thomas Christian Schuetz. SAE International
- Theory and Applications of Aerodynamics for Ground Vehicles T. Yomi Obidi SAE International
- An Introduction to Ansys Fluent 2025. John E. Matsson 2025. SDC Publications
- Versteeg, H. K., & Malalasekera, W. (2007). An Introduction to Computational Fluid Dynamics: The Finite Volume Method (2nd ed.). Pearson Education Limited.