COMILLAS
UNIVERSIDAD PONTIFICIA
ICAI ICADE CIHS

GUÍA DOCENTE
2025 - 2026

FICHA TÉCNICA DE LA ASIGNATURA

Datos de la asignatura

Nombre completo	Drivetrain
Código	DIM-M2S-523
Impartido en	Máster Universitario en Ingeniería Industrial + Máster in Motorsport, Mobility and Safety [Primer Curso] Máster Universitario en Ingeniería Industrial + Máster in Motorsport, Mobility and Safety [Primer Curso] Master in Motorsport, Mobility and Safety [Primer Curso]
Nivel	Master
Cuatrimestre	Semestral
Créditos	3,0 ECTS
Carácter	Obligatoria
Departamento / Área	Departamento de Ingeniería Mecánica
Responsable	Luis Barrada Buch

Datos del profesorado

Profesor

Nombre	Luis Barrada Buch
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DATOS ESPECÍFICOS DE LA ASIGNATURA

Contextualización de la asignatura

Aportación al perfil profesional de la titulación

Key topics include the design and functionality of components such as clutches, gearboxes, differentials, driveshafts, and axles, focusing on how they impact vehicle performance and efficiency. Through practical exercises, students will learn to analyze and troubleshoot drivetrain systems, enhancing their skills for selecting reliable and efficient powertrains.

Prerrequisitos

Bachelor's Degree in Engineering

Competencias - Objetivos

Competencias

Competences:

- **C1**: Critically assess drivetrain components and propose improvements for both serial production and race vehicles, ensuring optimal performance and efficiency.
- **C2**: Collaborate effectively in interdisciplinary teams to solve complex drivetrain design and optimization challenges.
- **C3**: Demonstrate the ability to autonomously analyze drivetrain systems using a combination of theoretical knowledge and practical

testing.

- **C4**: Stay updated on advancements in drivetrain technology and apply this knowledge to improve vehicle performance, particularly in hybrid and all-wheel-drive systems.
- **C5**: Communicate complex technical findings clearly and concisely, adapting the communication style to different technical and non-technical audiences.

Resultados de Aprendizaje

Knowledge:

- **K1**: Understand typical vehicle powertrain layouts, including serial production and race-specific configurations.
- **K2**: Gain detailed knowledge of clutch systems, including mechanical clutches, semiautomatic race systems, and control strategies.
- **K3**: Learn the principles behind different types of gearboxes: mechanical, automatic (epicycloidal, dual-clutch, CVT), and hybrid gearbox layouts.
- **K4**: Understand the design and function of differential mechanisms, including open differentials, limited-slip differentials, torque vectoring systems, and control strategies.
- **K5**: Familiarity with all-wheel-drive powertrain layouts, including serial production and race-specific systems.

Skills:

- **S1**: Analyze and compare different powertrain layouts and assess their performance in various vehicle configurations (serial production and race settings).
- **S2**: Evaluate the functionality and performance of clutch and gearbox systems, identifying key differences between mechanical, semiautomatic, and automatic systems.
- **S3**: Apply knowledge of differentials (Salisbury, Torsen, viscous) to optimize traction and torque distribution in vehicle design.
- **S4**: Use control strategies to enhance the performance of active and semi-active systems in drivetrain configurations.
- **S5**: Investigate and evaluate recent developments in drivetrain technologies, particularly in hybrid systems and torque vectoring differentials.

BLOQUES TEMÁTICOS Y CONTENIDOS

Contenidos – Bloques Temáticos

1. **Typical vehicle powertrain layouts**
2. **Clutch-Mechanical**
    1. Serial production clutch arrangement
    2. Race arrangements
    3. Semiautomatic race control systems
3. **Parallel gears mechanical gearboxes**
    1. Serial production layouts
    2. Serial production command & synchonizing
    3. Race arrangements & synchronizing
    4. Race command & control strategies
4. **Automotive automatic gearboxes (serial production)**
    1. Epicycloidal automatic gearboxes
    2. Dual clutch automatic gearboxes
    3. CVT automatic gearboxes
5. **Hybrid gearboxes layout**

6. **Differential mechanism: open differential standard & epicycloidal. Locking systems**
7. **Limited slip and torque vectoring differentials**
    1. Salisbury
    2. Torsen
    3. Viscous
    4. Active & semiactive systems. Control strategies
    5. New Developments
8. **All wheel drive powertrain layouts**
    1. Serial production
    2. Race arrangements.

METODOLOGÍA DOCENTE

Aspectos metodológicos generales de la asignatura

In order to achieve the acquisition of the proposed competencies, the course will be developed with a focus on student activity as a priority factor. This means that both in-person and remote sessions will encourage the active involvement of students in learning activities

EVALUACIÓN Y CRITERIOS DE CALIFICACIÓN

- Multiple-choice exam at the end of the semester.
- Depending on the characteristics of the group, group work could be used as a grading criterion.

Calificaciones

- The grade will be based on the score obtained in the test or the group work, if applicable.
- A grade above 5 over 10 is required to pass the course.

BIBLIOGRAFÍA Y RECURSOS

Bibliografía Básica

- *Fundamentals of Vehicle Dynamics* - Thomas D. Gillespie - Society of Automotive Engineers (SAE) - ISBN 1-56091-199-9
- *Universal joints and Driveshafts* - Schmelz, v.Seherr-Thoss, Aucktor - ISBN 3-540-5333-14-1