GUÍA DOCENTE
2026 - 2027

FICHA TÉCNICA DE LA ASIGNATURA

Datos de la asignatura	
Nombre completo	Technologies and methods
Código	DIM-M2S-601
Impartido en	Máster Universitario en Ingeniería Industrial + Máster in Motorsport, Mobility and Safety [Segundo Curso] Master in Motorsport, Mobility and Safety [Segundo Curso]
Nivel	Master
Cuatrimestre	Semestral
Créditos	3,0 ECTS
Carácter	Obligatoria
Departamento / Área	Departamento de Ingeniería Mecánica
Responsable	Alberto Carnicero

Datos del profesorado	
Profesor	
Nombre	Silvia Fernández Villamarín
Departamento / Área	Departamento de Ingeniería Mecánica
Correo electrónico	sfernandez@icai.comillas.edu
Profesor	
Nombre	Guillermo Calviño Palacios
Departamento / Área	Departamento de Ingeniería Mecánica
Correo electrónico	gcalvino@icai.comillas.edu

DATOS ESPECÍFICOS DE LA ASIGNATURA

Contextualización de la asignatura

Aportación al perfil profesional de la titulación

This course introduces students to a range of tools, technologies, and methodologies relevant to mobility and safety engineering.
It provides an overview of fundamental techniques such as hydraulics, computer-aided design (CAD), finite element modelling, additive manufacturing (3D printing), and the use of accident and injury databases.
By exploring these diverse topics, students gain a multidisciplinary foundation that allows them to identify, understand, and later deepen their expertise in the methods most relevant to their professional focus within motorsport, vehicle design, and safety systems

Prerrequisitos

There are no specific prerequisites for this course.
However, basic knowledge of mechanics, materials, fluid dynamics, and computer tools (such as CAD software) is recommended to facilitate the understanding of the applied methodologies.

Competencias - Objetivos

Competencias

Specific Competences

SC1: Understand the principles of hydraulic and servo-hydraulic systems and their application to vehicle steering and braking.

SC2: Acquire basic skills in CAD editing and the generation of finite element models from design files.

SC3: Understand the fundamentals of additive manufacturing technologies and their applications in mobility and safety.

SC4: Identify and use relevant data sources for crash and injury analysis.

SC5: Integrate interdisciplinary tools and methods to address real-world engineering challenges related to vehicle safety and performance.

Transversal Competences

TC1 – STEM Competence: Apply basic engineering principles to the analysis of systems and technologies used in modern vehicles.

TC2 – Digital Competence: Use digital tools for CAD, FEM modelling, and data management.

TC3 – Communication and Collaboration: Work effectively within interdisciplinary teams and communicate technical results clearly.

TC4 – Innovation Competence: Identify opportunities for applying emerging technologies to enhance safety and efficiency in mobility.

Resultados de Aprendizaje

Knowledge

K1: Understand the operation and applications of hydraulic and servo-hydraulic systems in vehicle dynamics and control.

K2: Know the fundamentals of CAD editing and the process of converting CAD models into finite element models.

K3: Describe additive manufacturing processes and their potential applications in the automotive and safety sectors.

K4: Identify and interpret the main data sources used for injury and crash analysis in real-world conditions.

K5: Understand how these technologies contribute to research, design, and innovation in mobility and motorsport.

Skills

S1: Apply basic hydraulic principles to design or analyze steering and braking systems.

S2: Create and modify CAD and FEM models using digital tools for structural and safety analysis.

S3: Utilize 3D printing technologies to prototype or test small components.

S4: Collect, organize, and interpret accident data from international databases.

S5: Combine different methods and technologies to develop integrated engineering solutions.

BLOQUES TEMÁTICOS Y CONTENIDOS

Contenidos – Bloques Temáticos

- **Vehicle-assisted systems**
  - Principles of hydraulics
  - Industrial application of servo-hydraulic systems
  - Application to steering and braking vehicle systems
- **CAD edition**
  - Introduction to medical imaging relevance in mobility safety
  - Medical imaging processing software
  - 3D Slicer
    - Basic tools for image (general and injury) analysis
    - Manual and semi-automatic tools for segmentation
    - 3D volume generation and export to CAD-supported formats
- **Additive Manufacturing**
  - General methodology, stages and components of the process
  - Main technologies, principles and applications
  - Strengths, weaknesses, challenges, and limitations of additive manufacturing technologies
  - Main brands and suppliers available
  - Design for Additive Manufacturing (DFAM)
  - Design for functionality and 3D printability
  - Topology optimization
  - Planning and slicing additive manufacturing software.
- **Reverse Engineering**
  - General methodology: point clouds, meshes (.stl), NURBS surface models and parametric CAD models
  - Digitizing methods and main technologies: applications and selection of reverse engineering systems
  - Hardware and software involved. Reverse engineering and additive manufacturing
  - Post-treatment software: Data alignment, point cloud cleaning up, mesh reconstruction and improvement
  - Surface models, history-based solid models and export to CAD software

METODOLOGÍA DOCENTE

Aspectos metodológicos generales de la asignatura

Metodología Presencial: Actividades

The teaching methodology combines theoretical lectures that promote student interaction and participation with practical sessions.
In these sessions, students will apply the concepts covered in class by developing a specific project proposed and supervised by the professor

Metodología No presencial: Actividades

The non-presential activities will include autonomous student work aimed at reviewing and consolidating the concepts explained in class, together with the preparation of reports or team projects assigned by the professor.

EVALUACIÓN Y CRITERIOS DE CALIFICACIÓN

- Exam
- Team projects

Calificaciones

- If there is exam:
  - Exam 30%
  - Team projects 70%
- Without exam
  - Team projects 100%

Each part will be weighted proportionally to the number of hours

BIBLIOGRAFÍA Y RECURSOS