COMILLAS
UNIVERSIDAD PONTIFICIA
ICAI ICADE CIHS

GUÍA DOCENTE
2025 - 2026

FICHA TÉCNICA DE LA ASIGNATURA

Datos de la asignatura

Nombre completo	Structural modelling and FEA
Código	DIM-M2S-502
Créditos	3,0 ECTS
Carácter	Obligatoria
Departamento / Área	Departamento de Ingeniería Mecánica

Datos del profesorado

Profesor

Nombre	Jaime Espinosa de los Monteros García-Frías
Departamento / Área	Departamento de Ingeniería Mecánica
Correo electrónico	jespinosalosmonteros@icai.comillas.edu

Profesor

Nombre	Jesús Ángel García Matos
Departamento / Área	Departamento de Ingeniería Mecánica
Correo electrónico	jesus.garcia@iit.comillas.edu

Profesor

Nombre	José Rubén Pérez Domínguez
Departamento / Área	Departamento de Ingeniería Mecánica
Correo electrónico	jrpdominguez@icai.comillas.edu

Profesor

Nombre	Yolanda Gutiérrez Diego
Departamento / Área	Departamento de Ingeniería Mecánica
Correo electrónico	ygutierrez@comillas.edu

DATOS ESPECÍFICOS DE LA ASIGNATURA

Contextualización de la asignatura

Aportación al perfil profesional de la titulación

After the course students will have a good overview about current simulation capabilities

Prerrequisitos

Knowledge of basic courses of algebra and mechanics of materials

Competencias - Objetivos

Competencias

Specialized Knowledge: This course equips students with specialized knowledge and skills in structural modelling and Finite Element Analysis (FEA), which are valuable assets in various engineering fields.

Design Optimization: Students learn how to optimize the design of structures and components, enhancing their strength and efficiency, and making them well-prepared for engineering challenges.

Safety Expertise: The course covers safety and impact analysis, ensuring that students can prioritize safety in their engineering work across different domains.

Performance Enhancement: Students gain the ability to use FEA to improve the performance of various structures and systems, a skill that can be applied in diverse industries.

Innovation in Technology: The knowledge gained extends beyond the classroom, enabling students to innovate in various technology sectors by designing advanced and efficient systems.

Broad Safety Awareness: The skills acquired can be applied not only in specialized fields but also in everyday applications, contributing to the safety of conventional products and structures.

Competitive Advantage: Completing this course gives students a competitive edge in the job market, as the demand for engineers with expertise in structural modelling and FEA remains high.

The successful completion of the "Structural Modelling and FEA" course within a motorsport, mobility, and safety education enhances students' versatility, competitiveness, and readiness to tackle engineering challenges in various sectors. These skills are valuable assets as they embark on their professional journey.

Resultados de Aprendizaje

This course will be an introduction to the different analyses that can be done in the ANSYS workbench environment and the coupling among them working with solids and Ls-Dyna.
At the end of the course, students have fundamental skills in all the analyses for solids available in Ansys Workbench environment and Explicit Dynamic analysis with Ls-Dyna.

BLOQUES TEMÁTICOS Y CONTENIDOS

Contenidos – Bloques Temáticos

- Structural Modelling
  - Introduction to finite elements and workbench environment.
    - Analysis type and workbench workflow.
    - Materials definition.
    - Static structural analysis of plane cases.
    - Parameters.
  - 3D models.
    - Boundary conditions.
    - Mesh generation.

        - Postprocess result.
        - Submodelling
    - Load cases and load steps.
    - Thermal analysis.
        - Coupled thermal-structural analysis.
    - Static structural analysis of beam and link and shell elements.
    - Fundamentals of nonlinear analysis.
        - Non-linear materials and geometric non-linearities
    - Fundamentals of contact non-linearities.
        - Types of contact models.
    - Modal and harmonic analysis
        - Linear buckling analysis
    - Rigid Body dynamics
    - Transient analysis.
        - Implicit integration
- Ls-Dyna:
    - Explicit Integration
    - Element Formulation
    - Materials
    - Crash modelling
    - Crash simulations

METODOLOGÍA DOCENTE

Aspectos metodológicos generales de la asignatura

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

Código	#	Sesión
STR	1+2	Introduction to FEM and Workbench. Analysis type and workbench workflow. Materials.Plane cases. Parameters.
STR	3+4	3D models: Boundary, mesh, postprocessing, submodelling
STR	5	Static structural analysis of beam and link and shells elements
STR	6	Load cases and load steps. Pseudo static analysis.
STR	7	Thermal analysis. Coupled thermal-structural analysis
STR	8	Fundamentals of nonlinear analysis. Non-linear materials and geometric non-linearities
STR	9	Fundamentals of contact non-linearities. Types of contact models.
STR	10	Modal and harmonic analysis. Linear buckling analysis.
STR	11	Transient analysis. Implicit integration
DYN	1	Explicit Integration
DYN	2	Element Formulation
DYN	3	Materials
DYN	4	Crash modelling
DYN	5	Crash simulations

BIBLIOGRAFÍA Y RECURSOS

Bibliografía Básica

- Finite Element Simulations with ANSYS Workbench 18. Huei-Huang Lee. ISBN 978-1630571733.
- Engineering Analysis with ANSYS Workbench 18. Guangming Zhang. ISBN-13: 978-1935673385
- Engineering Analysis with ANSYS Software. Tadeusz Stolarski Y. Nakasone S. Yoshimoto. ISBN: 9780081021644