GUÍA DOCENTE
2025 - 2026

FICHA TÉCNICA DE LA ASIGNATURA

Datos de la asignatura	
Nombre completo	Optativa Complementaria. Sustainable Development
Código	DIM-OPT-611
Impartido en	Máster Universitario en Ingeniería de Telecomunicación y Mást. Univ. en Administración de Empresas [Segundo Curso] Máster Universitario en Ingeniería Industrial [Segundo Curso] Máster Universitario en Ingeniería Industrial y Máster Universitario en Administración de Empresas [Segundo Curso]
Nivel	Postgrado Oficial Master
Cuatrimestre	Semestral
Créditos	6,0 ECTS
Carácter	Optativa
Departamento / Área	Departamento de Ingeniería Mecánica
Responsable	Carlos Morales Polo

Datos del profesorado	
Profesor	
Nombre	Catalina Hueso Kortekaas
Departamento / Área	Departamento de Ingeniería Mecánica
Correo electrónico	khueso@icai.comillas.edu
Profesor	
Nombre	Daniel Fernández Alonso
Departamento / Área	Departamento de Ingeniería Eléctrica
Correo electrónico	dfalonso@icai.comillas.edu
Profesor	
Nombre	Raquel Chamochín Escribano
Departamento / Área	Departamento de Ingeniería Mecánica
Correo electrónico	rchamochin@icai.comillas.edu

DATOS ESPECÍFICOS DE LA ASIGNATURA

Contextualización de la asignatura

Aportación al perfil profesional de la titulación

Within the professional profile of the Master's Degree in Industrial Engineering, this subject is designed to provide students with the knowledge and skills required to understand the sustainable development agenda and the goals it sets. Students will examine the existing tools available for achieving these goals and will ultimately be equipped to guide a company through its sustainable transition process.

The key concepts developed in this subject are sustainability, the sustainable development agenda and goals, and the practical tools used to address sustainability challenges at the energy, resource, and environmental levels. Accordingly, the course is structured into three thematic blocks, laying the foundation for subsequent subjects such as *Energy Transition* and *Sustainable Transportation*.

By the end of the course, students will be able to identify which components of a corporation must be adapted to achieve a sustainable transformation and assess the most efficient strategies to implement this change.

Prerrequisitos

There are no mandatory prerequisites to pass this course. However, since the subject is framed within environmental concepts, it is recommended that students have previously completed *Environmental Engineering* or a similar course.

Competencias - Objetivos

Competencias

This course contributes to the development of the following competences of the Master's Degree in Industrial Engineering:

CB2 – Students will be able to apply their knowledge in a professional context and demonstrate the skills necessary to develop and defend arguments, as well as to solve problems within their field of study.

CB4 – Students will be capable of conveying information, ideas, problems, and solutions to both specialized and non-specialized audiences.

CG04 – Students will develop the ability to solve problems with initiative, make decisions, think creatively and critically, and communicate and transfer knowledge and skills within the field of Industrial Engineering.

CG07 – Students will be able to analyze and assess the social and environmental impact of technical solutions.

Resultados de Aprendizaje

By the end of the course, students will be able to:

LO1 – Understand the Sustainable Development Goals (SDGs) and the overall sustainable development agenda.

LO2 – Identify the main activities and strategies implemented in the transition of the energy sector.

LO3 – Understand the concept of the circular economy and how to develop projects aligned with it.

LO4 – Analyze and evaluate industrial developments related to the circular economy.

LO5 – Recognize the environmental impact of industrial activity on both companies and the broader economy.

LO6 – Identify and apply tools available to guide a company towards the achievement of sustainable development goals.

BLOQUES TEMÁTICOS Y CONTENIDOS

Contenidos – Bloques Temáticos

he course is structured into three thematic units:

Unit 1: Climate Change, Emissions, Sustainable Development, and Energy

Climate change: causes, evidence, and consequences

Greenhouse gas (GHG) emissions: historical perspective, cumulative and current values

Sustainable development and the 2030 Agenda

Global climate policies

Carbon pricing and CO_2 footprint

Emission and sustainability forecasting scenarios

Spanish climate and energy policies: PNIECC (National Integrated Energy and Climate Plan) and PNACC (National Climate Change Adaptation Plan)

Unit 2: Sustainable and Environmental Management in Industry

Sustainability in the corporate environment

The challenge of economic valuation

Social and environmental impact of industrial activity

Environmental management regulations

From classical economics to environmental and ecological economics

Environmental economics in practice

Sustainable culture in organizations

Sustainable finance principles and practices

Unit 3: Circular Economy

Concepts, implications, and economic impact of the circular economy

Secondary raw materials and dematerialization

Eco-design and emerging sustainable design trends

Circular economy and consumption: shifting from product ownership to service models

European and Spanish Circular Economy Strategies

METODOLOGÍA DOCENTE

Aspectos metodológicos generales de la asignatura

Metodología Presencial: Actividades

Lectures: The lecturer will present the fundamental concepts of each unit, emphasizing the most relevant aspects. Illustrative examples will be introduced, discussed, and solved to reinforce comprehension and facilitate applied understanding.

In-class case discussions and problem-solving: Students will analyze and discuss real-world cases and practical problems proposed by the lecturer. These cases will be open-ended challenges designed to be addressed using the concepts and tools introduced during the course sessions.

Teamwork activity and presentations: Students, working in small groups, will prepare and deliver presentations on topics related to the subject. These topics may be proposed by the lecturer or suggested by the students, subject to the lecturer's approval.

Metodología No presencial: Actividades

Self-study of course concepts: Students are expected to engage in independent study to review, understand, and internalize the concepts presented during lectures. For this purpose, they will use the lecture slides and additional reading materials provided by the instructor.

Case study analysis: Students will first review the in-class problem-solving exercises led by the lecturer and then tackle the unresolved cases proposed during the sessions, applying the theoretical frameworks learned in the course.

Teamwork development: Once a topic has been assigned, students — working in small groups — will carry out research, develop the assigned topic, and prepare the final presentation collaboratively.

RESUMEN HORAS DE TRABAJO DEL ALUMNO

Activity	Hours
Face-to-Face Activities	
- Lectures	30
- Teamwork in class	20
- Case discussions	8
- Team presentations	2
Distance/Independent Activities	
- Self-learning	40
- Case study resolution	30
- Periodical assignments and teamwork preparation	50
Total Workload	**180 hours**
ECTS Credits	**6 ECTS**

EVALUACIÓN Y CRITERIOS DE CALIFICACIÓN

Autonomous Work

Activity: Periodical Assignments

Assessment Criteria:

- Information search and analysis
- Application of knowledge to critically assess technical information
- Written communication skills

Continuous Assessment

Activity: Teamwork Activity and Presentation

Assessment Criteria:

- Information search and synthesis
- Application of knowledge to critically evaluate technical content
- Oral and written communication skills

Final Exam

Activity: Final Exam

Assessment Criteria:

- Comprehensive understanding of key concepts
- Ability to apply theoretical knowledge to practical scenarios

USE OF AI TOOLS

The use of AI tools in this course is permitted under the following institutional guideline:

Level 3 – AI COLLABORATION *– AI may be used to help complete the task, including idea generation, drafting, feedback, and refinement. Students should critically evaluate and modify the AI suggested outputs, demonstrating their understanding. You may use AI to assist with specific tasks such as drafting text, refining and evaluating your work. You must critically evaluate and modify any AI-generated content you use.*

This level of AI use is especially relevant for the **teamwork activity and presentation**, where students are encouraged to explore AI tools as a support mechanism — always ensuring that the final work is the result of their own critical thinking and academic effort.

Calificaciones

ORDINARY EVALUATION

The final grade for the course in the **ordinary evaluation** will be determined based on the following components:

A. Exams and Individual Assessments – 60%

- **Final Exam (Ef):** 30%
  Assesses the student's understanding of key theoretical concepts.
- **Periodical Assignments (Ep):** 30%
  Evaluates individual work through periodic deliverables and in-class case solving corresponding to each thematic unit.

B. Collaborative Activities – 40%

- **Teamwork and Presentation (T):** 40%
  Evaluates the quality of the team project, including both the development of content and its oral and written presentation.

To pass the course, the student must obtain a minimum grade of **5.0 out of 10** in each of the three components (Ef, Ep, T).

If **Ef ≥ 5.0**, **Ep ≥ 5.0**, and **T ≥ 5.0**, the final grade will be calculated as:

Final Grade = 30% Ef + 30% Ep + 40% T

If any of the minimum thresholds is not met, the final grade will correspond to the **lowest individual score** obtained among Ef, Ep, and T.

EXTRAORDINARY EVALUATION

In the case of an **extraordinary evaluation**, the student will only be required to repeat the component(s) in which the minimum grade was not achieved during the ordinary evaluation. The grades of the other components will be carried over.

The final grade will be calculated using the same formula:

Final Grade = 30% Ef + 30% Ep + 40% T

BIBLIOGRAFÍA Y RECURSOS

Bibliografía Básica

•*WMO Statement on the State of the Global Climate in 2019*. World Meteorological Organization. WMO-No. 1248

•*AR5 Synthesis Report: Climate Change 2014*. IPCC. 2014

•*SP 1.5 Global Warming of 1.5 ºC*. IPCC. 2019

•*The circular economy. A user's guide*. Walter R. Stahel (2019). Routledge

•*The Age of Sustainable Development*. Jeffrey D. Sachs (2015)

•*An Introduction to Sustainable Development*. Peter R., Kazi F., John A. (2008)