

COURSE GUIDE

2025/26

Faculty

345 - Faculty of Engineering - Bilbao

Cycle

.

Degree

INMEC901 - Mechanical Engineering

Year

.

COURSE

504247 - Green Design and Manufacture

Credits, ECTS: 6

COURSE DESCRIPTION

The aim of this course is to allow students to achieve the necessary skills for the design and management of the life cycle of a product. For this, it is necessary to deepen the knowledge on principles of design and development of eco-products, energy efficiency and resource management, eco-materials and their applications in product design, PLM models and tools, sustainable manufacturing processes, energy efficiency and of the resources in the manufacturing processes, evolution of the microstructure and the properties of the material as a consequence of the ecological and sustainable design and manufacturing process.

- Topic 1. Green design
Topic 2. Green or sustainable manufacturing
Topic 3. Durability of green components

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

COMPETENCIAS DE LA ASIGNATURA

- Basic knowledge of ecodesign processes
Knowledge of sustainable manufacturing processes
Knowledge of the behavior in service of the eco-components
Knowledge of the bases of energy efficiency and natural resources
Know the current sustainable manufacturing equipment and its foreseeable evolution
Being able to define a sustainable manufacturing process based on process time, part quality and cost requirements
Being able to propose options for improving sustainable manufacturing systems
Take into account and evaluate the environmental impact of these processes

RESULTADOS DE APRENDIZAJE DE LA ASIGNATURA

- Upon completion of the course, the student will have the ability to:
- ecologically design a component taking into account its life cycle
 - choose the sustainable manufacturing processes appropriate to a component
 - define a sustainable manufacturing process based on process time, part quality and cost requirements
 - propose options for improving sustainable manufacturing systems
 - take into account and evaluate the environmental impact of these processes

Theoretical and Practical Contents

TOPIC 1 Eco-Design / Green Design (3 ECTS)

CHAPTER 1.1 Introduction to Eco Design & Sustainable Manufacture

- 1.1.1 Environmental today challenges
1.1.2 Industrial challenges
1.1.3 Key actions and possibilities at the engineer level
1.1.4 Regulation and norms aspects
1.1.5 Eco-design and organizational solutions: introduction to logistic and industrial ecology, and to bionic design.

CHAPTER 1.2 Sustainability, Sustainable Development & Corporate Social Responsibility

- 1.2.1 Introduction to sustainable design of complex industrial systems / industrial ecology
1.2.2 Sustainable definition: economic - environmental and social
1.2.3 Role of the engineer and the different stakeholders
1.2.4 Industrial ecology
1.2.5 Economical and environmental analysis

CHAPTER 1.3 Principles of Eco Product Design & Development

- 1.3.1 Eco-indicators
1.3.2 Flux approaches: energy & materials
1.3.3 Eco Materials & Their Applications in Product-Service Design

CHAPTER 1.4 Eco Efficiency: Energy Efficiency & Resource Management

- 1.4.1. Design and optimization methodologies of complex systems
1.4.2. Eco-design methods: qualitative / quantitative
1.4.3. Eco design tools: principles / Check list / ASQV / ACV

CHAPTER 1.5 Eco Materials & Their Applications in Product-Service Design

CHAPTER 1.6 Product Life Cycle Design & Management
1.6.1. PLM models and tools

TOPIC 2: Green or Sustainable Manufacturing (1.5 ECTS)

CHAPTER 2.1 Sustainable manufacturing processes
2.1.1 Advanced manufacturing processes
2.1.2 Re-manufacturing
2.1.3 Manufacturing process simulation: tribology of manufacturing processes

CHAPTER 2.2 Resource efficiency of manufacturing processes
2.2.1 Optimization of materials and resources
2.2.2 Minimization of waste production
2.2.3 Safe alternative material production processes
2.2.4 Elimination or reduction of emissions

CHAPTER 2.3 Energy efficiency of manufacturing processes
2.3.1 New control systems for higher productivity and reduced energy consumption
2.3.2 Design new machine tools and equipment, components, tooling and processes
CAPÍTULO 2.4 Sustainable Manufacturing Case Studies and Workshop

TOPIC 3: Behavior in service of Eco-components (1.5 ECTS)

CHAPTER 3.1 Evolution of the microstructure and properties of the material as a consequence of the eco-design process and eco-efficient manufacturing

CHAPTER 3.2 Complements on fatigue behavior

CHAPTER 3.3 Practical cases on behavior in service of Eco-products.

METODOLOGIA (ACTIVIDADES FORMATIVAS)

Actividad Formativa	Hours	Porcentaje presencialidad
Exercises	5	100 %
Expositive classes	35	100 %
Application Workshops	50	40 %
Student's personal work	60	0 %

TYPES OF TEACHING

Types of teaching	M	S	GA	GL	GO	GCL	TA	TI	GCA
Hours of face-to-face teaching	35		5		15			5	
Horas de Actividad No Presencial del Alumno/a	52,5		7,5		22,5			7,5	

Legend:
M: Lecture-based
GL: Applied laboratory-based groups
TA: Workshop

S: Seminar
GO: Applied computer-based groups
TI: Industrial workshop

GA: Applied classroom-based groups
GCL: Applied clinical-based groups
GCA: Applied fieldwork groups

Evaluation tools and percentages of final mark

Denominación	Ponderación mínima	Ponderación máxima
Case study (version 2.0 of previous work)	15 %	25 %
Written examination	50 %	80 %
Presentations	25 %	35 %
Practical tasks	15 %	25 %
Questions to discuss	0 %	10 %
Works and projects	25 %	35 %

ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

The evaluation method is Continuous Evaluation.
The CONTINUOUS EVALUATION will consist of:



- An eco-design project (weight: 30%)
 - An oral presentation of that work (weight: 30%)
 - Realization and exhibition of a practical work on circular economy (weight 20%)
 - A practical assignment on the choice of materials and eco-processes associated with the ecodesign project (20%).
- Approval in continuous assessment will be achieved when the following condition is met:
- that the average of the notes is equal to or greater than 5.

EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

The extraordinary call will consist of a single oral exam. Approval will be achieved by getting a grade of 5 or higher. The student will be offered a list of 4 subject topics to choose from. After a 30-minute preparation, you will have 15 minutes to present your chosen topic.

Students who have been evaluated in the ordinary call are offered the option of saving the notes related to the works that have a grade higher than 4 (of the same course), except the blocks related to the written work and the oral presentation. In this case, each evaluable block has the same weights with respect to the final grade as in the ordinary call.

MANDATORY MATERIALS

Course notes.

BIBLIOGRAPHY

Basic bibliography

EL LIBRO DE LAS 3R: REDUCIR, REUTILIZAR, RECICLAR, SUSANA MARTINEZ, Editorial: NUEVOS EMPRENDIMIENTOS EDITORIALES, ISBN: 9788493683269

Guía para la compra pública verde y el análisis de costes de ciclo de vida, IHOBE
Manual Práctico de Ecodiseño. Operativa de Implantación en 7 pasos, IHOBE

Overfished Ocean Strategy: Powering Up Innovation for a Resource-Deprived World, Nadya Zhexembayeba, ReadHowYouWant (2 June 2014), ISBN-13: 978-0369380869

Towards the circular economy Vol. 1: an economic and business rationale for an accelerated transition, Ellen MacArthur Foundation, <https://ellenmacarthurfoundation.org/towards-the-circular-economy-vol-1-an-economic-and-business-rationale-for-an#:~:text=The%20Ellen%20MacArthur%20Foundation%20works,systems%20solutions%20at%20scale%2C%20globally.>

Cradle to Cradle: Remaking the Way We Make Things, William McDonough, Michael Braungart, Rodale Press; N.º 1 edition (2 June 2003), ISBN-13 978-0865475878

Ecodiseño: Ingeniería del ciclo de vida para el desarrollo de productos sostenibles, ISBN: 9788497051910, Editorial: Universidad Politécnica de Valencia

Detailed bibliography

Ecodesign: A Manual for Ecological Design
Author: Ken Yeang
Pages: 500 pages
Published: April 2008
Publisher: Wiley-ISTE
ISBN: 978-0-470-99778-9

Sustainable Manufacturing
Editor(s): J. Paolo Davim
Published: April 2010,
Publisher: Wiley-ISTE
ISBN: 978-1-84821-212-1

Life Cycle Assessment Handbook: A Guide for Environmentally Sustainable Products
Editor(s): Mary Ann Curran (Editor)
Pages: 640 pages
Published: November 2012
Publisher: Wiley-ISTE

ISBN: 978-1-1180-9972-8

Journals

International Journal of Sustainable Manufacturing (IJSM)
CIRP Journal of Manufacturing Science and Technology
J MANUF PROC
INT J MACH TOOL MANU
EXP MECH
SCI TECHNOL WELD JOI
J MATER PROCESS TECH
CIRP ANN-MANUF TECHN
MATER & DESIGN
J COMPOS MATER
J INTELL MANUF
J ENG MATER-T ASME
INT J ADV MANUF TECH
MATER MANUF PROCESS
MACH SCI TECHNOL
INT J MATER PROD TEC
INT J MATER FORMING
COMPOS SCI TECHNOL
COMPOS PART A-APPL S
MAT SCI ENG A-STRUCT

Web sites of interest

<http://www.basqueecodesigncenter.net/Paginas/Ficha.aspx?IdMenu=de39febf-1d3a-461c-aa61-dd091ea99e96&Idioma=es-ES>
<https://www.ihobe.eus/economia-circular>
<https://www.azti.es/aztinnova/financiacion/programa-de-ecodiseno-y-demostracion-en-economia-circular-y-de-ecoinnovacion-estrategica-2020/>