Master of Science in Mechanical Engineering

Green Design and Sustainable Manufacturing

CM4

Contacts

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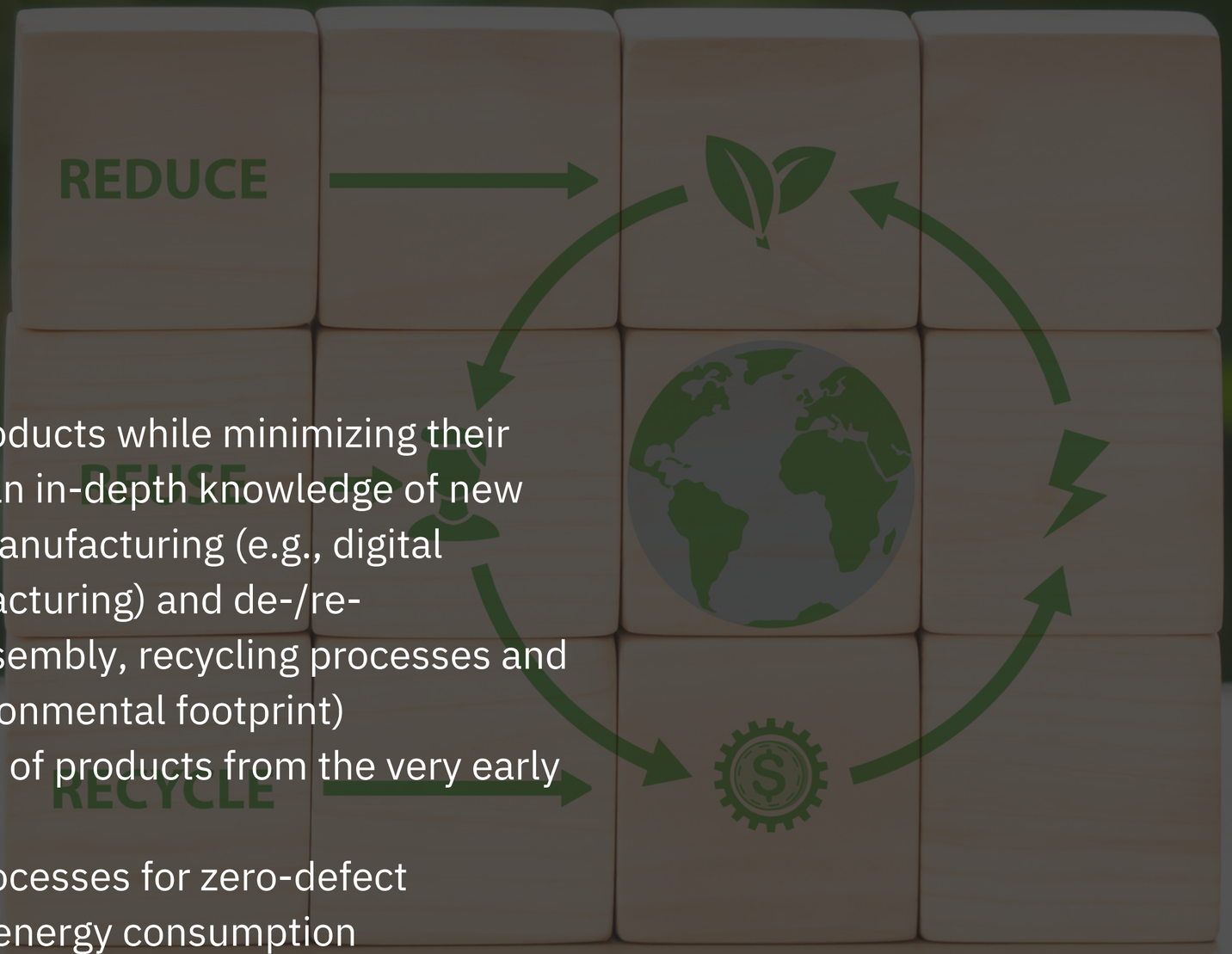
Track description

The 2030 Agenda for Sustainable Development and the European Green Deal define a (social, energetic and environmental) path for the future perspective of the planet and its inhabitants.
A fundamental factor in achieving these ambitious targets is the paradigm shift in product design and industrial production, i.e. to foster the transition to a new generation of green products and circular and sustainable manufacturing.
The aim of the Green Design and Sustainable Manufacturing track is the education and training of a new generation of professionals specialized in sustainable development.
A wide variety of complementary courses and dedicated laboratories are also offered in the three specialistic paths (Green Design, Sustainable Smart Manufacturing, Additive Manufacturing) of the second year.

Skills

Students will learn how to:

- design innovative green products while minimizing their lifecycle impact thanks to an in-depth knowledge of new solutions for sustainable manufacturing (e.g., digital machining, additive manufacturing) and de-/re-manufacturing, (e.g., disassembly, recycling processes and systems reducing the environmental footprint)
- evaluate the overall impact of products from the very early design stage
- innovate manufacturing processes for zero-defect production and minimized energy consumption



CM4: Core Courses

Course Title	YEAR	SEM	ECTS	ECTS GROUP
Dynamics of Mechanical Systems	1	1	5	5
Advanced Manufacturing Processes A	1	1	10	10
Advanced Materials for Mechanical Engineering	1	1	5	5
Measurements for Mechanical Engineering	1	2	5	5
Machine Design	1	2	5	5
Design and Management of Production Systems	1	2	10	10

CM4: Track Specific Courses

Course Title	YEAR	SEM	ECTS	ECTS GROUP
Methods and Tools for Circular Mechanical Design	1	2	10	10
Manufacturing and De-manufacturing Systems Engineering	1	1	10	10
Digital Machining A	2	1	10	10
Lightweight Design of Mechanical Structures	2	1	10	
Additive Manufacturing A	2	1	10	
Materials Engineering, Recycling and Environmental Impact A	2	2	10	
Elective courses (Energy Conversion Technologies, Design of Robotic Systems, Advanced Design of Machine Elements, Lightweight Design of Mechanical Structures - Fundamentals, Reliable And Resilient Design of Mechanical Systems, Topology Optimisation, Product Digital Twin, Additive Manufacturing for Space and Aerospace Applications, Digital Factory, Repairing and Re-manufacturing Processes, Circular Industrial Systems, Sustainable Manufacturing, Polymer Technologies For Circular Economy, ...)	2	1-2	5	20
Lab course (Additive Manufacturing for the Green Transition, Product Design for Life Cycle Analysis Assessment, Digital Machining, Re-Manufacturing, Robotic Manufacturing)	2	2	5	5

CM4: Additive Manufacturing Profile

Course Title	YEAR	SEM	ECTS
Additive Manufacturing B	2	1	5
Additive Manufacturing for Space and Aerospace Applications	2	2	5
Energy Conversion Technologies	2	1	5
Geometry Assurance	2	1	5
Materials Engineering, Recycling and Environmental Impact B	2	2	5
Metamaterials and Metastructures	2	1	5
Methods for Complex Shapes Generation	2	1	5
Quality Data Analysis B	2	2	5
Repairing and Re-manufacturing Processes	2	1	5
Sustainable Manufacturing	2	1	5
Topology Optimisation	2	1	5
LAB - Additive Manufacturing for the Green Transition	2	2	5
LAB - Robotic Manufacturing	2	2	5

CM4: Green Design Profile

Course Title	YEAR	SEM	ECTS
Additive Manufacturing B	2	1	5
Advanced Design of Machine Elements	2	1	5
Biomimetic Structure Design	2	1	5
Design of Robotic Systems	2	1	5
Digital Machining B	2	1	5
Energy Conversion Technologies	2	1	5
Failure Analysis, Sicurezza Industriale e Ingegneria Forense	2	2	5
Lightweight Design of Mechanical Structures - Fundamentals	2	1	5
Non-Distructive Testing and Evaluation for Materials and Components	2	1	5
Reliable And Resilent Design of Mechanical Systems	2	1	5
Repairing and Re-manufacturing Processes	2	1	5
LAB - Product Design for Life Cycle Analysis Assessment	2	2	5
LAB - Re-Manufacturing	2	2	5

CM4: Sustainable Smart Manufacturing Profile

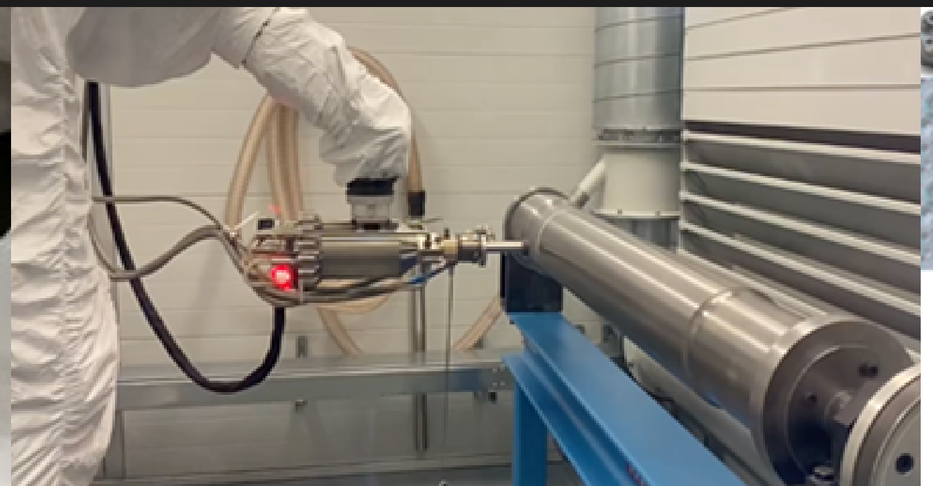
Course Title	YEAR	SEM	ECTS
Circular Industrial Systems	2	1	5
Design of Robotic Systems	2	1	5
Digital Factory	2	1	5
Digital Machining B	2	1	5
Energy Conversion Technologies	2	1	5
Lightweight Design of Mechanical Structures - Fundamentals	2	1	5
Polymer Technologies For Circular Economy	2	2	5
Product Digital Twin	2	1	5
Sustainable Materials for Innovative Processes	2	1	5
Vision Based 3D Measurements	2	1	5
LAB - Digital Machining	2	2	5
LAB - Re-Manufacturing	2	2	5

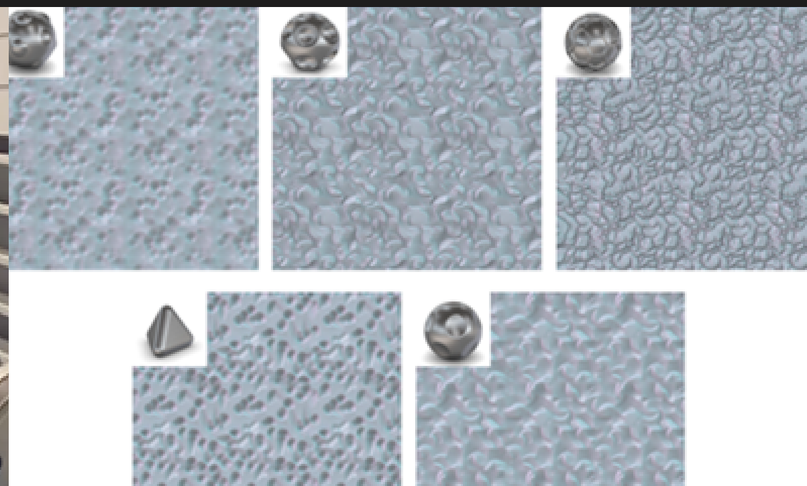
CM4: Master's Thesis

Recupero semiautomatizz ato delle lamiere da carrozzeria tramite Abrasive Waterjet

Kinetic powder deposition for repair, remanufacturing and upcycling

Sustainable post-processing for functional and durable surfaces





CM4: Master's Thesis

Redesign for Circular Economy: Methodology and Application to Lithium-ion Battery Packs for Electric Vehicles

Netshape Additive manufacturing

AM for the twin transition: new processes and LCA