

# CM2 Materials Design and Processing for Industrial Engineering

The Materials Design and Processing for Industrial Engineering track aims to train mechanical engineers with interdisciplinary and multidisciplinary skills capable of connecting the production process, microstructure, and material properties. These skills will be complemented by a strong foundation in the entire product life cycle, from raw materials to the component end-of-life management. Additionally, competencies related to emission reduction and circular economy are essential for continuous innovation in processes and products.

Therefore, students in this program are required to take a specific course on materials for industrial and engineering purposes, advanced courses in classical mechanics, and specific courses on sustainability, emission reduction, circular economy, and innovation. Moreover, students are offered numerous elective courses to deepen their expertise in energy efficiency, advanced controls and measurement systems, data analysis systems, and the latest testing methods.

## LEARNING OBJECTIVES

Students opting for the Materials Design and Processing for Industrial Engineering track are not required to have specific prerequisites. However, a strong foundation in basic skills (mathematics and physics) and in-depth knowledge of metallurgy are recommended. Curiosity is also necessary to tackle and solve complex, interdisciplinary, and multidisciplinary problems.

## PRE-REQUISITES



# CM2

# Materials Design and Processing for Industrial Engineering

## LEARNING OUTCOMES

Mechanical engineers focusing on Materials Design and Processing for Industrial Engineering are professionals with a broad cultural background. Thanks to the exploration of related subjects (ranging from the dynamics of mechanical systems to machine design), they can address complex problems related to materials in various fields of industrial engineering.

## JOB OPPORTUNITIES

Mechanical engineers focusing on Materials Design and Processing for Industrial Engineering are professionals with a broad cultural background. Thanks to the exploration of related subjects (ranging from the dynamics of mechanical systems to machine design), they can address complex problems related to materials in various fields of industrial engineering.



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## PARTNER UNIVERSITIES

There are numerous collaborations with prestigious international universities. For illustrative purposes, some of the universities where students in the Materials Design and Processing for Industrial Engineering program have completed their theses in the last year include: Montanuniversität Leoben (Austria), Technische Universität Graz (TU Graz, Austria), Universiteit Gent (UGent, Belgium), McMaster University (MAC, Canada), Yanshan University (YSU, China), University of Oulu (Finland), École nationale supérieure des mines de Saint-Étienne (ENSM-SE, France), European Synchrotron Radiation Facility (ESRF, France), Université de Technologie de Compiègne (UTC, France), Otto-von-Guericke-Universität Magdeburg (OvGU, Germany), Rheinisch-Westfälische Technische Hochschule Aachen (RWTH Aachen, Germany), Universidad de Oviedo (Spain), Luleå Tekniska Universitet (LTU, Sweden), Conseil Européen pour la Recherche Nucléaire (CERN, Switzerland), École Polytechnique Fédérale de Lausanne (EPFL, Switzerland), Technische Universiteit Delft (TU Delft, The Netherlands), and University of Nottingham (UoN, UK).



# Materials Design and Processing for Industrial Engineering

## 1 YEAR COURSES

60 ECTS

### 40 ECTS

ECTS

<u>Energy Conversion Technologies</u>	<b>5</b>
<u>Dynamics of Mechanical Systems</u>	<b>5</b>
<u>Machine Design</u>	<b>5</b>
<u>Advanced Manufacturing Processes B</u>	<b>5</b>
<u>Design and Management of Production Systems</u>	<b>10</b>
<u>Advanced Materials for Industrial Engineering</u>	<b>10</b>

### 10 ECTS

ECTS

<u>Materials Engineering, Recycling and Environmental Impact A</u>	<b>10</b>
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# Materials Design and Processing for Industrial Engineering

10 ECTS

	ECTS
<u>Energy Efficiency and Decarbonization of Industrial Processes</u>	<b>5</b>
<u>Vision Based 3D Measurements</u>	<b>5</b>
<u>Control of Mechanical Systems</u>	<b>5</b>
<u>Non-Destructive Testing and Evaluation for Materials and Components</u>	<b>5</b>
<u>Design and Analysis of Experiments</u>	<b>5</b>
<u>Materials and Simulation Tools for Sustainable Processes</u>	<b>5</b>
<u>Solidification and Welding Metallurgy</u>	<b>5</b>



# Materials Design and Processing for Industrial Engineering

## 2 YEAR COURSES

40 ECTS + 20 ECTS Master's Thesis

### 10 ECTS

ECTS

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<b>Innovation in Materials and Products Production A</b>	<b>10</b>
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### 5 ECTS

ECTS

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<b>LAB - Robotic Manufacturing</b>	<b>5</b>
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<b>LAB - Materials Selection and Life Cycle Analysis</b>	<b>5</b>
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### 5 ECTS

ECTS

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<b>Open Course</b>	<b>5</b>
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# Materials Design and Processing for Industrial Engineering

20 ECTS

	ECTS
<b>Lightweight Design of Mechanical Structures - Composite Structures</b>	<b>5</b>
<b>Modelling of Mechanical Behaviour of Materials</b>	<b>5</b>
<b>Intellectual Property and Patents in Innovation</b>	<b>5</b>
<b>Additive Manufacturing B</b>	<b>5</b>
<b>Finite Element Method based Optimization of Manufacturing Processes</b>	<b>5</b>
<b>Repairing and Re-manufacturing Processes</b>	<b>5</b>
<b>Industrial Project Management A</b>	<b>5</b>
<b>Failure Analysis, Sicurezza Industriale e Ingegneria Forense</b>	<b>5</b>
<b>One (or more) of the above courses of 5 ECTS</b>	<b>5</b>

\*None of the following courses can be selected together: «Failure Analysis, Sicurezza Industriale e Ingegneria Forense», «Solidification and Welding Metallurgy» and «Materials and Simulation Tools for Sustainable Processes»