

# FA1 Automotive and Motorsport Engineering

## LEARNING OBJECTIVES

The Automotive and Motorsport Engineering track aims to train graduates with the technical skills required by vehicle manufacturers and component suppliers. Students will learn to design both the vehicle as an integrated system and its components (wheels, suspensions, powertrains, transmissions, chassis, interior, etc.); they will also get knowledge about the production processes typical of the sector and address issues related to motorsport. The automotive sector has always stood out as one of the most dynamic and innovative in the global industrial panorama, evolving to meet the needs of economic and environmental sustainability and safety. Motorsport represents the most extreme and competitive side of automotive engineering in which the most recent technical acquisitions find immediate application and are then gradually implemented into series production.

## PRE-REQUISITES

There are no particular requirements for the students who opt for the Automotive and Motorsport Engineering track. However, good basic skills (mathematics and physics) and in-depth knowledge of machine design and mechanical systems topics are required. Students will face and solve complex, interdisciplinary, and multidisciplinary problems during the training.

## LEARNING OUTCOMES

The mechanical engineer with Automotive and Motorsport Engineering specialization is a professional with a highly multidisciplinary background. At the end of the course, graduates will be able to define the performance of a vehicle or one of its components and will be able to conceive, design, build, and test new design solutions. Practical experiences in the vehicle's design and its subsystems will be combined with traditional teaching through the support of numerous industrial partners.



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## MINORS

The Automotive and Motorsport Engineering track offers three sub-tracks. "Science and Technology" represents the more general, "Aerodynamics" focuses on aerodynamic aspects, and "Noise Vibration Harshness" deepens the analysis of vibrational and acoustic comfort.

## JOB OPPORTUNITIES

The transversality of the Automotive and Motorsport Engineering track allows students to find work in companies that develop and produce vehicles and components. Safety, sustainability, electrification, integration, and automation are the keywords.

## PARTNER UNIVERSITIES

Countless collaborations exist with the most prestigious international universities and several vehicle and component manufacturers. A list of universities where Automotive and Motorsport Engineering students have completed their thesis in recent years is the following: Technische Universität Graz (TU Graz, Austria), École polytechnique universitaire de l'université Lyon-I (Polytech Lyon, France), Technische Universität Berlin (TU Berlin, Germany), Technische Universität München (TUM, Germany), Chalmers Tekniska Högskola (Chalmers, Sweden), Technische Universiteit Delft (TU Delft, The Netherlands), Cranfield University (UK), Clemson University International Center for Automotive Research (CU-ICAR, USA), University of California, Berkeley (UC Berkeley, USA), University of Michigan (UMich, USA), and Virginia Tech (VT, USA).



# **FA1** Automotive and Motorsport Engineering

## **1 YEAR COURSES** 60 ECTS

### **40 ECTS**

ECTS

<u>Energy Conversion Technologies</u>	<b>5</b>
<u>Data Analysis for Future Transportation Systems</u>	<b>5</b>
<u>Control of Mechanical Systems</u>	<b>5</b>
<u>Advanced Dynamics of Mechanical Systems</u>	<b>10</b>
<u>Advanced Machine Design</u>	<b>10</b>
<u>Advanced Manufacturing Processes B</u>	<b>5</b>

### **10 ECTS**

ECTS

<u>Vehicle Dynamics and Control A</u>	<b>10</b>
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# **FA1** Automotive and Motorsport Engineering

10 ECTS

ECTS

<u>Computational Fluid Dynamics - Fundamentals</u>	<b>5</b>
<u>Noise and Vibration Engineering</u>	<b>5</b>
<u>Finite Element Simulation for Mechanical</u>	<b>5</b>
<u>DesignProduction Management</u>	<b>5</b>
<u>Materials for Sustainable Transportation Systems</u>	<b>5</b>
<u>Manufacturing Process and Technology Selection for Automotive</u>	<b>5</b>

# **FA1** Automotive and Motorsport Engineering

## **2 YEAR COURSES**

40 ECTS + 20 ECTS Master's Thesis

**10 ECTS**

ECTS

**Road and Off-Road Vehicle Design**

**10**

**10 ECTS**

ECTS

**Aerodynamics of Transport Vehicles**

**5**

**Fuel Cells and Batteries**

**5**

**Autonomous Vehicles**

**5**

**Advanced Motorsport Engineering**

**5**

**Advanced Tire Modeling and Testing**

**5**

**Hybrid and Electric Vehicles**

**5**

**Vehicle Optimal Design**

**5**

**Design and Construction of Automotive Electric Motors**

**5**

**Manufacturing Process and Technology Selection for Automotive**

**5**

# **FA1** Automotive and Motorsport Engineering

10 ECTS

ECTS

<b>Sustainable Mobility Behavior and Policies</b>	<b>5</b>
<b>Advanced Human Machine Interfaces</b>	<b>5</b>
<b>Extended Reality for Creativity in Design</b>	<b>5</b>
<b>Sicurezza Passiva delle Strutture</b>	<b>5</b>
<b>Computational Fluid Dynamics - Advanced Methods and Applications*</b>	<b>5</b>
<b>Experimental Techniques for Vehicles Noise, Vibration and Harshness</b>	<b>5</b>
<b>Computational Fluid Dynamics - Experimental Assessment</b>	<b>5</b>
<b>Flow Measurement Systems for Engineering</b>	<b>5</b>
<b>Machine Learning for Mechanical Systems</b>	<b>5</b>
<b>Nonlinear Dynamics and Chaos</b>	<b>5</b>
<b>Vehicle Acoustics</b>	<b>5</b>
<b>Advanced Design of Machine Elements</b>	<b>5</b>
<b>Impact Engineering</b>	<b>5</b>
<b>Reverse Engineering</b>	<b>5</b>
<b>Additive Manufacturing B</b>	<b>5</b>

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	ECTS
Lightweight Design of Mechanical Structures - Composite Structures	5
Lightweight Design of Mechanical Structures - Fundamentals	5
Mechanical Design for High Temperature Engineering Applications	5
Structural Reliability for Aerospace and Mechanical Components	5
Reliable and Resilient Design of Mechanical Systems	5
Intellectual Property and Patents in Innovation	5
Surface Modeling for Engineering Applications	5
Industrial Project Management A	5
Smart Maintenance Management	5
Electromagnetic Compatibility D	5
Infrastructure for Electric Mobility	5
Failure Analysis, Sicurezza Industriale e Ingegneria Forense	5
Electrical Drives for Industry and Transport Applications	5
Communication Technologies for Industrial and Vehicle Engineering	5
One (or more) of the above courses of 5 ECTS	5



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5 ECTS

ECTS

<u>LAB - Noise, Vibration and Harshness Testing</u>	<b>5</b>
<u>LAB - Digital Machining</u>	<b>5</b>
<u>LAB - Formula Student</u>	<b>5</b>
<u>LAB - Motostudent</u>	<b>5</b>
<u>LAB - Human-in-the-loop Dynamic Driving Simulator</u>	<b>5</b>
<u>LAB - Shell Eco Marathon</u>	<b>5</b>
<u>LAB - Virtual and Physical Prototyping</u>	<b>5</b>
<u>LAB - Destructive and Non-Destructive Testing of Composite Materials for Automotive Applications</u>	<b>5</b>

5 ECTS

ECTS

<u>Open Course</u>	<b>5</b>
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