FA3 Railway Engineering

The Railway Engineering track aims to train engineers combining a solid preparation in the fundamental subjects of mechanical engineering with an advanced knowledge of railway engineering, with particular reference to the design and operation of railway vehicles.

Therefore, the didactic plan of this track consists of a group of compulsory courses of a general nature, together with specialized courses covering the dynamics and design of railway vehicles and electrical systems for railway transport. Finally, several elective courses are offered, which students can use to complement their skills, addressing specific aspects of railway engineering of their interest.

There are no specific prerequisites for students taking the Railway Engineering track, but a good knowledge of the fundamental topics in mathematics, physics, applied mechanics, machine construction, electrical engineering, and thermodynamics is expected.

The master's graduates in the Railway Engineering track have a broad range of skills, allowing them to operate in any sector of mechanical engineering, particularly in the areas of the design of mechanical systems and their operation. They also have advanced skills in the field of vehicles and railway systems and are, therefore, specifically prepared to work in the design, operation, and management of the railway systems sector.

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FA3 Railway Engineering

The master's graduates in the Railway Engineering track may find jobs in any company/body operating in the mechanical engineering sector. The specific skills acquired in this track make them particularly suitable for taking advanced working positions in the railway industry, e.g., with vehicle manufacturers/integrators, first and second-tier suppliers, as well as railway service companies (operators, infrastructure managers, …). The railway sector is of great significance for the European industry. There is currently a strong imbalance between many highly qualified job positions and the limited availability of graduates with specific skills.

Politecnico di Milano, and specifically the Department of Mechanical Engineering, is recognized as outstanding in railway-related research. Over the last four decades, strong links and cooperation have been established with the sector's main academic and industrial research centers. By way of example, we mention here the collaborations with Central Queensland University (CQUniversity, Australia), Peking University (PKU, China), Southwest Jiaotong University (SWJTU, China), Technische Universität Berlin (TU Berlin, Germany), Instituto Superior Técnico (IST, Portugal), Universitat Politècnica de València (UPV, Spain), Chalmers Tekniska Högskola (Chalmers, Sweden), Kungliga Tekniska Högskolan (KTH, Sweden), University of Huddersfield (UK), University of Southampton (Soton, UK), and Virginia Tech (VT, USA).

Given the relevance of industrial research in the railway sector, it is worth mentioning here also current and past research cooperation with (e.g.) Alstom, CRRC, Hitachi Rail, Lucchini, MerMec, ATM, RFI, Trenitalia, Trenord, Mercitalia, DB, SNCF, Chinese Academy of Railway Sciences, Korean Railway Research Institute, Railway Technical Research Institute Japan, Transportation Technology Center USA.

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MECHENG POLIMI

FA3 Railway Engineering

1 YEAR COURSES
60 ECTS

45 ECTS

	ECTS
Advanced Dynamics of Mechanical Systems	10
Advanced Machine Design	10
Advanced Manufacturing Processes B	5
Control of Mechanical Systems	5
Data Analysis for Future Transportation Systems	5
Energy Conversion Technologies	5

20 ECTS

	ECTS
Electrical Systems for Railway Transportation	10
Railway Vehicle Dynamics and Train-Track Interaction	10

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FA3 Railway Engineering

2 YEAR COURSES
40 ECTS + 20 ECTS Master's Thesis

10 ECTS

	ECTS
Railway Vehicle Design	10

5 ECTS

	ECTS
LAB - Railway Engineering	5

25 ECTS

	ECTS
Sustainable Mobility Behavior and Policies	5
Vehicle Aerodynamics	5
Computational Fluid Dynamics - Fundamentals	5
Computational Fluid Dynamics - Experimental Assessment	5
Signalling and Operation in Railway Systems	5
Vehicle Acoustics	5
Machine Learning for Mechanical Systems	5
Nonlinear Dynamics and Chaos	5

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MECHENG POLIMI

FA3 Railway Engineering

	ECTS
Advanced Design of Machine Elements	5
Industrial Asset Management	5
Smart Maintenance Management	5
Reliable and Resilient Design of Mechanical Systems	5
Intellectual Property and Patents in Innovation	5
Repairing and Remanufacturing	5
Materials for Sustainable Transportation Systems	5
Structural Issues in Railways	5
Actuating Devices for Mechanical Systems	5
Noise and Vibration Engineering	5
Edge-based Sensing and Industrial Interent of Things	5
Lightweight Design of Mechanical Structures - Fundamentals	5
Failure Analysis, Sicurezza Industriale e Ingegneria Forense	5
Electrical Drives for Industry and Transport Applications	5
Non-Destructive Testing and Evaluation for Materials and Components	5
Communication Technologies for Industrial and Vehicle Engineering	5

FA3 Railway Engineering

	ECTS
Lightweight Design of Mechanical Structures - Fundamentals	5
	5
Experimental Techniques for Vehicles Noise, Vibration and Harshness	5
Computational Fluid Dynamics - Experimental Assessment	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

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