

How to choose your study path in the Master Programmes of the ICAT School

In this document you will find:

1. A brief description of the **Master (MSc) Degree Programmes** delivered by the ICAT School
2. A brief description of the **different tracks** of each MSc Programme:
3. A **comparison** between **related study programmes** (MSc/tracks) by content

1. The Master Degree Programmes in a nutshell

What are the Master of Science Degree programmes delivered by the ICAT School?

- **Civil Engineering** trains professionals in the field of **constructions** (buildings, bridges, tunnels, dams ...) and **infrastructures** (roads, railways, airports, water supply, treatment, and distribution systems, wastewater collection, treatment, and disposal systems...).
- **Civil Engineering for Risk Mitigation** trains engineers with a specific expertise in assessing and mitigating different risks related to the civil engineering area (seismic, hydrogeological, fire and blast events), by implementing an innovative teaching approach in which groups of students are challenged to address a problem at stake whose solution requires the interplay among several disciplines.
- **Environmental and Land Planning Engineering** trains professionals able to analyse environmental phenomena and design interventions to address problems arising from the interaction of man with the natural and built environment.
- **Geoinformatics Engineering** trains professionals with expertise both in **Geomatics** (geospatial data acquisition, validation, classification, storage, analysis, processing ...) and **Computer Science** (computational infrastructures, software engineering, databases, big data, image analysis, web technologies ...) able to grasp information from observations.

2. The tracks of the MSc Programmes in a nutshell

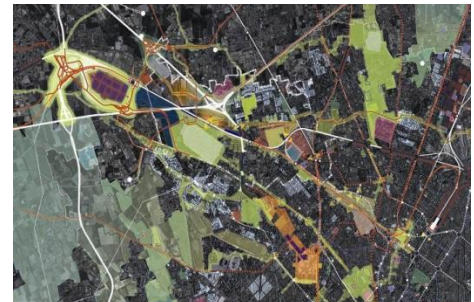
2.1. What is the focus of the different tracks in **Civil Engineering**?

- **Geotechnics** deals with all the engineering problems involving geomaterials (i.e., soil and rock), such as slope stability, excavations, mining activities, subsidence, foundations, retaining structures, tunnels, underground pipelines, etc.



- **Structures** provides students with the fundamentals of structural analysis and design of constructions, such as buildings, bridges, dams, tunnels and foundation systems. Four study plans are suggested in the second year, to allow students to deepen their training in one of these fields: Advanced structural analysis, Assessment of existing structures, Design of new structures, Earthquake engineering.

- **Transportation Infrastructures** (in Italian) trains professionals capable of designing and managing roads, highways, railways, subways, airports, intermodal nodes, harbours, stations and transport terminals, cable-driven transports and innovative movement systems.



- **Water Engineering** trains professionals capable of designing and managing infrastructures for an environmentally-compatible water resources exploitation (wells, water supply systems, hydroelectric plants, irrigation systems...) and treatment (sewers, sewage treatment plants, soil remediation), and capable of dealing with hydrological risk.

2.2. What is the focus of the different tracks in **Environmental and Land Planning Engineering**?

- **Land protection and natural risks prevention** (in Italian) focuses on the assessment and design of mitigation measures against natural hazards, including structural and non-structural interventions for earthquake, landslide and flood risk.



- **Natural resources planning and management** (in Italian) trains professionals able to deal with complex environmental systems and plan networks of services for the management of natural resources and ecosystems, for the assessment of the ecological, social and economic impact of major projects.

- **Environmental protection and remediation technologies** (in Italian) trains professionals able to identify, analyse, design intervention for reclamation and management of environmental quality of water, atmosphere and soil, e.g., drinking water, the reuse of wastewater, recycling of biomass, recovery and reuse of resources from solid wastes and sludge.



- **Environmental monitoring and diagnostics** (in Italian) trains professionals able to develop and apply land and environmental monitoring tools and systems, exploiting both in situ and remotely sensed data, to design and administrate information systems needed for land planning, natural resources management and coordination of civil protection activities.

- **Environmental engineering for sustainability** trains professionals able to assess and mitigate, with a comprehensive and interdisciplinary approach, the expected impact of natural hazards and human activities on the environment (air, water, soil and biota). The acquired capabilities are those required for strategic planning and management of industrial infrastructures and land development.



2.3. What is the focus of the different tracks in **Civil Engineering for Risk Mitigation**?

- **Hydrogeological risk** is focused on slope stability, monitoring and design of protective structures interacting with the soil, as well as on river basin-induced risk with non-structural mitigation measures.
- **Risk for Structures and Infrastructures** is focused on the retrofit of structures prone to seismic loading and fire/blast impact, on emergency management during seismic events, and on transport network use/management under emergency.

2.4. What is the focus of the different tracks in **Geoinformatics Engineering**?

- The **Computer Science** (CS) track is designed for students coming from a CS bachelor: it provides them with new expertise in Geoinformation, and deepens their knowledge on theoretical and methodological CS.
- The **Environmental** track is mainly designed for students with a background in Geomatics, Environmental, Surveying or Civil engineering: it provides them with new skills in Computer Science, and deepens their knowledge on Geospatial data analysis.

3. Differences between degree programmes and specific tracks

3.1. What is the difference between **Geoinformatics Engineering** and the track “**Environmental monitoring and diagnostics**” of Environmental and Land Planning Engineering (ENV)?

Both Geoinformatics and Environmental engineers have expertise on environmental monitoring, but the first ones work specifically on the definition and implementation of software tools for the retrieval of information from available monitoring systems leveraging on a computer science background, while the second ones are able to use those tools to derive the information required for specific tasks, such as to assess the status of environmental compartments (soil, agricultural fields, water, etc.), to identify potential degradation of the environment (e.g., pollutants plumes in seawater, eutrophication of inland waters) or to indicate how to exploit natural resources.

3.2. What is the difference between **Civil Engineering (CIV)** and **Civil Engineering for Risk Mitigation (CERM)**?

Note: The CIV programme is based in the Leonardo campus, whereas the CERM programme is based in the Lecco campus.

The MSc in Civil Engineering deals with planning, design, construction, assessment, monitoring, maintenance and management of structures and infrastructures, including buildings, bridges, tunnels, dams, water collection, supply and drainage systems, transportation infrastructures such as roads, railways, harbours, airports, and other engineering works that play a fundamental role for the economic growth and sustainable development of the modern society and resilient communities.

The CERM programme has a specific focus on risk analysis and management. To this aim, the study program deepens the civil engineer's expertise in the assessment of the structures and infrastructures risks, even in extreme environmental conditions, for the establishment of short and long term risk mitigation strategies, including emergency plans. This implies to broaden the traditional topics of civil engineering to include skills in management, land planning, industrial risks assessment, as well as on the evaluation of social, economic and financial impacts of possible hazards. In this context, the study programme involves three integrated courses, in which groups of students are challenged to address a problem, whose solution requires the interplay among several disciplines.

3.3. What is the difference between the track “**Land protection and natural risks prevention**” of Environmental and Land Planning Engineering (ENV) and **Civil Engineering for Risk Mitigation (CERM)**?

Note: The ENV programme is based in the Leonardo campus, whereas the CERM programme is based in the Lecco campus.

The track “Land protection and natural risks prevention” of ENV mainly focuses on the identification of the natural hazards that threaten the natural and built environment (i.e. seismic, hydraulic and hydro-geological

risk), providing students with the capability to recognize their causes and identify their characteristics, and with the tools for planning and designing mitigation measures. Differently from the CERM programme, it does not focus on crisis mapping and emergency management.

Differently from ENV, the CERM program includes subjects requiring a specific civil engineering background such as the assessment of residual bearing capacity, the retrofitting design of structures subjected to seismic events, the role of transport infrastructure in risk management.

A further important difference is connected to the teaching methodology based on an innovative problem solving approach.

3.4. What is the difference between the track “**Land protection and natural risks prevention**” of Environmental and Land Planning Engineering and the track “**Geotechnics**” of Civil Engineering?

“Land protection and natural risks prevention” mainly focuses on land protection from an Environmental perspective, and embraces all the main causes of natural (seismic, hydraulic and hydro-geological) risk. “Geotechnics” focuses on civil engineering problems related to soil and rock mechanics. There is undoubtedly convergence of the two tracks on some topics, such as slope stability, but no overlap exists when dealing, for instance, with hydraulic hazard (in Land protection and natural risks prevention) or with underground constructions (in Geotechnics).