A PhD course covering advanced research topics in all the fields of Civil and Environmental Engineering
Research Topics in Civil and Environmental Engineering

This PhD program has eight wide research branches addressing all fields of theoretical and applied research for Civil Engineers and Environmental Engineers.

- Geoengineering
- Water engineering
- Geotechnics
- Infrastructures, transport systems and civil works
- Applied Environmental Engineering
- Mechanics of Structures
- Mechanics of Materials
- Structural Design

The numbers at a glance:

- 35 PhD Students enrolled in the last year;
- More than 100 Students currently active;
- 104 Professors and Researchers in this program

It is one of the largest and more variegated PhD Programs at Politecnico di Torino.
Research Infrastructures (Labs)

The wide variety of topics is supported by several laboratories and infrastructures. Each research area has specialized laboratories for conducting experimental and/or computational and simulation research with a total of 23 main laboratories directly connected to the PhD program. In between the largest infrastructures we may cite:

- The Laboratory for Structural and Material Testing (first established in Italy, active since 1887);
- The Geotechnics Laboratory
- Hydraulics and Fluid Mechanics Laboratory
- Road Materials Laboratory

Extensive lists can be found at the DISEG and DIATI Departments websites:

https://www.diseg.polito.it/il_dipartimento/strutture_interne/centri_e_laboratori
https://www.diati.polito.it/en/about/laboratories
Research topics
Characterization and simulation of underground reservoirs through advanced and integrated static and dynamic studies

Environmental, geotechnical, geological and hydrogeological problems, monitoring of glacial and periglacial environments, prospection of geothermal reservoir.

Analysis and treatment on solid raw materials and their pollutants such as asbestos and microplastics.

Geoengineering

Underground Energy Systems

Applied Geophysics

Raw Material Engineering
Water Engineering

- Civil and industrial hydraulic systems
- Climate changes (impact, mitigation and adaptation)
- Eco-hydraulics, eco-hydrology, biofluid mechanics
- Energy-food-water nexus
- Environmental fluid mechanics
- Hydraulic design and management
- Hydroinformatics
- Hydro-meteorological risk assessment and mitigation
- Hydropower plants
- River and coastal engineering
- Urban water management
- Water resources planning and management
Geotechnical Engineering

- Soil Mechanics
- Rock Mechanics
- Environmental Geotechnics
- Geotechnical Earthquake Engineering
- Soil-foundation-structure interaction
- Slope stability
- Tunneling and underground structures
- Geothermal energy
- Hydro-chemo-mechanical interaction
- Unsaturated soils
- Seismic Risk
Infrastructures, transport systems and civil works

- Transport planning and mobility behaviours
- Modelling and simulation of traffic flows
- Advanced road design, human factors and safety issues
- Pavements design and characterisation of innovative materials
- Recycled and nano-reinforced materials in road construction
- Support and reinforcement structures in underground works
- Rock-tool interaction of the mechanized excavation
- Integrated geomatic sensors, digital photogrammetry and GIS
Objective of the research is the **improvement of environmental quality and sustainability**:

- evaluation of the environmental footprint and risk of new or existing processes
- assessment of contaminations and their effect on humans and on the ecosystems
- reclamation, treatment, and improvement of soils and water resources
- waste management, valorization, reuse and recycling
- adaptation to climate change through environmental technologies
Mechanics of Structures

- **Structural glass**: Improvement of structural glass reliability
- **Finite fracture mechanics**: Modelling of the failure behavior of brittle or quasi-brittle materials
- **Innovative techniques for damage monitoring**: new insights into the behaviors of structures and exploration of the residual capacity
- **Structural robustness and progressive collapses**: threat-independent damage tolerance, progressive collapses, blast loads and natural phenomena
- **Artificial intelligence and structural health monitoring**: model based and artificial intelligence systems
- **Computational Mechanics**: development of new computational models to analyze challenging problems
Mechanics of Materials

→ Flexural behavior in FRC beams: fracturing process in fiber-reinforced concrete
→ Very-high-cycle fatigue and size effects: lifetime of existing civil infrastructures. Ultrasonic fatigue tests to obtain the VHCF resistance of high-strength steels
→ Safety of reinforced concrete structures: size-scale effects and behaviour of RC and PC beams
→ Elastic lattice models for protein vibrations: structural mechanics based models to reveal insights into protein vibrations in connection to its function
→ Aeroelastic analysis of suspension bridges
→ Static, dynamic and stability analysis of tall buildings: preliminary analysis of tall buildings through fast analytical methods
Structural Design

- **Structural Health Monitoring**: implementing a damage detection and characterization strategy for engineering structures such as bridges and buildings.

- **Structural Safety**: risk and reliability among technical disciplines involved in design and construction, and to enhance the use of risk management in the constructed environment.

- **Machine Learning in Structural Engineering**: interdisciplinary integration of Artificial Intelligence to structural engineering problems.

- **Sustainability in structural engineering**: use of recycled materials as aggregates in concrete, Life Cycle Assessment for new and existing buildings.

- **Structural Optimization**: new tools applied for designing large structures.
Skills and work opportunities

High-quality laboratories for advanced experimental research

Simulation tools to model and simulation of complex engineering problems

Field work and development of pilot technologies

Collaboration with industry and agencies

Job opportunities:
- civil and environmental consulting
- research & development
- design, management and employment of new technologies
- certifications
Some practical notes (http://dottorato.polito.it/en/call_for_applications)

- The current PhD application has deadline May 13, 2021 at 12 p.m. (noon - CEST)
- Read carefully the application requirements in advance to get organized
- Note that you participate to all positions with own research topic but you have to select explicitly any position with predefined research topic
- Note that a few scholarships are visible now as we are allocating the available resources. Most of the scholarships will be visible in a couple of weeks.