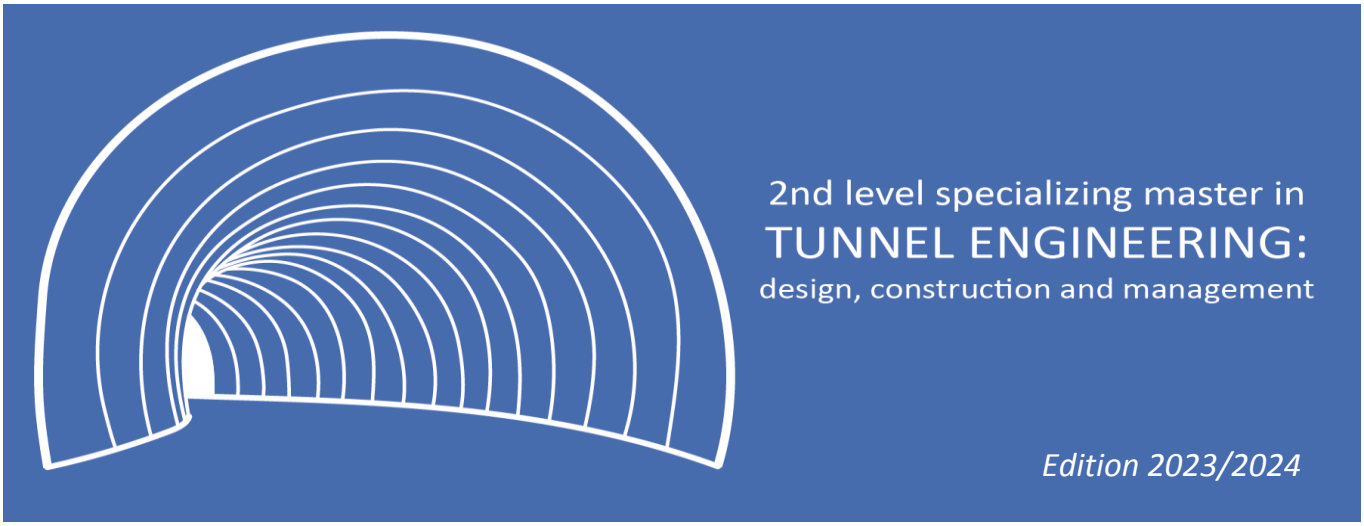

CALENDAR *

LESSONS (°)	
From March to June 2023 *(5 days a week / 8 hours a day)*	
1. Tunnel design: general concepts & risk managment in tunneling **Module coordinator: Daniele Peila** **SSD: ING-IND/28 – ICAR07** **CFU 1**	This module is devoted to presents the main concepts associated with tunnelling process. This process always deals with a series of unavoidable uncertainties and unknowns, which have to be tackled by systematically applying appropriate risk management strategies.
2. Geology, hydrogeology, geophysics and risk analysis **Module coordinator: Laura Scesi** **SSD: GE0/05 – GEO/11** **CFU 3**	The behaviour of rock and soils being excavated depends on may factors, among which the most important are the geological and the hydrogeological ones. The knowledge of geological and the hydrogeological conceptual models allows us to identify the hazards, estimate the risks and define the most suitable mitigation measures. This module is devoted to describe all the geological and hydrogeological aspects necessary for the definition of both geological and hydrogeological conceptual models.
3. Soil and Rock Mechanics & Investigations **Module coordinator: Monica Barbero** **SSD: ICAR/07** **CFU 3.5**	The geotechnical characterization is necessary to select the most appropriate construction method, to anticipate possible risks during construction and to define the most suitable mitigation strategies. In this module the main definitions of geotechnical properties for both soils and rocks are introduced and both laboratory tests and site investigations for geotechnical characterization are presented.

4. Computational methods **Module coordinator: Luca Flessati** **SSD: ICAR/07** **CFU 4**	The aim of any computational analysis involving tunnelling problems consists in describing and simulating the hydro-thermo-chemo-mechanical processes taking place during the excavation and during tunnel operational life. In this module the most used computational tools will be presented. A particular attention is given to the numerical methods (Finite elements, finite differences and discrete element methods).
5. Construction Methods: conventional tunneling **Module coordinator: Marilena Cardu** **SSD: ING-IND/28** **CFU 3**	Tunnel construction can be described as the set of operations that are carried out to produce a stable underground excavation. The construction process can be subdivided into three phases: excavation, short term stabilization of the created cavity and long-term stabilization of the tunnel. Tunnel excavation methods are usually divided into two main families: conventional methods and full-face mechanized methods. This module is devoted to the description of the most common conventional excavation methods.
6. Construction methods: Improvements and presupports (technology) **Module coordinator: Carmine Todaro** **SSD: ING-IND/28 – ICAR07** **CFU 1**	Ground reinforcements and improvements, pre-confinements and pre-supports are interventions that are carried out both inside the geological materials that must be excavated (into the tunnel core) and around the future tunnel cavity, to ensure the stability of the tunnel, to manage the stresses around the tunnel and ahead of the tunnel face and to limit the ground deformations and finally to guarantee the health and safety of the workers. This module is devoted to the presentation of the most common techniques used to improve soils and rocks and to support tunnel faces.
7. Construction Methods: mechanized tunneling **Module coordinator: Daniele Peila** **SSD: ING-IND/28** **CFU 3.5**	Tunnel construction can be described as the set of operations that are carried out to produce a stable underground excavation. The construction process can be subdivided into three phases: excavation, short term stabilization of the created cavity and long-term stabilization of the tunnel. Tunnel excavation methods are usually divided into two main families: conventional methods and full-face mechanized methods. This module is devoted to the description of the most common Tunnel Boring Machines (TBMs).
8. Assessment of excavation related hazard and design of mitigation measures **Module coordinator: Claudio di Prisco** **SSD: ICAR/07 – ICAR/09 – ING-IND/28** **CFU 7**	Tunnelling process has to be inspired by risk management strategies: for each hazard risk is individuated/assessed/evaluated. When the assessed risk are not acceptable, mitigation measures have to be defined/designed/implemented. This module is devoted to the presentation of the design approaches to the most common mitigation measures.
9. Plants **Module coordinator: Daniele Martinelli** **SSD: ING-IND/28 – ICAR07** **CFU 3**	This module is aimed at summarizing several topics related to muck handling, concrete pouring systems, waste water management systems technological plants such as ventilation.

10. Monitoring **Module coordinator: Riccardo Barzaghi** **SSD: ICAR/06 – ING-IND/28** **CFU 1**	During tunnel construction data are collected, processed and interpreted with the aim of observing the performance of the system under construction. The whole of all these activities is named monitoring, and it is commonly included in a risk control and management strategy. The aim of this section is to illustrate the relevant physical quantities typically measured, the measuring instruments usually employed and, overall, the criteria that should be followed in order to correctly develop a monitoring plan and to properly use the collected data.
11. Environment, Contracts, Managment and Safety **Module coordinator: Mauro Mancini** **SSD: ING-IND/28 – ICAR/17 – ING-IND/17** **CFU 4.5**	This module is aimed at summarizing the main aspects of the current legislation in tunnelling with a special reference to environment, safety and contracts. Moreover, in this module also the main concepts of project management are discussed.
12. Maintenance & refurbishment **Module coordinator: Giuseppe Marano** **SSD: ING-IND/28 – ICAR/09** **CFU 1**	With time, several degradation phenomena started to appear – induced by the action of natural agents, the ageing of the materials and the use of the tunnels and accelerated by construction defects – and required the implementation of systematic maintenance activities and reparation works. Maintenance enables good operational performances and increases the life of the tunnel. This module illustrates the activities – inspections and monitoring – necessary to keep tabs on the evolution of the state of the tunnel.

(°) Lessons will be held online, with the exception for those scheduled in May, which will be held on-site at Campus Lingotto of Politecnico di Torino (Via Nizza, 230 – 10126 Torino, TO), and for the technical visits. Further information will be provided before the Master starts.

MID-TERM TEST
September 2023

INTERNSHIP	
At least 480 hours	**From September 2023 to January 2024**

FINAL EXAM
From February 2024

** This calendar may be subject to changes due to organizational issues independent of the will of the Master Direction.*