

Questionnaire

Training Organisation	University of Ljubljana, Faculty of Natural Sciences and Engineering, Department of Geotechnology and Mining Engineering
Country	Slovenia
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Courses offered

Programme ¹	Course	Semester	Type ²	Hrs ³	CP ⁴	Syllabus
B-ME	Underground Structures I	5	C	45hrs/semester of lectures 35hrs/semester of exercises 2days/semester of field training	6	Basic principles and general criteria for designing and construction of underground structures, investigation and description of the ground conditions, structural analysis and dimensioning, excavation methods and sequences, primary support, construction contract, organization of project execution.
B-ME	Underground Structures II	6	E	40hrs/semester of lectures 20hrs/semester of exercises 10hrs/semester of seminar 1 day of field training	5	Special methods of construction of large underground structures, layout of underground structures, modifications to construction methods on site, dewatering and drainage, ground reinforcement, special geotechnical measurements and monitoring the construction of underground structures with feedback parameter analyses during the construction and

¹ B-CE Bachelor programme in Civil Engineering
 M-CE Master programme in Civil Engineering
 B-ME Bachelor programme in Mining Engineering
 M-ME Master programme in Mining Engineering
 MAS Master of advanced studies

² C: compulsory
 E: elective

³ Number of teaching hours/week for lectures and exercises

⁴ Number of ECTS credit points (1 credit point = 30 hours student workload incl. homework)

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						operation of such structures electrical installation.
M-ME	Tunnels Construction and Risk Management	2	C	45hrs/semester of lectures 45hrs/semester of exercises 20hrs/semester of seminar 2t day of field training	8	<p>Choice of tunnel system and alignment, shape of cross section, excavation and support, outline of the design process, monitoring of tunnel atmosphere, objectives of monitoring, tunneling boring machines and road headers hazards and their mitigation.</p> <p>Technical and technological part of topics which include</p> <ul style="list-style-type: none"> - grouting and reinforcement of ground layers by injecting, installation of bearing steel structures and other materials, chemical procedures for optimizing the bearing capacity of geological materials; - performance analyses of active and passive anchoring systems by considering time interdependence of individual types of ground; - procedures for ensuring long-term stability of underground structures; - economic criteria in planning of the construction of underground structures in known geotechnical and technological conditions for the implementation of works and by considering the environmental requirements; - special geotechnical measurements and monitoring the construction of underground structures with feedback parameter analyses during the construction and operation of such structures; - designing ventilation measures during the construction and operation of such underground structures.
M-ME	Security and Management of Underground Structures	3	E	30hrs/semester of lectures 10hrs/semester of exercises 20hrs/semester	5	The theme of the course deals with the procedures and methods of planning and performance management systems and operation

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				of seminar 1 day of field training		<p>management of underground facilities for a variety of purposes with an emphasis on road, rail and other transportation tunnels and ancillary facilities in terms of the conditions laid down in the field of functional usability, management techniques and safety during construction and operation as well as methods of making analyses of risk assessments.</p> <p>Included is an upgrade of the basic principles of research methods in order to solve complex technical problems of management and administration. Particular attention is paid to the analysis of the specific conditions of ventilation and emergency response in underground facilities, analytical evaluation of the planning processes of underground structures taking into account the methods of risk for both classical construction systems as well as risk analysis, construction of underground structures using the TBM with a critical assessment of individual solutions.</p> <p>Some content also relates to the analysis of fire scenarios in underground facilities, and analysis of possible ways to act in emergency situations.</p>
Others*	Sustainable development oriented technologies of underground space used		E	60hrs/semester of lectures 40hrs/semester of exercises 45hrs/semester of seminar 1 day of field training 145hrs/semester of individual work	10	<p>Revising the basics of planning the construction of underground structures with regarding to their functionality and modern principles of designing accordance to sustainable development large areas and in the case of development infrastructure and energy supply urban parts of the country.</p> <p>The emphasis of described fundamentals is on following</p>

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						<p>topics:</p> <ul style="list-style-type: none"> - adjustment possibility underground space use in the name of preservation environment and region, - placement of underground spaces in the integrity frame to find infrastructure solution in the aim of country parts of sustainable development, - verification possibilities of underground space use regarding adaptation to arriving climate changing with emphasis on research rational and environmental suitable technical solutions, Technical and technological part of topics which include underground space use are: <ul style="list-style-type: none"> - modern methods of construction of underground structures in normal bearing capacity and stable rocks, - modern methods of construction of underground structures in weak rocks and unstable soils, - application of modern and professionally established numeric methods with emphasis on the analysis of interaction between the ground and the support by considering rheological laws for individual types of ground.
Others**	Modern construction technologies and numeric modelling of underground structures	1	E	30hrs/semester of lectures 20hrs/semester of laboratory work 40hrs/semester of seminar 1 day of field training 50hrs/semester of individual work	5	<p>The course has been designed in view of the specifics and complexity of underground construction. It includes the following topics:</p> <ul style="list-style-type: none"> -detailed and accurate analyses for understanding modern construction methods of underground structures, considering methods of observation and their practical applications, -planning target-oriented research and observations of rock sites by using critical assessment of the research methods, their advantages and limitations, -analysis of laboratory

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					<p>methods of rock research by critical evaluation of the results in terms of defining project parameters,</p> <ul style="list-style-type: none"> -engineering assessment of the classification of rocks with emphasis on determining geomechanical parameters of the rock mass and the broader construction site, -geotechnical design of the system rock – construction by using the results of geomechanical analyses, -analysis and critical evaluation of geological and technological risks in using cyclic methods of the construction of underground structures -economic aspects and contractual relationships between the contractor and the client, -analysis and critical evaluation of geological and technological risks in using machine methods in underground construction with emphasis on TBM, -economic aspects and contractual relationships between the client and contractor of underground structures by considering the principles of TBM, -deep understanding analysis of construction phases and numerical simulation with implementation of suitable constitutive models of rocks in conventional cyclic and mechanical methods of underground excavations, -survey, observation and assessment of key methods in conducting underground constructions with special consideration to the economic principles and regulations for safe work in underground environments, -methods of planning and implementation of safety measures with regard to the
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						legislation in the field of health and safety at work.
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Remarks:

* Interdisciplinary Doctoral Programme in Environmental Protection at the University of Ljubljana

** Interdisciplinary Doctoral Programme in Materials Science and Engineering at the Faculty of Natural Sciences and Engineering