CURRICULUM

For the University Programme

NATM Master of Engineering

(Subtitle: Construction, rehabilitation and operation of NATM- and TBM-tunnels)

at Graz University of Technology and the Montanuniversität Leoben

The following curriculum for the joint university programme 'NATM Master of Engineering' is approved by resolutions of the senate of the Montanuniversität Leoben on 30.01.2019 and the senate of Graz University of Technology on 28.01.2019.

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GENERAL REGULATIONS

§ 1 Description of the qualification

(1) The university programme is designed to give the students advanced knowledge of tunnel building, especially of the New Austrian Tunnelling Method and tunnelling machines. Assuming that the students have a prior degree in a relevant subject and ideally some practical experience, the programme should equip them to design tunnels independently, and to work on tunnelling projects in leadership or consultancy roles. The programme will also cover topics such as rehabilitation and regular maintenance of existing tunnels and aspects of safety and risk analysis. A special programme on this subject is justified by the fact that traditional degrees in construction or engineering geology only cover parts of this material.

(2) The university programme is intended for engineers with degrees in construction, mining, geotechnical engineering, and engineering geology with an emphasis on engineering, who wish to specialize in the field of the NATM.

(3) Future areas of work of graduates of this university programme are design, consulting and construction supervision roles for engineering firms, and construction management for construction firms. The graduates may also find work in positions of responsibility with organizations that commission tunnelling projects and public authorities.

(4) The graduates should be able to manage tunnelling projects with regard to geotechnical, structural, organizational, contractual and economic aspects.

§ 2 ECTS credits

In accordance with the European Credit Transfer and Accumulation System (ECTS), the individual parts of the programme are assigned ECTS credits which reflect the effort invested by the students. A year of full-time study corresponds to 60 ECTS credits.

§ 3 Duration and structure

(1) The university programme lasts six semesters and counts for 90 ECTS credits.

(2) The lectures and other elements of the programme are all compulsory; there are no elective subjects.

(3) The university programme is organized in five lecture blocks of three weeks each, one in each of the first five semesters. The sixth semester is used for a one-week teaching block, for writing the master's thesis and for the master's examination.

(4) The teaching blocks/modules are held alternately at MU Leoben and TU Graz.

§ 4 Language of instruction

The language of instruction in lectures, other types of courses and study materials is English.

PROGRAMME ORGANISATION

§ 5 Programme director

(1) A new class will begin the certificate programme every two years and for each class a programme director will be appointed from the staff of one of the two universities (Graz University of Technology and the Montanuniversität Leoben) and a deputy programme director from the staff of the other university. Programme directors will remain responsible for each class for the duration of the programme (6 semesters).

(2) Programme directors shall be persons suitably qualified in the subject area from the staff of the universities named in (1) and shall be appointed by the responsible bodies, by consensus.

(3) The member of the Rectorate responsible for teaching shall assign additional members of staff to academic and administrative roles as proposed by the programme director and in accordance with the organizational needs of the programme.

§ 6 Quality system

(1) Every lecture or other teaching activity of the university programme shall be evaluated in accordance with the applicable guidelines of Graz University of Technology and Montanuniversität Leoben. The results of the teaching evaluations must be taken into consideration on an ongoing basis when assigning teachers to the programme. Additionally, an interim and a final evaluation will be carried out using questionnaires. The academic programme directors will decide on possible corrective measures based on the results.

(2) The results of the evaluations shall be documented in written reports that are submitted to the Rectorate. A financial report shall also be submitted.

(3) In order to evaluate the programme and to guide its future development, an academic advisory committee will be set up. Details are to be set out in the contract of cooperation that regulates how the programme is to be carried out.

§ 7 Programme fee

In order to ensure that the programme is run in a way that covers costs, a programme fee will be proposed by the programme director, decided on by mutual agreement of the rectorates and whenever necessary, adapted to meet budgetary requirements.

ADMISSIONS

§ 8 Conditions of admission

(1) The conditions of admission for the university programme 'NATM Master of Engineering' are:

- A completed Master's degree in a relevant subject at a university in Austria, or
- An equivalent degree at a post-secondary educational institution specializing in relevant subjects in Austria or abroad, or
- A Bachelor's degree in a relevant subject and at least three years of relevant professional experience;
- Sufficient proficiency in the English language
- The availability of a place on the programme

(2) It is the responsibility of the programme director to determine whether the language competence of the students is adequate. The final decision on admission is made in accordance with the procedures of each university.

§ 9 Application and admissions procedure

(1) Applications for places on the programme are to be submitted in writing to the programme director and must include a completely filled out and signed application form, proof of identity and proof of fulfilment of the admission criteria (academic/degree certificates and record of employment). Proof of competence in English can be omitted if English is the first language of the applicant.

(2) The admission procedure consists of checking the admission documents and if necessary an admission interview. If it is not possible to judge the applicant's suitability for the programme, and admission test is administered. This test examines the applicant's knowledge of fundamentals of mechanics and geology/geotechnical engineering.

(3) Places on the programme are awarded by means of written confirmation sent by the programme director after receipt of the programme fee. Admission and registration as an postgraduate master's student is carried out by the Rectorate.

§ 10 Number of places

The maximum number of students that can be admitted to a class in the programme is to be decided by the programme director giving due consideration to pedagogical and organizational factors. The maximum number should not exceed 30 students.

PROGRAMME PLAN

§ 11 Teaching activities

The university programme includes the lectures and other types of courses set out in the appendix.

§ 12 Programme and examination rules

Types of teaching activity

The university programme provides the following types of teaching activities/courses:

- Lecture (VO): Introduction to specialist areas and methods of a subject.
- Lecture with integrated exercises (VU): Introduction to specialist areas and methods of a subject including autonomous application of the material by the students in exercises.
- Exercise-based course: Excursion (EX): specialization and/or expansion of theoretical knowledge through practical, experimental, theoretical and/or constructive work.
- Laboratory course (LU): Practical, experimental or constructive work to specialize and/or expand theoretical knowledge under particularly intensive supervision.

(1) The decision on whether examinations are passed or failed is the responsibility of the programme director. He or she must give notice of the form of examination before each teaching activity begins. The range of examination types includes written and/or oral examinations, homework, continuous assessment, etc.
(2) Grades reflect both the examination results and homework.
(3) The Master's thesis may only be submitted in the sixth semester.
(4) The final examination will be carried out in the form of an oral examination in the presence of an examination board.
(5) As well as the results of the individual courses, an overall evaluation will be made. The overall evaluation is "passed" when every course has been passed; otherwise, the overall evaluation is "failed". The overall evaluation shall be "passed with distinction" if the student has obtained at least the grade "good" in all courses and the final examination and the grade "very good" in at least half of all the courses.
(6) Failed examinations can be repeated a maximum of four times.
(7) The maximum duration of studies is limited to double the number of semesters set out in the curriculum. After this time, the admission to the university programme expires.

§ 13 Recognition of examinations

(1) The recognition of examinations that were taken at educational institutions as defined in §78(1) of the Austrian University Act (UG) is the responsibility of the 'officer responsible for study matters'.

(2) Recognition of courses of the university programme 'NATM Engineering' (Directive passed by decision of the senate of the Montanuniversität Leoben of 18.06.2008 and of the senate of Graz University of Technology of 23.06.2008, as amended by the directive passed by decision of the senate of the Montanuniversität Leoben of 26.01.2011 and of the senate of Graz University of

Technology of 14.12.2010) is done in accordance with the list of equivalences (see appendix).

§ 14 Master's Thesis

(1) The Master's thesis may be practical or theoretical in nature.

(2) The thesis projects may be carried out in collaboration with an industrial partner.

(3) The name of the supervisor, the working title of the Master's thesis and a description of its content are to be submitted as a rough outline to the programme director for approval before beginning the work.

(4) The work for the Master's thesis is to be done in the sixth semester.

(5) When the work is completed it is to be submitted to the supervisor for evaluation.

FINAL EXAMINATION & DEGREE

§ 15 Final examination

(1) Registration for the final examination is conditional on the proof of having passed all the course examinations (see § 12) and of the Master's thesis having been evaluated as "passed" (§ 14).

(2) The final examination takes place before a board of three examiners, who are nominated by the 'officer responsible for study matters'. One of the examiners must be the supervisor of the student's thesis. If they are unable to attend, they can nominate a replacement. The examination is carried out orally on the examination subject to which the master's thesis belongs as well as associated subjects. The candidate must defend the content of the Master's thesis.

§ 16 Academic degree

The graduates of the university programme 'NATM Master of Engineering (Construction, rehabilitation and operation of NATM- and TBM–tunnels' are awarded the degree of 'Master of Engineering'.

CONCLUDING REGULATIONS

§ 17 Coming into effect of the curriculum

The curriculum comes into effect on the first day of the month following its promulgation in the gazettes of Graz University of Technology and the Montanuniversität Leoben.

§ 18 Transitional arrangements

Students of the Master's programme 'NATM Master of Engineering', Gazette No.27 of 27.01.2011 of the MU Leoben and Gazette No. 5a of 14.12.2010 of Graz University of Technology, who are subject to the subject to the 2010 curriculum 'NATM Master of Engineering' when the present curriculum comes into effect on 01.03.2019 have the right to conclude their studies under the abovementioned curriculum 'NATM Master of Engineering' within 7 semesters. If they have not completed their studies by 30.09.2023, they shall become subject to the curriculum for the Master's programme 'NATM Master of Engineering (Construction, rehabilitation and operation of NATM- and TBM-tunnels)' in the version that is in effect at that time. The students also have the right to switch voluntarily to the new curriculum at any time within the admission deadlines.

§ 19 Providers

The providers of the university programme 'NATM Master of Engineering (Construction, rehabilitation and operation of NATM- and TBM–tunnels)' are Graz University of Technology and the Montanuniversität Leoben.

The rights and obligations of the cooperation partners are regulated in a contract of cooperation.

Contents of the curriculum: Overview of courses

MODUL		LVs	Typ	ECTS	ETCS/ Modul	SWS	SWS/ Modul
1	**Geology, Geotechnics & Tunneling methods**	Lab tests	LU	2.5	15	2.5	10
		Geological model	VO	2		1	
		Geotechnical characterisation	VO	3		1.5	
		Geotechnical models	VO	2.5		1.5	
		Investigation	VO	3		1.5	
		Tunnel construction methods	VO	1.5		1	
		Excursion	EX	0.5		1	
2	**Tunnel Design & Support methods**	TBM inkl. support	VO	2	12.75	1	8.5
		Road Header	VO	1.5		1	
		NATM	VO	1.5		1.5	
		Tunnel design & layout analytics	VO	4		2	
		Numerical methods in tunnelling	VO	3		1.5	
		Excursion	EX	0.75		1.5	
3	**Contract & Site Management**	NATM contract	VO	3	16.5	1.5	9.5
		Geotechnical monitoring	VO	1.5		1	
		Interpretation	VO	2		1	
		Blasting	VO	3		1.5	
		Site management	VO	3		1.5	
		Excursion	VO	0.5		1	
		NATM & TBM – design guide lines	VO	3.5		2	
4	**Special Methods in tunnelling & HSR**	Grouting	VO	5	14.75	5	11.5
		TBM - part 2	VO	3		1.5	
		Health & safety	VO	3		2	
		Risk ass.	VO	3		1.5	
		Excursion	EX	0.75		1.5	
5	**Equipment & Maintenance**	Equipment (motorway tunnels, railway tunnels, metros, power houses)	VO	2	11	2	7.5
		LCA	VO	2		1	
		Maintenance & repair	VO	3		1.5	
		Tunnel ventilation	VO	2		1	
		Water mist systems	VO	1.5		1	
		Excursion	EX	0.5		1	
6	**Master Thesis**	Master thesis		20	20	13	13
		SUMME		**90.00**	**90.00**	**60.00**	**60.00**
		GESAMT					

Appendix:
Equivalence list

Courses whose equivalence or recognition is defined in this part of the appendix no longer require individual recognition by the 'officer responsible for study matters'. However we note that the possibility of individual recognition in the form of a written decision by the 'officer responsible for study matters' pursuant to § 78 of the Austrian University Act UG exists. An equivalence list defines the equivalence of passed courses in the present curriculum to those in the previous curriculum, i.e. courses passed under the previous curriculum should be counted under the present curriculum. The equivalence list also applies in the reverse direction, so that courses passed under the 2019 curriculum can be counted under the 2010 curriculum.

Courses that have the same title and type and the same number of ECRS credits or 'semester hours' in both curricula are equivalent and are not listed in the equivalence list.

Present Curriculum 2019				**Previous Curriculum 2010**			
Course	**LV-Typ**	**SST**	**ECTS**	**Course**	**LV-Typ**	**SST**	**ECTS**
Lab tests	LU	2.5	2.5	Investigation and ground characterization	VO	8	11.5
Geological model	VO	1	2				
Geotechnical characterisation	VO	1.5	3				
Investigation	VO	1.5	3				
Geotechnical models	VO	1.5	2.5	Geotechnical design and tunnel layout, part 1	VO	8	12
Tunnel construction methods	VO	1	1.5				
Tunnel design & layout analytics	VO	2	4				
Numerical Methods in tunnelling	VO	1.5	3				
Blasting	VO	1.5	3	Geotechnical design and tunnel layout, part 2	VO	6	9
NATM & TBM – design guide lines	VO	2	3.5				
TBM - part 2	VO	1.5	3				
Risk Ass.	VO	1.5	3	Risk analysis and management	VO	2.5	3.75
NATM contract	VO	1.5	3	Site organization. construction contract and construction management	VO	4	6
Site Management	VO	1.5	3				
Geotechnical Monitoring	VO	1	1.5	Instrumentation, Monitoring, data evaluation and interpretation	VO	4.5	6.75
Interpretation	VO	1	2				
Health & Safety	VO	2	3				
NATM	VO	1.5	1.5	Conventional and mechanical excavation techniques including basics in TBM-Tunnelling	VO	4	6
TBM incl. Support	VO	1	2				
Road Header	VO	1	1.5				
Excursion	EX	1	0.5				
Grouting	VO	5	5	Ground improvement	VO	2	3