The officially published GERMAN text alone is legallyp binding

Academic and Examination Regulations for the Master's Degree Program Environmental Engineering at the Technical University of Munich

From 27 January 2022

In accordance with Art. 13 (1) sentence 2 in conjunction with Art. 58 (1) sentence 1, Art. 61 (2) sentence 1 and Art. 43 (5) of the *Bayerisches Hochschulgesetz* (*BayHSchG*) [Bavarian Higher Education Act] the Technical University of Munich issues the following Regulations:

Table of Contents:

§ 34
Applicability, Academic Titles

(1) [1]The Examination and Academic Regulations for the Master's Degree Program Environmental Engineering (FPSO) complement the General Academic and Examination Regulations for Bachelor's and Master's Programs at the Technical University of Munich (APSO) dated 18 March 2011 as amended. [2]The APSO has precedence.

(2) [1]Upon successful completion of the Master's examination the degree "Master of Science" ("M.Sc.") is awarded. [2]The academic title may also be used with the name of the university "(TUM)".

§ 35
Commencement of Studies, Standard Duration of Study, ECTS

(1) Admission to the Master's Degree Program Environmental Engineering at the Technical University of Munich is possible both in the winter semester and the summer semester.

(2) [1]The number of classes in required and elective subjects needed to obtain the master's degree is 90 credits (60 weekly hours per semester) spread over three semesters. [2]Students will have a maximum of six months to complete their master's thesis in accordance with § 46. [3]The number of examinations in required and elective subjects to be taken in the Master's Degree Program Environmental Engineering according to Appendix 1 is a minimum of 120 credits. [4]The standard duration of study for the master's program will be a total of four semesters.

§ 36
Eligibility Requirements

(1) Eligibility for the Master's Degree Program Environmental Engineering is demonstrated by

1. a qualified bachelor's degree obtained after a program of at least six semesters from a domestic or foreign institution of higher education, or at least an equivalent degree in environmental engineering or a comparable degree program,

2. adequate knowledge of the English language; students whose language of instruction is not English must demonstrate proficiency through an acknowledged language test such as "Test of English as a Foreign Language" (TOEFL) (with at least 88 points), "International English Language Testing System" (IELTS) (with at least 6.5 points) or "Cambridge Main Suite of English Examinations"; alternatively, adequate language skills may be proven by a language qualification specialized in environmental engineering at C1 level of the Common European Framework amounting to at least 3 credits. If, in the undergraduate program, 30 credits were obtained for examinations administered in English language examination modules, adequate proficiency in English is deemed proven.

3. passing of the Aptitude Assessment according to Appendix 2.

(2) A degree is considered a qualified degree within the meaning of § 36(1)1 if there are no significant differences regarding the competencies obtained (learning outcome) in the named TUM bachelor's degree programs.

(3) [1]For determining a qualified degree in accordance with § 36(2), the required modules and the elective modules from the profiles of the TUM Bachelor's Degree Program Environmental Engineering will be considered. [2]If students do not meet all credit requirements, the Selection Committee can, in accordance with Appendix 2, require students to complete additional fundamentals exams in accordance with § 36(1) to verify their qualification as stipulated in

Appendix 2 No. 5.1.3. [3]Candidates must be informed thereof after review of the documentation during the first stage of Aptitude Assessment.

§ 37
Modular Structure, Module Examination, Courses, Areas of Specialization, Language of Instruction

(1) [1]General provisions on modules and courses are set out in §§ 6 and 8 of the APSO. [2]For any changes to the stipulated module provisions § 12(8) of the APSO applies.

(2) The curriculum with the modules in the required and elective studies is provided in Appendix 1.

(3) [1]The following fields of study can be selected for the Master's Degree Program Environmental Engineering:

1. Urban Water Engineering
2. Water Resources Management
3. Hydraulic Engineering
4. Hydrogeology, Groundwater, Pedology
5. Modelling and Measurement of Flow and Transport
6. Resource Efficiency in Urban Planning
7. Environmental Geotechnics
8. Environmental Hazards and Risk
9. Sustainable Urban Mobility Planning
10. Transportation Engineering and Control
11. Water Energy Food Nexus

[2]The students select two of the fields of study listed above at the beginning of the first semester of enrollment in current degree program (Fachsemester) and thus set out their own individual degree program profile. [3]Areas of specialization that have already been selected can be changed upon request and in consultation with the Student Advisory Office over the course of the first semester of enrollment in the current degree program (Fachsemester). [4]The Examination Board decides on changes to already selected areas of specialization on request from the second semester of enrollment in current degree program (Fachsemester).

(4) [1]Students should compile an individual semester curriculum amounting to 12 credits. [2]The corresponding modules are to be selected from other courses offered at TUM. [3]You should seek advice from a mentor assigned by the TUM department. [4]Any person from the School of Engineering and Design who is an authorized examiner in accordance with the University Examiners Act can be assigned as a mentor. [5]The individually selected modules have the status of an elective module.

(5) [1]Differing from (3), individual decisions are to be made for students, who participate in a contractually agreed 1:1 program or Double Degree program. [2]The individual decisions are made in cooperation with a mentor and the Student Advisory Office and need to be approved by the Examination Board.

(6) [1]As a rule, the language of instruction in the Master's Degree Program Environmental Engineering is English. [2]Students who have not verified their knowledge of German in the application process will be conditionally admitted with the stipulation that they complete at least one module by the end of the second semester of enrollment in the degree program, in which they acquire integrative knowledge of German. [3]The offer will be announced by the Examination Board accordingly. [4]Optional credits completed in extracurricular courses, e.g. German courses offered by the TUM Language Center, will also be recognized.

§ 37 a
Project Studies

(1) [1]Within the framework of the Master's Degree Program Environmental Engineering, a study project about a topic from the selected area of specialization or a selected topic area from the cross-cutting methods is required. [2]The project studies amount to 12 credits. [3]The topic of the project studies can be determined and supervised by the expert examiner from the School of Engineering and Design at the Technical University of Munich (thesis supervisor). [4]The topic can be determined at any time over the course of studies. [5]The assignment period once the topic is set is six months.

(2) The handout for project studies that is published by the Examination Board for Environmental Engineering regulates the details of the project studies.

(3) The project studies are successfully completed if they are evaluated with at least "sufficient" (4.0).

§ 38
Examination Deadlines, Academic Progress Checks, Failure to Meet Deadlines

(1) Examination deadlines, progress monitoring, and failure to meet deadlines are governed by § 10 of the APSO.

(2) [1]At least one of the module examinations from the required modules of areas of specialization listed in Appendix 1 or the Scientific Methods and Presentation Skills module from the cross-cutting methods must be successfully completed by the end of the second semester. [2]For any failure to meet the deadlines, § 10(5) of the APSO applies.

§ 39
Examination Board

In accordance with § 29 of the APSO, the board responsible for all decisions concerning examination matters is the Examination Board for Environmental Engineering of the TUM School of Engineering and Design,

§ 40
Recognition of Periods of Study, Coursework and Examination Results

(1) The recognition of periods of study, coursework and examination results is governed by § 16 of the APSO.

(2) Coursework and examination results that are achieved as part of this master's degree program in accordance with an individual curriculum for a double degree in accordance with § 37(5) or a contractually arranged 1:1 program are recognized without equivalence assessment.

§ 41
Continuous Assessment Procedure, Types of Assessment

(1) [1]In addition to written and oral examinations, types of assessment in accordance with § 12 and § 13 of the APSO may include (but are not limited to) laboratory assignments, exercises (tests, where applicable), reports, project work, presentations, learning portfolios, research papers, or parcours examinations. [2]Details of each module examination and the related competencies to be examined are set out in the module descriptions. [3]Where the topic permits, the examination can

be held either as an individual or group examination; § 18(2) Sentences 2 and 3 of the APSO apply accordingly.

a) [1]A **written examination** is a supervised examination, in which students are expected to demonstrate, within a limited amount of time and using predefined methods and resources, their ability to identify problems, find solution strategies and, if required, implement them. [2]The duration of written examinations is regulated in § 12(7) of the APSO.

b) [1]Depending on the discipline, **laboratory assignments** may include experiments, measurements, field work, field exercises, etc., with the goal of students conducting such work, evaluating results, and gaining knowledge. [2]These may consist of, for example, process descriptions and the underlying theoretical principles including the relevant literature; preparation and practical implementation; calculations, if required; documentation, evaluation, and interpretation of the results in the context of the knowledge to be gained. [3]Laboratory assignments may be complemented by presentations designed to demonstrate a student's communication competency in presenting scholarly work to an audience.

c) [1]**Practical credit requirements (tests, where applicable)** involve students completing assigned tasks (for example, solving mathematical problems, writing computer programs, preparing models, preparing designs) using theoretical knowledge to solve application-oriented problems. [2]Exercises are designed to assess a student's factual and detailed knowledge and its application. [3]Practical exercises may be administered in writing, orally, or electronically. [4]They may be in the form of homework assignments, practice sheets, programming exercises, (e-)tests, design tasks, posters, tasks assigned within a university internship program, etc.

d) [1]A **report** is a written record and summary of a learning process for the purpose of presenting the acquired knowledge in a structured way and analyzing the results in the context of a module. [2]Students are expected to demonstrate that they have understood all essential aspects and are able to present them in writing. [3]Reports may include excursion reports, internship reports, work reports, etc. [4]The written report may be complemented by a presentation for the purpose of assessing the student's communication competency in presenting scholarly work to an audience.

e) [1]**Project work** is designed to reach, in several phases (initiation, problem definition, role assignment, idea generation, criteria development, decision, implementation, presentation, written evaluation), the defined objective of a project assignment within a given period of time and using suitable instruments. [2]In addition, project work may include a presentation, or a subject-specific discussion in order to assess a student's communication competency in presenting scholarly work to an audience. [3]It may also encompass design sketches, drawings, plans, models, objects, simulations or documentation.

f) [1]A **research paper** is a written assignment in which students work independently on solving complex scholarly or scholarly/application-oriented problems, using the scientific methods of the related discipline. [2]Students are expected to demonstrate that they are able to solve problems corresponding to the learning results of the module in question in compliance with the guidelines for scholarly work – from analysis and conception to implementation. [3]Research papers, differing in their requirement standards, may take the form of a conceptual framework/theory paper, abstract, term paper, seminar paper, etc. [4]The research paper may be complemented by a presentation and/or a colloquium for the purpose of assessing the student's communication competency in presenting scholarly work to an audience.

g) [1]A **presentation** is a systematic and structured oral performance supported by suitable audio-visual equipment (such as projector, slides, posters, videos) for the purpose of demonstrating and summarizing specific issues or results and paring complex problems down to their essential core. [2]For the presentation, the student is expected to demonstrate that he or she is capable of preparing a certain topic within a given time frame in such a way as to present or report it in a clear and comprehensible manner to an audience. [3]In addition, the student is expected to demonstrate that he or she is able to respond competently to any questions, suggestions, or discussions brought by the audience and relating to his or her subject area. [4]The presentation may be complemented by a brief written precis.

h) [1]An **oral examination** is a timed, graded discussion on relevant topics and specific questions to be answered. [2]In oral examinations students are expected to demonstrate that they have understood the central concepts of the subject matters covered by the exam, and are able to apply them to specific problems. [3]The duration of the examination is regulated in § 13(2) of the APSO.

i) [1]A **learning portfolio** is a collection of completed work compiled by the student according to predefined criteria that exhibits the student's progress and achievements in defined content areas at a given time. [2]Students are required to explain why they chose the work they have and its relevance for their learning progress and the achievement of the defined learning outcomes. [3]With the learning portfolio, students are expected to demonstrate that they have taken active responsibility for their learning process. [4]Depending on the module description, types of independent study assessment in a learning portfolio may include, in particular, application-oriented assignments, web pages, weblogs, bibliographies, analyses, conceptual framework/theory papers, as well as the graphic representation of facts or problems. [5]A subject-specific final discussion for the purpose of reflection and based on the content of the learning portfolio may also take place.

j) [1]The **parcours examination** is made up of several components. [2]Unlike a module examination component, parcours exam components are administered in sequence and completed in a specific time frame and location. [3]Parcours components entail various types of examination, which together evaluate the competency profile of the module as a whole. [4]Possible types of examination in parcours components may include those listed in g) and h) in combination with a practical requirement. [5]The total duration of the parcours examination with all its components is indicated in the module catalog.

(2) [1]As a rule, module examinations are taken concurrently with the program. [2]The type and duration of module examinations is stipulated in Appendix 1. [3]For any changes to the stipulated module provisions § 12(8) of the APSO applies. [4]The assessment of the module examination is governed by § 17 of the APSO. [5]The grade weights of module examination components correspond to the weighting factors assigned to them in Appendix 1.

(3) Where Appendix 1 provides that a module examination is either in written or oral form, the examiner will inform the students officially and in appropriate form, no later than the first day of classes, of the type of examination to be held.

(4) At the request of the students and with the consent of the examiners, examinations in English may be taken for modules in German.

§ 42
Admission to and Registration for the Master's Examination

(1) [1]Students who are enrolled in the Master's Degree Program Environmental Engineering are deemed admitted to the module examinations of the master's examination. [2]Students who take additional examinations as part of the consecutive Bachelor's Degree Program Environmental Engineering at the Technical University of Munich are also deemed admitted to the individual module examinations.

(2) [1]Registration requirements for required and elective module examinations are stipulated in § 15(1) of the APSO. [2]The registration requirements for repeat examinations for failed required modules are stipulated in § 15(2) of the APSO.

§ 43
Scope of the Master's Examination

(1) The master's examination consists of:

1. the module examinations in the corresponding modules according to § 43(2)
2. the project studies according to § 37a
3. the Master's Thesis module according to § 46

(2) [1]The module examinations are listed in Appendix 1. [2]30 credits are required in the required modules (12 credits from each of the selected areas of specialization and 6 credits in the cross-cutting methods), at least 48 credits in the elective modules. [3]The elective modules are made up as follows:

- at least 12 credits in each of the two selected areas of specialization (in total at least 24 credits)
- at least 12 credits from the elective modules of the "cross-cutting methods"
- a maximum of 12 credits from other modules offered by TUM in accordance with § 37(4).

[4]The selection of modules must comply with § 8(2) of the APSO.

§ 44
Repeat Examinations, Failed Examinations

(1) The repetition of examinations is governed by § 24 of the APSO.

(2) Failure of examinations is governed by § 23 of the APSO.

§ 45
Coursework (Pass/Fail Credit Requirements)

In the Master's Degree Program Environmental Engineering, no modules are completed as pass/fail credits.

§ 45 a
Multiple Choice Test

The conduct of multiple choice tests is governed by § 12a of the APSO.

§ 46
Master's Thesis

(1) As part of the master's examination in the Master's Thesis module, each student must write a thesis in accordance with § 18 of the APSO.

(2) [1]As a rule, the completion of the master's thesis module should form the last examination component. [2]Students can request early admission to the master's thesis module if the aim of the thesis within the meaning of § 18(2) APSO can be achieved taking the previous course of study into consideration.

(3) [1]The period between topic assignment and submission of the completed thesis must not exceed six months. [2]The thesis is considered presented and not passed if the student fails to submit it on time without valid reasons as specified in § 10(7) of the APSO. [3]The thesis should be written in English.

(4) [1]The completion of the master's thesis module consists of a written composition and a presentation on its content. [2]The presentation does not affect the grading. [3]30 credits are awarded for the Master's Thesis module.

(5) [1]If the Master's Thesis module was not graded with at least "sufficient" (4.0), it may be repeated once with a new topic. [2]Students must renew their application to prepare the Master's Thesis module within six weeks of receipt of the grade.

§ 47
Passing and Assessment of the Master's Examination

(1) The master's examination is deemed passed when all examinations required for the master's examination according to § 43(1) have been passed and a plus credits account of at least 120 credits has been achieved.

(2) [1]The grade for a module will be calculated according to § 17 of the APSO. [2]The overall grade for the master's examination will be calculated as the weighted grade average of the modules according to § 43(2), the project studies according to § 37 a and the Master's Thesis module. [3]The grade weights of the individual modules correspond to the credits assigned to each module. [4]The overall assessment is expressed by the designation according to § 17 of the APSO.

§ 48
Degree Certificate, Diploma, Diploma Supplement

If the master's examination was passed, a degree certificate, a diploma, and a diploma supplement including a transcript of records are to be issued in compliance with § 25(1) and § 26 of the APSO.

§ 49
Double Degree

[1]The Technical University of Munich and the universities École Nationale des Ponts et Chausées (ENPC), École Politechnique (EP), Kungliga Tekniska Högskolan (KTH) and Universidad Politécnic de Madrid (UPM) (partner universities) offer Double Degree programs on the basis of collaboration agreements. [2]The following special regulations apply for students participating in one of these programs:

(1) [1]The Double Degree program is regulated by a special arrangement (Collaboration Agreement) between the universities. [2]The students can obtain information on the Collaboration Agreement from the relevant Student Advisory Office and the International Affairs Delegate at the TUM department.

(2) [1]The participants are selected in two stages. [2]Firstly, potential participants are selected on the basis of school, success academic success, knowledge of the English language and interests. [3]The final selection is made on the basis of interviews with representatives from both universities.

(3) Within the framework of the Double Degree program, achievements amounting to at least 120 credits are required from the respective partner university and at least 60 credits from the Technical University of Munich.

(4) Differing from § 46(1) Sentence 2, the master's thesis can be written at the Technical University of Munich or at the respective partner university under the joint supervision of an examiner from the Technical University of Munich and from the respective partner university.

(5) Students who successfully complete the Master's Degree Program Environmental Engineering at the Technical University of Munich additionally receive the degree specified in the Double Degree agreement from the partner university.

§ 50
Entry into Force

(1) [1]These regulations will enter into force on 1 October 2022. [2]They apply to all students who commence their studies at the Technical University of Munich as of the winter semester 2022/23.

(2) [1]At the same time, the Academic and Examination Regulations for the Master's Degree Program Environmental Engineering at the Technical University of Munich from 10 June 2016, recently amended with the statute from 27 January 2022, ceases to be effective. [2]Students who commenced their studies at the Technical University of Munich prior to the winter semester 2022/23 are to complete their studies in accordance with the regulations named in § 49(2) Sentence 1.

APPENDIX 1: Examination Modules

Required Modules
12 credits are required from each of the two selected areas of specialization and 6 credits from required modules as set out in the list below.

Elective Modules
At least 48 credits from elective modules are required from the elective module catalog for the Master's Degree Program Environmental Engineering. They are made up as follows:

- At least 12 credits from each selected area of specialization (field of study), i.e. at least 24 credits in total from both areas of specialization.
- At least 12 credits from cross-cutting methods.

The Examination Board regularly updates the elective modules catalog and publishes the binding catalog on TUMonline no later than at the beginning of the semester.
In addition, elective modules amounting a maximum of 12 credits are to be selected from the whole module course catalog for TUM.

No.	Module name	Type of instruction SWS	Sem.	Credits	Type of examination	Duration of examination	Language(s) of instruction

Area of Specialization 1 – Urban Water Engineering

Required Modules

BGU38014	Water and Wastewater Treatment Engineering	4 VI	WS	6	Written exam	120'	English
BGU38024	Advanced Water Treatment and Anaerobic Processes	2 VO + 2 VO	SoSe	6	Written exam	120'	English

Examples of elective modules
In the elective studies for area of specialization 1, at least 12 credits are required from the following (example and non-conclusive) list of elective modules:

BGU38036	Fundamentals of Hydrochemistry	2 VO + 2 VO	WS	6	Written exam	120'	English
BGU38034	Design and Operation of Conventional and Natural Water and Wastewater Treatment Systems	2 SE + 2 SE	WS	6	Written exam	120'	English
BGU38035	Advanced Water Treatment - Unit operations laboratory	4 PR	SoSe	6	Laboratory assignment	-	English
BV180051	Hydrochemistry Lab	4 Ü	Every semester	6	Laboratory assignment	-	English

Further elective modules from area of specialization 1 can be found on TUMonline. The Examination Board regularly updates the elective modules catalog and publishes the binding catalog on TUMonline no later than at the beginning of the semester.

Area of specialization 2 – Water Resources Management

Required Modules

BGU54009	Flood Risk and Flood Management	4 VI	SoSe	6	Written exam	120'	English
BGU54011	Integrated Water Resources Management	4 VI	WS	6	Written exam	120'	English

Examples of elective modules

In the elective studies for area of specialization 2, at least 12 credits are required from the following (example and non-conclusive) list of elective modules:

BGU54021	Remote Sensing in Hydrology	4 VO	SoSe	6	Written exam	120’	English
BV460012	Rivers as an Ecosystem	4 VO	SoSe	6	Written exam	90’	English
BGU66041	Contaminant Transport and Remediation	2 VO + 2 VO	SoSe	6	Written exam	120'	English
NN	Urban Flood Modelling and Resilience	4 VI	WS	6	Project work	-	English

Further elective modules from area of specialization 2 can be found on TUMonline. The Examination Board regularly updates the elective modules catalog and publishes the binding catalog on TUMonline no later than at the beginning of the semester.

Area of Specialization 3 – Hydraulic Engineering

Required Modules

BGU46036	Water Resources and Hydropower	2 VO + 2 VO	WS	6	Written exam	120’	English
BGU46035	Hydraulic Engineering and Hydromorphology	2 VO + 2 VO	WS	6	Written exam	120‘	English

Examples of elective modules

In the elective studies for area of specialization 3, at least 12 credits are required from the following (example and non-conclusive) list of elective modules:

BGU46027	Rapidly Varying Flows in Hydraulic Engineering	4 VO	WS	6	Project work	-	English
BGU46026	Alpine Hazards	2 VO + 2 VO	WS	6	Written exam	120’	English
BGU46040	Ocean and Wind Energy	4 VO	SoSe	6	Written exam	90’	English
BV460012	Rivers as an Ecosystem	4 VO	SoSe	6	Written exam	120‘	English

Further elective modules from area of specialization 3 can be found on TUMonline. The Examination Board regularly updates the elective modules catalog and publishes the binding catalog on TUMonline no later than at the beginning of the semester.

Area of Specialization 4 – Hydrogeology, Groundwater and Geothermal Energy

Required Modules

BGU66023D2	The Saturated and the Unsaturated Zone: Process Understanding and Modelling	2 VO + 2 Ü	WS+SoSe	6	Project work	-	English
BGU66022	Groundwater Hydraulics	2 VO + 2 VI	WS	6	Written exam	90‘	English

Examples of elective modules

In the elective studies for area of specialization 4, at least 12 credits are required from the following (example and non-conclusive) list of elective modules:

BGU66042	Technical Aspects of Deep Geothermal Energy	2 VI + 2 VI	WS	6	Written exam	-	English
BGU66041	Contaminant Transport and Remediation	2 VO + 2 VO	SoSe	6	Written exam	120’	English
BGU66040	Case Studies in Technical Hydrogeology	2 VI + 2 VO	SoSe	6	Project work	-	English

BGU66024D2	Advanced Groundwater Modelling for Environmental Engineers	2 VI + 3 VI	WS+SoSe	6	Project work	-	English

Further elective modules from area of specialization 4 can be found on TUMonline. The Examination Board regularly updates the elective modules catalog and publishes the binding catalog on TUMonline no later than at the beginning of the semester.

Area of Specialization 5 – Modelling and Measurement of Flow and Transport

Required Modules

BGU41020	Mechanics and Transport Mechanisms	4 Vo + 3 SE	WS	6	Written exam	90	English
BGU41022	Numerical Methods in Hydromechanics	2 VO + 2 Ü	SoSe	6	Practical credit requirement	-	English

Examples of elective modules

In the elective studies for area of specialization 5, at least 12 credits are required from the following (example and non-conclusive) list of elective modules:

BGU41019	Modeling and Simulation of Turbulent Flows	2 VI	SoSe	6	Written exam	60‘	English
BGU54016	Process Based Modelling of Mesoscale Pre-alpine Catchments	4 VO	WS	6	Project work	-	English
BGU66041	Contaminant Transport and Remediation	2 VO + 2 VO	SoSe	6	Written exam	120’	English
BGU54008T2	Hydrological and Environmental River Basin Modelling	2 VO + 2 Ü	WS	6	Written exam + coursework (practical credit requirement)	90‘	English

Further elective modules from area of specialization 5 can be found on TUMonline. The Examination Board regularly updates the elective modules catalog and publishes the binding catalog on TUMonline no later than at the beginning of the semester.

Area of specialization 6 – Resource Efficiency in Urban Planning

Required Modules

BGU36010	Energy-Building-City	3VO+1Ü	WS	6	Written exam	120’	English
BGU62041	Sustainable Architecture, Urban and Landscape Planning – for Environmental Engineering	2 VO + 2 SE	WS	6	Research paper	-	English

Examples of elective modules

In the elective studies for area of specialization 6, at least 12 credits are required from the following (example and non-conclusive) list of elective modules:

BGU62059	Application of an Life Cycle Assessment for Civil Engineering	4 SE	WS	6	Research paper	-	English
BGU62062	TUM.Stadt	2 VO + 2 SE	SoSe	6	Written exam	90’	English
BGU62051	Sufficiency in Architecture and Engineering	4 SE	WS	6	Research paper	-	English
BV620003	Interaction between Sustainability and Building Culture	2 VO + 2 SE	WS	6	Research paper	-	English

Further elective modules from area of specialization 6 can be found on TUMonline. The Examination Board regularly updates the elective modules catalog and publishes the binding catalog on TUMonline no later than at the beginning of the semester.

Area of Specialization 7 – Environmental Geotechnics

Required Modules

BGU50008	Geotechnical Issues in Environmental Engineering	4 VO	WS	6	Written exam	90’	English
BGU50007	Ground Water Handling and Sustainable Use of Geomaterials in Civil Construction	4 VO	SoSe	6	Written exam	90‘	English

Examples of elective modules

In the elective studies for area of specialization 7, at least 12 credits are required from the following (example and non-conclusive) list of elective modules:

BGU66024D2	Advanced Groundwater Modelling for Environmental Engineers	2 VI + 3 VI	WS+SoSe	6	Project work	-	English
BGU67001	Landslides	2 VO + 1 VO + 1 VO	SoSe	6	Written exam	60’	English
BGU50018	Soil Dynamics and Geotechnical Earthquake Engineering with Project Work	2 VO + 2 KO	SoSe	6	Project work	-	English
BGU50019	Earthworks and Building with Geosynthetics	4 VO	WS	6	Written exam	90‘	English

Further elective modules from area of specialization 7 can be found on TUMonline. The Examination Board regularly updates the elective modules catalog and publishes the binding catalog on TUMonline no later than at the beginning of the semester.

Area of Specialization 8 – Environmental Hazards and Risk

Required Modules

BGU46026	Alpine Hazards	2 VO + 2 VO	WS	6	Written exam	120’	English
BGU60020	Risk Analysis	4 VI	WS	6	Written exam	90‘	English

Examples of elective modules

In the elective studies for area of specialization 8, at least 12 credits are required from the following (example and non-conclusive) list of elective modules:

BGU54009	Flood Risk and Flood Management	4 VI	SoSe	6	Written exam	120‘	English
BGU54016	Process Based Modelling of Mesoscale Pre-alpine Catchments	4 VO	WS	6	Project work	-	English
BGU60016	Risk and Reliability Assessment	3 VO + 2 VO	SoSe	6	Written exam	120’	English
BGU67001	Landslides	2 VO + 1 VO + 1 VO	SoSe	6	Written exam	60‘	English

Further elective modules from area of specialization 8 can be found on TUMonline. The Examination Board regularly updates the elective modules catalog and publishes the binding catalog on TUMonline no later than at the beginning of the semester.

Area of Specialization 9 – Sustainable Urban Mobility Planning

Required Modules

BV580008	Modelling of Environmental Effects in Transportation	2 VO + 3 VO	WS+SoSe	6	Research paper	-	English
BV520007	Land Use and Transport - Interactions and Strategies	2 VO + 3 SE	WS+SoSe	6	Written exam + research paper	60‘	English

Examples of elective modules

In the elective studies for area of specialization 9, at least 12 credits are required from the following (example and non-conclusive) list of elective modules:

BV400009	Land Management and Land Policy	2 VO + 3 SE	WS	6	Project work	-	English
BGU70004	Discrete Choice Methods for Transportation Systems Analysis	4 VI	WS	6	Practical credit requirement	-	English
BV520008	Land Use and Transportation Modelling	2 VO + 3 VO	WS+SoSe	6	Written exam	120’	English
BGU70005	Transportation Economics	4 VI	WS	6	Project work	-	English

Further elective modules from area of specialization 9 can be found on TUMonline. The Examination Board regularly updates the elective modules catalog and publishes the binding catalog on TUMonline no later than at the beginning of the semester.

Area of Specialization 10 – Transportation Engineering and Control

Required Modules

BV560023	Intelligent Transport Systems	2VI + 2 VI	SoSe	6	Written exam	120’	English
BV560024	Traffic Management	2VI + 2 VI	WS	6	Written exam	120‘	English

Examples of elective modules

In the elective studies for area of specialization 9, at least 12 credits are required from the following (example and non-conclusive) list of elective modules:

BGU70008	Urban Transportation Systems: Operations Research and Emerging Mobility Technologies	2VI + 2VI	SoSe	6	Written exam	120‘	English
BGU68006	Road Safety	3VO + 3VO	SoSe	6	Project work	-	English
BGU70006	Statistical Learning and Data Analytics for Transportation Systems	4 VI	SoSe	6	Practical credit requirement	-	English
BV520009	Project Appraisal and Planning Processes in Transportation	2 VO + 2 VO + 1 Ü	SoSe	6	Written exam	120‘	English

Further elective modules from area of specialization 10 can be found on TUMonline. The Examination Board regularly updates the elective modules catalog and publishes the binding catalog on TUMonline no later than at the beginning of the semester.

Area of Specialization 11 – Water Energy Food Nexus

Required Modules

BGU46038	Integrated Land-Water Management	4 VI	WS	6	Written exam	90’	English
BGU38038	Planning the Water Energy Food Nexus	4 VI	SoSe	6	Project work	-	English

Examples of elective modules

In the elective studies for area of specialization 10, at least 12 credits are required from the following (example and non-conclusive) list of elective modules:

BGU54011	Integrated Water Resources Management	4 VI	WS	6	Written exam	120‘	English
EI7467	Interdisciplinary Project Internship Concept Development of a Renewable Energy System in a Developing Country	4 FO	WS	6	Project work		English
BGU46039	Ethics in Science and Technology	2 VO + 2 VO	WS + SoSe	6	Research paper	-	English
BGU46036	Water Resources and Hydropower	2 VO + 2 VO	WS	6	Written exam	120‘	English
BGU36010	Energy-Building-City	3V+1Ü	WS		Written exam	120‘	English

Further elective modules from area of specialization 11 can be found on TUMonline. The Examination Board regularly updates the elective modules catalog and publishes the binding catalog on TUMonline no later than at the beginning of the semester.

Cross-cutting methods

Required Modules

NN	Research work and presentation techniques	4 SE	Every semester	6	Research paper	-	English

Examples of elective modules

In the elective studies for cross-cutting methods, at least 12 credits are required from the following (example and non-conclusive) list of elective modules:

BGU62059	Application of a Life Cycle Assessment for Civil Engineering	4 SE	SoSe	6	Research paper	-	English
BV480016	Introduction to Photogrammetry, Remote Sensing and Image Processing	2 VO + 2 VO + 1 Ü	WS	6	Written exam	120’	English
EI74831	Project Lab Renewable and Sustainable Energy Systems	4 FO	Every semester	6	Project work	-	English
BV030004	Software Lab	2 PR + 2 PR	WS + SoSe	6	Project work	-	English

Further elective modules from cross-cutting methods can be found on TUMonline. The Examination Board regularly updates the elective modules catalog and publishes the binding catalog on TUMonline no later than at the beginning of the semester.

	Project Studies	-	WS or SoSe	12	Project work		

	Master’s Thesis	-	WS or SoSe	30	Research paper		

Explanation:

Sem. = semester; SWS = weekly hours per semester; VO = lecture; Ü = exercise module; VI = lecture with exercise; PR = internship, SE = seminar; FO = research practical course

In the column “Duration of examination”, the duration of written and oral examinations is specified in minutes.

APPENDIX 2: Aptitude Assessment

Aptitude assessment for the Master's Degree Program Environmental Engineering at the Technical University of Munich

1. Purpose of the Process

[1]Eligibility for the Master's Degree Program Environmental Engineering, in addition to the requirements according to § 36(1)1 and 2, requires proof of aptitude as set out in § 36(1)3 in accordance with the following provisions. [2]The special qualifications and skills of the candidates should correspond to the field of environmental engineering. [3]Individual aptitude parameters are:

1.1 ability to conduct scholarly and/or basic and methodologically sound research;

1.2 specialist knowledge in the field of environmental engineering from a bachelor's degree program or from a comparable degree program to the Bachelor's Degree Program Environmental Engineering at the Technical University of Munich,

1.3 technical terminology competences in spoken and written form,

1.4 scientific interest in engineering and environmental engineering problems.

2. Aptitude Assessment Process

2.1 The Aptitude Assessment takes place semi annually.

2.2 [1]Applications for the aptitude assessment process for the winter semester must be submitted to the Technical University of Munich together with the documents listed in 2.3.1. through 2.3.4. and in § 36(1)2 no later than 31 May and for the summer semester no later than 15 January (absolute deadlines) using the online application procedure. [2]Official copies of the student's diploma and graduation certificate, serving as proof of the conferral of the bachelor's degree, must be submitted to the TUM Center for Study and Teaching – Admissions and Enrollment Office no later than five weeks after the first day of classes. [3]Admission to the master's program is, otherwise, not possible in accordance with § 36 of these regulations.

2.3 The application must include:

2.3.1 A transcript of records with modules amounting to at least 140 credits; the transcript of records must be issued by the relevant examination authority or the relevant academic programs office and include a list of module titles, grades and accompanying credits,

2.3.2 curriculum vitae formatted as a table

2.3.3 an English- or German-language written statement (max. 1-2 A4 pages) giving the reasons for choosing the Master's Degree Program Environmental Engineering at the Technical University of Munich, in which the candidate explains their exceptional motivation that makes him/her particularly qualified for the program; a candidate's exceptional motivation and commitment is to be demonstrated, for example, by providing details on program-related vocational training, internships, stays abroad, or program-related further education beyond the attendance and course requirements of the bachelor's program, if necessary by appropriate documentation,

2.3.4 a declaration that the written statement is the applicant's own work and that the applicant has clearly identified any ideas taken from outside sources.

3. Aptitude Assessment Commission, Selection Committees

3.1 [1]Aptitude Assessment is administered by the Aptitude Assessment Commission and the Selection Committees. [2]The Commission is responsible for preparing the aptitude assessment process,

organizing it and ensuring a structured and standardized process for determining aptitude within the framework of these Regulations; it bears responsibility, insofar as no other body is specified by these Regulations or through delegation of its authority to another body. [3]Selection Committees are to conduct the assessment process in accordance with No. 5 below, subject to No. 3.2 Sentence 11.

3.2 [1]The Commission consists of five members. [2]Members of the Commission are appointed by the Dean, in consultation with the Vice Dean of Academic and Student Affairs, from among the authorized examiners of the School of Engineering and Design, who are members of the degree program faculty. [3]At least three Commission members must be university educators within the meaning of the Bavarian Act on Higher Education Staff (BayHSchPG). [4]The Departmental Student Council has the right to name a student representative to serve on the Commission in an advisory capacity. [5]A deputy is to be appointed for each member of the Commission. [6]The Commission elects a chairperson and a deputy chairperson from among its members. [7]Procedures are governed by § 30 of the TUM Charter as last amended. [8]The term in office of Commission members is 4 years. [9]Extensions of the term of office and reappointments are possible. [10]Urgent decisions that cannot be postponed can be made by the chairperson on behalf of the Commission; He/She must inform the Commission of such decisions without delay. [11]The Academic Programs Office supports the Commission and the Selection Committee; the Commission may delegate to the Office the task of assessing formal admissions requirements in accordance with No. 4, as well as the determination of points to be awarded based on defined criteria for which there is no freedom of discretion involved. This includes, in particular, the conversion of grades and the calculation of the overall points earned by the applicant. The Office may also be involved in choosing the members of the Selection Committee from among the commissioners and assigning them to applicants.

3.3 [1]Each Selection Committee consists of two members of the School of Engineering and Design, who are authorized to conduct examinations in the degree program according to Art. 62(1) Sentence 1 of the Bavarian Higher Education Act [BayHSchG] in conjunction with the act governing examiners at institutions of higher education [Hochschulprüferverordnung]. [2]At least one member must be a university educator within the meaning of the Bavarian Act on Higher Education Staff (BayHSchPG). [3]It is permissible to serve concurrently on both the Aptitude Assessment Commission and the Selection Committee. [4]Members of the Committee are appointed by the Commission for a term of 1 year; No. 3.2 Sentence 9 applies accordingly. [5]Different Selection Committees may be assigned to individual criteria and stages of the assessment process.

4. Admission to the Aptitude Assessment Process

4.1 Admission to the aptitude assessment process requires that all documentation specified in No. 2.2 has been submitted in a timely and complete fashion.

4.2 [1] Applicants who have fulfilled the requirements according to No. 4.1 will be assessed according to No. 5. [2]Applicants not suited the program will receive a letter of rejection stating the grounds for rejection and informing them of legal remedies.

5. Stages of the Aptitude Assessment Process

5.1 First stage of aptitude assessment

5.1.1 [1]It will be assessed, on the basis of the written application documents required under no. 2.3, whether or not an applicant is suitable for a program pursuant to no. 1 (First stage of the aptitude assessment process). [2]The candidate's application documents will be evaluated on a scale ranging from 0 to 100 points, 0 being the worst and 100 the best possible result:

The following criteria will be applied:

a) Discipline-Specific Skills and Qualifications

[1]The curricular analysis is conducted on the basis of competencies, rather than a schematic comparison of modules. [2]The analysis is based on the fundamental subject groups listed in the following table of the Bachelor's Degree Program Environmental Engineering at the Technical University of Munich.

Academic Subject Area	Credits TUM	Max. points	Total max. points
Higher Mathematics for Engineering Degree Programs	15	15	60
Applied Mechanics	10	10	
Hydromechanics, Thermodynamics	10	10	
Chemistry	10	10	
Hydrology, Hydraulic Engineering, Water Management, Urban Water Management, Traffic Planning, Traffic Engineering	15	15	

[3]If it is established that there are no significant differences in the competencies acquired (learning outcomes), a maximum of 60 points will be awarded. [4]For any competencies missing from the student's undergraduate curriculum, points equivalent to the amount of module credits for the respective competencies in the TUM Bachelor's Program Environmental Engineering will be deducted from the overall score. [5]If this value is not a whole number, it will be rounded up.

b) **Grade**

[1]The applicant will be awarded one point for each tenth that the average calculated from examinations in the amount of 140 credits is better than 2.0. [2]The maximum number of points is 10. [3]Negative points will not be awarded. [4]Grades of international degrees will be converted by applying the Bavarian formula. [5]If the candidate has submitted a degree certificate containing more than 140 credits with the application, the assessment will be made on the basis of the best graded modules in the amount of 140 credits. [6]The applicant needs to submit a list of the results together with the application and confirm its accuracy in writing.

[7]If the candidate submits this list, the average is calculated from graded module examinations with the best grades amounting to 140 credits; if no list is submitted, the overall average of grades submitted by the candidate will be used to calculate the average.

[8]The overall grade average is calculated as a weighted grade average. [9]The grade weights of the individual modules correspond to the credits assigned to each module.

c) Letter of motivation

[1]The applicant's written statement will be evaluated and graded on a scale of 0 – 30 points.
[2]The content of the written statement will be assessed using the following criteria:

1. can describe the relationship between personal interests and content of the degree program in a well structured manner (maximum 15 points),
2. can convincingly justify the special aptitude through arguments and relevant extracurricular activities and commitment (see 2.3.3) (max. 10 points),
3. can verbally highlight significant points of the justification in an appropriate manner (max. 5 points).

[3]Committee members independently assess each of the criteria with equal weighting. [4]The points total will be calculated as the arithmetic means of the individual assessments, rounded up to the nearest full point.

5.1.2 [1]The points total in the first stage will be calculated as the sum of the individual evaluations. [2]Decimal places must be rounded up.

5.1.3 [1]Applicants with at least 70 points will be deemed suitable. [2]In those cases where it is determined that only some subject-specific requirements for the master's program are missing from undergraduate studies, the Commission may require that applicants complete fundamentals exams from the Bachelor's Degree Program Environmental Engineering amounting to a maximum of 30 credits. [3]These fundamentals exams must be successfully completed in the first year of study. [4]Failed fundamentals exams may be repeated only once and at the next examination date.

5.1.4 Applicants who have achieved less than 60 points fail the aptitude assessment.

5.2 Second stage of aptitude assessment

5.2.1 [1]The remaining applicants will be invited to an aptitude assessment interview. [2]Within the framework of the second stage of the aptitude assessment process, the qualification obtained during the bachelor's degree and the result of the aptitude assessment interview are evaluated, whereby the qualification obtained during the bachelor's degree program should be taken into consideration at least on an equal level. [3]Interview appointments will be announced at least one week in advance. [4]Time slots for interviews must be scheduled before expiration of the application deadline. [5]The interview appointment must be kept by the applicant. [6]Conducting the aptitude assessment interview via video conference is possible upon a student's well-founded request. [7]The applicant bears the risk in the event of any technical problems, unless these are attributable to the Technical University of Munich. [8]If the applicant is unable to attend an aptitude assessment interview due to reasons beyond his/her control, a later appointment may be scheduled upon a student's well-grounded request, but no later than two weeks before the beginning of classes.

5.2.2 [1]The aptitude assessment interview is to be held individually for each applicant. [2]The interview will be held in English and last at least 20 but not more than 30 minutes for each applicant. [3]The interview will focus on the following topics*:*

1. exceptional motivation and interest for the Master's Degree Program Environmental Engineering in accordance with the criteria for the assessment of the written statement listed under No. 2.3.3 (max. 20 points)
2. reflection on own talents and competencies in relation to the aims of the degree program – with regard to the specific areas of specialization that can be studied (max. 20 points)
3. fundamentals and application-related questions from the subject groups listed under No. 5.1.1 a) as well as any explanations of the thesis topic area in the bachelor's degree program for assessing the discipline-specific qualification (max. 20 points),
4. personal impression after the interview (max. 20 points). Applicants will be evaluated, for example, on their ability to convincingly demonstrate information using arguments and meaningful examples and appropriately respond to interview questions.

[4]The above topics may cover the documentation submitted according to 2.3. [5]Any subject-specific academic knowledge that is to be taught in the Master's Degree Program Environmental Engineering will not affect the decision. [6]With the applicant's approval, a representative of the student body may sit in on the interview.

5.2.3 [1]Each commission member independently assesses each of the four points with the four points being weighted equally. [3]Each member will assign points for the result of the aptitude assessment interview on a scale from 0 to 80, 0 being the worst and 80 being the best possible result. [4]The points total will be calculated as the arithmetic mean of the individual evaluations. [5]Non-vanishing decimal places must be rounded up.

5.2.4 [1]The total number of points awarded in Stage 2 is the sum of the total points from No. 5.2.3 and the points from No. 5.1.1.a) (subject-specific qualification) and 5.1.1.b) (grade). [2]Applicants with 105 or more points will be deemed suitable. [3]Applicants with an overall score of less than 105 points have failed the aptitude assessment.

5.3 Determination and Notification of Results

[1]Applicants will be informed of the results of the aptitude assessment through official notification. [2]Applicants not suited for the program will receive a letter of rejection stating the grounds for rejection and informing them of legal remedies.

5.4 Candidate's suitability for the program, once determined in aptitude assessment, applies to all subsequent applications for this program.

6. Documentation

[1]The aptitude assessment process must be documented, in particular the names of the participating members of the Selection Committee, the evaluation of the first and second stages, as well as the overall results. [2]The aptitude assessment interview must be documented, including the date, duration and location of the assessment, the names of the participating Selection Committee members, the applicant's name, and a list of main topics of discussion in bullet points.

7. Repeat Aptitude Assessments

Applicants who have failed an aptitude assessment may apply once to repeat the process.

Executed following a resolution of the Senate of the Technical University of Munich dated 13 October 2021 and approval of the President of the Technical University of Munich on 27 January 2022.

Munich, 27 January 2022

Technical University of Munich

Thomas F. Hofmann

President

These Regulations were made available for inspection at the Technical University of Munich on 27 January 2022, following their announcement on 27 January 2022. Day of proclamation shall therefore be 27 January 2022.