**DISCLAIMER**: Please note that the English translation is provided for information purposes only. The English text is not legally binding. Only the original German document has legal validity. The official language at TU Dresden is German. German jurisdiction applies.

TUD Dresden University of Technology Faculty of Civil Engineering

# Study Regulations for the consecutive Master's degree program Water Security and Global Change

From 25<sup>th</sup> April 2024

On the basis of § 37 para. 1 of the Saxon Higher Education Act (SächsHSG) in the version published on May 31, 2023 (SächsGVBI. p. 329), TUD Dresden University of Technology issues the following Study Regulations as statutes.

# **Table of contents**

- § 1 Scope of application
- § 2 <u>Objectives of the degree program</u>
- § 3 Admission requirements
- § 4 <u>Start and duration of the degree program</u>
- § 5 <u>Teaching and learning methods</u>
- § 6 <u>Structure and organization of the degree program</u>
- § 7 <u>Content of the degree program</u>
- § 8 <u>Credit points</u>
- § 9 Academic advisory and counseling service
- § 10 <u>Amendments to module descriptions</u>
- § 11 Entry into force and publication
- Annex 1: <u>Module descriptions</u>
- Annex 2: <u>Study schedule</u>

#### § 1 Scope of application

On the basis of the Saxon Higher Education Act (SächsHSG) and the Examination Regulations, these Study Regulations stipulate the objectives, content, structure and organization of the consecutive Master's program in Water Security and Global Change at TUD Dresden University of Technology.

### § 2 Objectives of the degree program

(1) Upon completion of the degree program, students will have an in-depth understanding of the complex interactions between water resources, global and regional environmental changes and human societies. They will be able to deal with modelling and data analysis in connection with the topics of water management and apply advanced technologies. Students will also be able to adequately deal with research topics in the field of water resource management. Through a multi-disciplinary approach, students will be able to manage current water safety challenges, and assess and evaluate their consequences. Students will be supported in developing a sense of responsibility and in their personal growth. They will also be able to critically self-reflect and engage with society. Moreover, students will be able to reflect on topics relevant to a pluralistic and open society and put them into context.

(2) Graduates will have a broad professional knowledge and command of current concepts and scientific methods, enabling them, after an appropriate training period in professional practice, to deal with diverse and complex tasks in the field of water resource management, water policy development and research, for example, in water management and nature conservation organizations, government agencies, non-profit organizations, private consulting companies, scientific research institutions and freelance activities both in Germany and abroad. They will also be able to work effectively with interdisciplinary and international teams. As Future Environmental Leaders, graduates will also be capable of playing a central role in shaping sustainable water policy, implementing innovative solutions and promoting resilience in the face of a changing climate and growing water-related problems, and contributing to a more secure and equitable future with regard to water.

### § 3 Admission requirements

(1) To be admitted to the degree program, candidates must have completed a first recognized vocational university degree acquired in Germany or a qualification from an officially recognized vocational academy in engineering, or environmental studies or a comparable specialist field.

(2) Knowledge of English at the B2 level of the Common European Framework of Reference for Language is a prerequisite. Proof thereof is a relevant examination certificate or language certificate. In particular, this can be a certificate of a university degree completed entirely in English or a language certificate such as TOEFL (at least 79) or IELTS (at least 6.0).

## § 4 Start and duration of the degree program

(1) The program can be started each winter semester.

(2) The standard period of study is four semesters and includes on-site attendance, independent study and the final examination.

## § 5 Teaching and learning methods

(1) The curriculum is structured in modules. In the individual modules, the course content is taught, consolidated and deepened through lectures, practicals, seminars, laboratory training, tutorials, organized excursions courses and independent study.

(2) The individual teaching and learning forms according to para. 1 sentence 2 are defined as follows:

1. Lectures introduce the subject matter of the modules.

- 2. Practicals allow to apply the subject matter in exemplary sub-areas.
- 3. Seminars enable students to familiarize themselves under supervision in a selected subject area on the basis of specialist literature, documentation, and other material, to report on the results of their work, to discuss them within the group and to present them in writing.
- 4. Laboratory training serves to apply the subject matter taught and to acquire practical skills in potential areas of employment.
- 5. Tutorials support students in repeating and deepening the course contents.
- 6. Excursions visualize the theoretical content of the course and enable students to put the knowledge they have acquired into practice and get to know potential fields of employment.
- 7. Independent study enables students to independently acquire both fundamental and in-depth subject knowledge using various media, such as teaching resources, literature, Internet, in individual work or small groups.

#### § 6 Structure and organization of the degree program

(1) The program is organized in modules. The curriculum is divided into three semesters. The fourth semester is dedicated to the preparation of the final thesis including the colloquium. Study achievements and examined assessments amounting to 30 credit points each must be completed over three semesters as part of the cooperation with the RWTH Aachen University and the Indian Institute of Technology Madras in accordance with the cooperation agreement.

(2) The degree program comprises four compulsory modules and two elective compulsory modules, which allows students to choose their concentration. They can choose from the topics of international water problems, climate systems and models and tropical forest management. The selection is binding. Modules can be re-selected; the student must submit a written request to the Examination Office stating the module to be replaced and the newly selected module.

(3) Learning goals, content, teaching and learning methods included, requirements, applicability, frequency, workload, and duration of the individual modules are all listed in the module descriptions (Annex 1).

(4) The courses are held in English and are hybrid, i.e. the respective course is held simultaneously and equally as an on-site and online class.

(5) The appropriate allocation of the modules to the individual semesters, the observance of which makes it possible to complete the program within the standard period of study, as well as the type and scope of the respective courses included, and the number and standard time of the required study achievements and examined assessments are defined in the study schedule attached (Annex 2).

(6) Upon proposal of the Academic Affairs Committee, the Faculty Board may change the range of elective compulsory modules as well as the study schedule. The current selection of elective compulsory modules will be announced in the usual manner at the beginning of the semester. The amended study schedule shall apply to all students who have been informed about this in the usual manner at the beginning of their studies. The Examination Committee shall decide, upon application by the student, on any exceptions to sentence 3.

### § 7 Content of the degree program

(1) The Master's degree course in Water Security and Global Change is research-oriented.

(2) The focus of the international English-language Master's degree program is on the planning, construction and operation of water management and hydraulic engineering infrastructure, in particular for adaptation to climate change-related extreme events both inland and coastal areas, physico-chemical, data analysis and hydrological principles as well as the modelling of complex material flows in water-related systems. The degree program covers both national and international guidelines and the development of water policy and social requirements. Further contents of the degree program are practice-oriented case studies as well as current topics from basic and application-oriented research. In addition, the degree program includes a combination of theoretical and methodical-practical principles in connection with water security in the context of global change.

#### § 8 Credit points

(1) ECTS credit points document the average workload of the students and their individual study progress. One credit point corresponds to a 30-hour workload. Normally, 60 credit points are awarded per academic year, i.e. 30 credit points per semester. The total workload for the program corresponds to 120 credit points and comprises the teaching and learning methods according to type and scope stipulated in the module descriptions, the study achievements and examined assessments, the final thesis and the colloquium.

(2) The module descriptions indicate the number of credits that can be earned by each module. Credits are awarded upon passing the module examination. § 33 of the examination regulations shall remain unaffected.

## § 9 Academic advisory and counseling service

(1) General advice will be provided by the Central Student Information and Counseling Service at TU Dresden. It covers questions regarding study options, enrollment modalities and general student affairs. Subject-specific advice during studies will be provided by the Academic Advisory Service of the Faculty of Civil Engineering. This subject-specific advisory service assists students with regard to the design of their studies.

(2) At the beginning of the third semester, each student who has not yet provided proof of academic performance shall make use of the subject-specific advisory services.

### § 10 Amendments to module descriptions

(1) In order to adapt them to changed conditions, module descriptions may be amended in a simplified procedure in order to optimize study organization, with the exemption of the fields "Module name", "Learning goals", "Content", "Teaching and learning methods," "Requirements for earning credit points", "Credit points and grades" and "Module duration."

(2) In a simplified procedure, the Faculty Board will adopt the amendments to the module descriptions upon proposal of the Academic Affairs Committee. The amendments must be published in the usual manner.

## § 11 Entry into force and publication

(1) These Study Regulations shall enter into force on the day following their publication in the Official Announcements of TU Dresden.

(2) They apply to all students enrolled on the Master's degree program in Water Security and Global Change in the 2024/2025 winter semester or later.

Issued based on the resolution of the Faculty Board of the Faculty of Civil Engineering as of (Date) and the approval of the University Executive Board as of (date).

Dresden, 25. April 2024

The Rector of TUD Dresden University of Technology

#### Prof. Ursula Staudinger

# Annex 1: Module descriptions

Module name	Ground Water
Module number	MHSE 29 (BIW-MA-ABCD-01)
Module coordinator	Prof. Dr. Andreas Hartmann andreas.hartmann@tu-dresden.de
Learning goals	Students will be able to identify flow and transport processes in ground- water and its storage behavior, apply basic calculation and evaluation methods and understand the operation of numerical solution methods.
Content	The module covers hydrogeological and geohydraulic fundamentals, flow and mass transport processes in aquifers as well as their storage capacity and issues relating to the water balance and water quality. Additional contents of the module are the fundamentals of the structure of the un- derground space, the definition of its hydrogeological parameters and the quantitative description of the relevant processes.
Teaching and learning methods	Lecture 2 hours per week, practical 2 hour per, self-study.
Prerequisites	None.
Applicability	The module is a compulsory module in the Master's degree program in Water Security and Global Change. It is one of 17 elective compulsory modules in the Master's degree program in Hydro Science and Engineer- ing, from which modules worth a total of 50 credit points must be se- lected.
Requirements for earning credit points	Credit points are awarded upon passing the module examination. The module examination comprises a 90-minute written test. The examination language is English.
Credit points and grades	The module is worth 5 credit points. The module grade corresponds to the grade of the examined assessment.
Frequency of the module	The module is offered each winter semester.
Workload	The workload comprises 150 hours in total.
Module duration	The module runs for the duration of one semester.

Module name	Urban Water Management
Module number	MHSE 33 (BIW-MA-ABCD-02)
Module coordinator	Prof. Peter Krebs isi@mail.zih.tu-dresden.de
Learning goals	Students will be able to reproduce and optimize important processes in urban water management, design and dimension the systems and as- sess the consequences for the polluted water.
Content	The content of the module is an overview of urban water management systems, which includes methods for raw water extraction, water treat- ment and distribution, wastewater and rainwater drainage as well as wastewater and sludge treatment. The module focuses on the dimen- sioning, operation and optimization of drinking water and wastewater systems. In addition, the module includes the characterization of water pollution caused by wastewater disposal as an optimization goal as well as the mechanisms of material pollution. An additional module content is the discussion of approaches to integrated operational optimization, taking into account the interactions between the subsystems.
Teaching and learning methods	Lecture 3 hours per week, internship 1 hour per week, self-study.
Prerequisites	Students are required to have a basic knowledge of mathematics, hydro- biology, hydrochemistry and hydromechanics at Bachelor's level.
Applicability	The module is a compulsory module in the Master's degree program in Water Security and Global Change. It is one of 17 elective compulsory modules in the Master's degree program in Hydro Science and Engineer- ing, from which modules worth a total of 50 credit points must be se- lected.
Requirements for earning credit points	Credit points are awarded upon passing the module examination. The module examination comprises a 90-minute written test. The examination language is English.
Credit points and grades	The module is worth 5 credit points. The module grade corresponds to the grade of the examined assessment.
Frequency of the module	The module is offered each year in the summer semester.
Workload	The workload comprises 150 hours in total.
Module duration	The module runs for the duration of one semester.

Module name	Water extremes – Risk Management and Adaptation
Module number	BIW-MA-ABCD-03
Module coordinator	Prof. Jürgen Stamm juergen.stamm@tu-dresden.de
Learning goals	Students will be familiar with the interactions between adaptation to cli- mate change and disaster risk reduction. They will be able to combine and develop "hard" and "soft" measures for more resilient systems. Stu- dents will understand the subtasks of extreme event management with special consideration of social impacts in order to derive an acceptable risk. In addition, they will be able to interpret and develop strategies for prevention and management options. They will be able to explain and evaluate practical applications such as case studies.
Content	The module covers management strategies for reducing the risk of ex- treme events as well as the development and interpretation of compre- hensive risk management and complex, transdisciplinary solution ap- proaches, the entirety of the physical processes of extreme events such as floods and droughts and socio-economic and ecological contexts. In addition, the module covers the presentation of the risk system, risk anal- yses, risk assessment, risk perception and the possibility of risk mitiga- tion, in particular prevention, including communication tools and crisis management, including early warning in the event of floods and droughts, as well as aftercare.
Teaching and learning methods	Lecture 2 hours per week (SWS), practical 2 hours per week (SWS), tutorial 1 hour per week (SWS), self-study.
Prerequisites	Students are required to have a basic understanding of meteorology, hy- drology, mathematical statistics and hydraulic engineering at Bachelor's level.
Applicability	The module is a compulsory module in the Master's degree program in Water Security and Global Change.
Requirements for earning credit points	Credit points are awarded upon passing the module examination. The module examination comprises a 90-minute written test. The examination language is English.
Credit points and grades	The module is worth 5 credit points. The module grade corresponds to the grade of the examined assessment.
Frequency of the module	The module is offered each year in the summer semester.
Workload	The workload comprises 150 hours in total.
Module duration	The module runs for the duration of one semester.

Module name	Hydraulic Engineering
Module number	MHSE 06 (BIW-MA-ABCD-04)
Module coordinator	Prof. Dr. Jürgen Stamm juergen.stamm@tu-dresden.de
Learning goals	Students will be familiar with the fundamentals of the design, operation and dimensioning of hydraulic structures.
Content	The module covers natural watercourses, flood protection structures such as dykes and retention basins, the use of water, for example weirs, dams and hydropower plants, as well as water quantity management, ecological and economic aspects. Additional content includes environ- mentally-friendly construction methods, sustainability, renewable ener- gies and hydraulic engineering.
Teaching and learning methods	Lecture 2 hours per week, practical 1 hour per week, internship 1 hour per week, self-study.
Prerequisites	Students are expected to have knowledge of physics and higher mathe- matics at Bachelor's level.
Applicability	The module is a compulsory module in the Master's degree program in Water Security and Global Change. It is one of 17 elective compulsory modules in the Master's degree program in Hydro Science and Engineer- ing, from which modules worth a total of 50 credit points must be se- lected.
Requirements for earning credit points	Credit points are awarded upon passing the module examination. The module examination comprises a 90-minute written test and a seminar paper of 30 hours. The examination language is English.
Credit points and grades	The module is worth 5 credit points. The module grade is calculated from the weighted average grade of the two examined assessments. The writ- ten examination will be weighted 3-fold and the seminar paper work will be weighted once.
Frequency of the module	The module is offered each winter semester.
Workload	The workload comprises 150 hours in total.
Module duration	The module runs for the duration of one semester.

Module name	International Water Issues
Module number	MHSE 10 (BIW-MA-ABCD-05)
Module coordinator	Prof. Dr. Peter Krebs peter.krebs@tu-dresden.de
Learning goals	Students will be familiar with the situation regarding water-related issues and problems such as water scarcity and water pollution in other coun- tries. They will gain a global overview of the water situation and be able to better classify what they have learned and make decisions. Students will be able to appropriately present and discuss specific topics related to water resources.
Content	Contents of the module are select water-specific issues of the home coun- tries, aspects of the water situation, i.e. hydrological regime, climate situ- ation including the expected climate change, supply situation with drink- ing or industrial water, the wastewater situation, the management of floods and water-related natural hazards, for example landslides and tsu- namis. Additional content of the module includes relevant projects and organizations in various regions, as well as an examination of these, in- cluding personal experiences.
Teaching and learning methods	3 hours per week seminars, self-study.
Prerequisites	Students are required to have basic knowledge of hydrosciences and knowledge of regional water management and hydrology at Bachelor's level.
Applicability	The module is one of three elective compulsory modules in the Master's degree program Water Security and global change, two of which must be selected.
Requirements for earning credit points	Credit points are awarded upon passing the module examination. The module examination comprises a seminar combined term paper with a scope of 30 hours. The examination language is English.
Credit points and grades	The module is worth 5 credit points. The module grade corresponds to the grade of the examined assessment.
Frequency of the module	The module is offered each year in the summer semester.
Workload	The workload comprises 150 hours in total.
Module duration	The module runs for the duration of one semester.

Module name	Climate Systems and Climate Modelling
Module number	MHSE 27 (BIW-MA-ABCD-06)
Module coordinator	Prof. Dr. Matthias Mauder matthias.mauder@tu-dresden.de
Learning goals	Students will be able to recognize the complex and scale-dependent re- lationships between climate system components and describe them on the basis of characteristic phenomena and will be able to apply special climate models in a scale-appropriate and problem-oriented manner.
Content	The module contains in-depth specialist content on the functioning and methods of describing climate system components, their interactions at all spatial scales and their modelling in climate models. Additional con- tent of the module includes components of the climate system, in partic- ular properties, scale dependency and interactions, description of com- ponents, development and application of climate models including ex- emplary use of corresponding models.
Teaching and learning methods	Lecture 3 hours per week, practical 1 hour per week, self-study.
Prerequisites	Students are expected to have knowledge of essential physical processes in the atmosphere and hydrosphere at Bachelor's level as well as knowledge of physics and mathematics at A-level ( <i>Abitur</i> ), basic course.
Applicability	The module is one of three elective compulsory modules in the Master's degree program Water Security and global change, two of which must be selected. It is one of 17 elective compulsory modules in the Master's degree program in Hydro Science and Engineering, from which modules worth a total of 50 credit points must be selected.
Requirements for earning credit points	Credit points are awarded upon passing the module examination. The module examination comprises a 90-minute written test. The examination language is English.
Credit points and grades	The module is worth 5 credit points. The module grade corresponds to the grade of the examined assessment.
Frequency of the module	The module is offered each winter semester.
Workload	The workload comprises 150 hours in total.

Module duration	The module runs for the duration of one semester.
Reading list	Kabat, P. (ed.), 2004: Vegetation, Water, Humans and the Climate. McGuffie, K., Henderson-Sellers, A., 2013: A Climate Modelling Primer. Oke, T.R., 1987: Boundary Layer Climates.

Module name	Natural Forest Management and Restoration in the Tropics
Module number	BIW-MA-ABCD-07
Module coordinator	Prof. Dr. Sven Wagner sven.wagner@tu-dresden.de
Learning goals	Students will be familiar with the important management systems of tropical forests. They will be able to apply methods of planning, imple- mentation, monitoring and control for natural forest management and will be able to apply multifunctional strategies for the management of tropical natural forests.
Content	This module covers management systems for natural forest manage- ment in the tropics, elements for recording, planning, implementing, monitoring and controlling these, management strategies using decision- theoretical models, management of different forest formations, sustain- ability units and operations, production strategies and value chains for timber, non-timber forest products and environmental services of the forest, biodiversity management, integrated forest protection and fire control in tropical and subtropical natural forests on the basis of case studies.
Teaching and learning methods	3 hours per week lecture, 0.5 hour per week practical, 2 hours per week seminar, 1 day excursion, self-study.
Prerequisites	Students are expected to have knowledge of forestry disciplines at Bachelor's level. Prerequisite literature: Lamprecht, H. (1989) Silviculture in the tropics. Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) Eschborn. Matthews, J. D. (1996) Silvicultural systems. Clarendon Press Oxford, Oxford. Johnson, E. A.; Miyanishi, K. (2001) Forest fires. Behavior and ecological effects. Academic Press, San Diego. Speight, M. R.; Wylie, F. R. (2001) Insect pests in tropical forestry, CABI Wallingford.
Applicability	The module is one of three elective compulsory modules in the Master's degree program Water Security and global change, two of which must be selected.
Requirements for earning credit points	Credit points are awarded upon passing the module examination. The module examination consists of a seminar combined term paper with a scope of 30 hours and a written examination ( <i>Klausur</i> ) of 90 minutes duration.

Credit points and grades	The module is worth 5 credit points. The module grade is calculated from the weighted average grade of the two examined assessments. The com- bined term paper is weighted singly and the written examination is weighted triply.					
Module frequency	he module is offered each winter semester.					
Workload	۲he workload comprises 150 hours in total.					
Module duration	The module runs for the duration of one semester.					
Reading list	<ul> <li>Clemen, R. (1996) Making hard decisions. Duxbury Press, Pacific Grove.</li> <li>Ffolliott, P. F.; Brooks, K. N.; Gregersen, H. N.; Lundgren, A. L. (1995) Dryland forestry. Planning and management. Wiley, New York.</li> <li>Buongiorno, J.; Gilles, K. (2003) Decision methods for forest resource management. Academic Press, Amsterdam, Boston.</li> <li>Goldammer, J. G. (1993) Fire management. In: Pancel, L. (ed.) (1993) Tropical Forestry Handbook. Springer, Berlin Heidelberg New York, pp.1221-1268.</li> <li>Heikkliä, T. V.; Grönqvist, R.; Jurvelius, M. (1993) Handbook on forest fire control. Forestry Training Programme: Publication 21. Helsinki.</li> <li>Speight, M. R.; Wainhouse, D. (1989) Ecology and management of forest insects. Oxford University Press, Oxford.</li> <li>Watt, A. D.; Stork, N. E.; Hunter, M. D. (1997) Forests and insects. Chapman &amp; Hall, London.</li> <li>Heyde, W. F. (1980) Timber supply, land allocation and economic efficiency. John Hopkins Univ. Press, Baltimore.</li> <li>Neher, P. A. (1993) Natural resource economics. Conservation and exploitation. Cambridge University Press, Cambridge.</li> </ul>					

# Annex 2:

# Study schedule

including type and scope of the courses in hours per week [SWS]) as well as required academic work, the type and design of which can be found in the module descriptions

Madula number	Module name	1 <sup>st</sup> semester	2 <sup>rd</sup> semester	3 <sup>th</sup> semester	4 <sup>st</sup> semester	Credits
Module number		V/Ü/S/P/T	V/Ü/S/P/T	V/Ü/S/P/T	V/Ü/S/P/T	
Modules of the compulsory area 1						
MHSE 29 (BIW-MA-ABCD-01)	Ground Water	2/2/0/0/0 PL				5
MHSE 33 (BIW-MA-ABCD-02)	Urban Water Management		3/0/0/1/0 PL			5
BIW-MA-ABCD-03	Water extremes – Risk Management and Adaptation		2/2/0/0/1 PL			5
MHSE 06 (BIW-MA-ABCD-04)	Hydraulic Engineering			2/1/0/1/0 2 x PL		5
Modules of the compulsory area <sup>1</sup>						
MHSE 10 (BIW-MA-ABCD-05)	International Water Issues <sup>2</sup>		0/0/3/0/0 PL			5
MHSE 27	Climate Systems and Climate Modelling <sup>2</sup>			3/1/0/0/0 PL		5

Module number	Module name	1 <sup>st</sup> semester	2 <sup>rd</sup> semester	3 <sup>th</sup> semester	4 <sup>st</sup> semester	Credits
		V/Ü/S/P/T	V/Ü/S/P/T	V/Ü/S/P/T	V/Ü/S/P/T	
(BIW-MA-ABCD-06)						
BIW-MA-ABCD-07	Natural Forest Management and Resto- ration in the Tropics <sup>2</sup>			3/0.5/2/0/0 1 day excursion, 2 x PL		5
					Final thesis	25
					Colloquium	5
Credits		30	30	30	30	120

- LPCredit pointsVLectureÜPracticalSSeminar
- P Practical training
- T Tutorial
- SWS Hours per week
- PL Examined assessment

<sup>1</sup> Study achievements and examined assessments amounting to 30 credit points each must be completed over three semesters as part of the cooperation with the RWTH Aachen University and the Indian Institute of Technology Madras in accordance with the cooperation agreement. <sup>2</sup> alternative (2 out of 3)