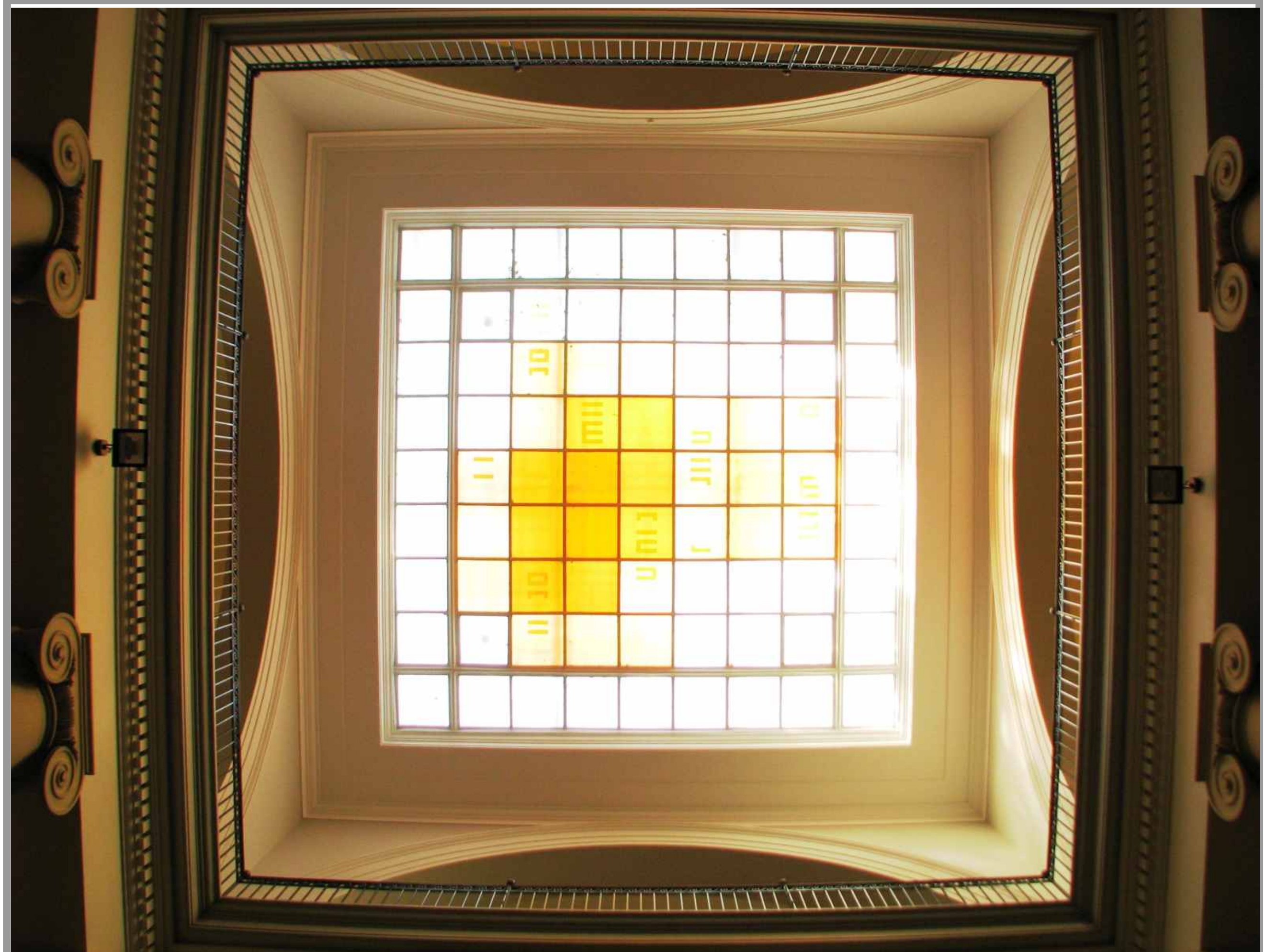
Karlsruhe Institute of Technology

Module Handbook
Civil Engineering (M.Sc.)

ER/SPO 2017
Summer term 2019
as at: 03/22/2019

KIT-Department of Civil Engineering, Geo and Environmental Sciences



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Preface

The module handbook is the document in which important additional information about the studies is described. The general rules from the examination regulation (s. https://www.sle.kit.edu/imstudium/master-bauingenieurwesen.php, *in German*) and the structure of the program are specified by the curriculum (Part I). The main function of the Module Handbook is the compilation of the module descriptions (Part II) and the learning controls (Part III).
In addition to the module handbook information about the execution of the single courses is collected within the course catalog (online). Information about the examinations is provided by the self-service function for students. This information is also announced by postings and web pages of the institutes

Contents

Part I
Curriculum

1 Curriculum

In this section 'Curriculum' rules in addition to the examination regulation (ER/SPO) are described. This can be found on

> https://www.sle.kit.edu/imstudium/master-bauingenieurwesen.php
> (2017 KIT 011 Studien- und Prüfungsordnung des Karlsruher Instituts für Technologie (KIT) für den Masterstudiengang Bauingenieurwesen; *in German*)

1.1 Objectives of the master degree program

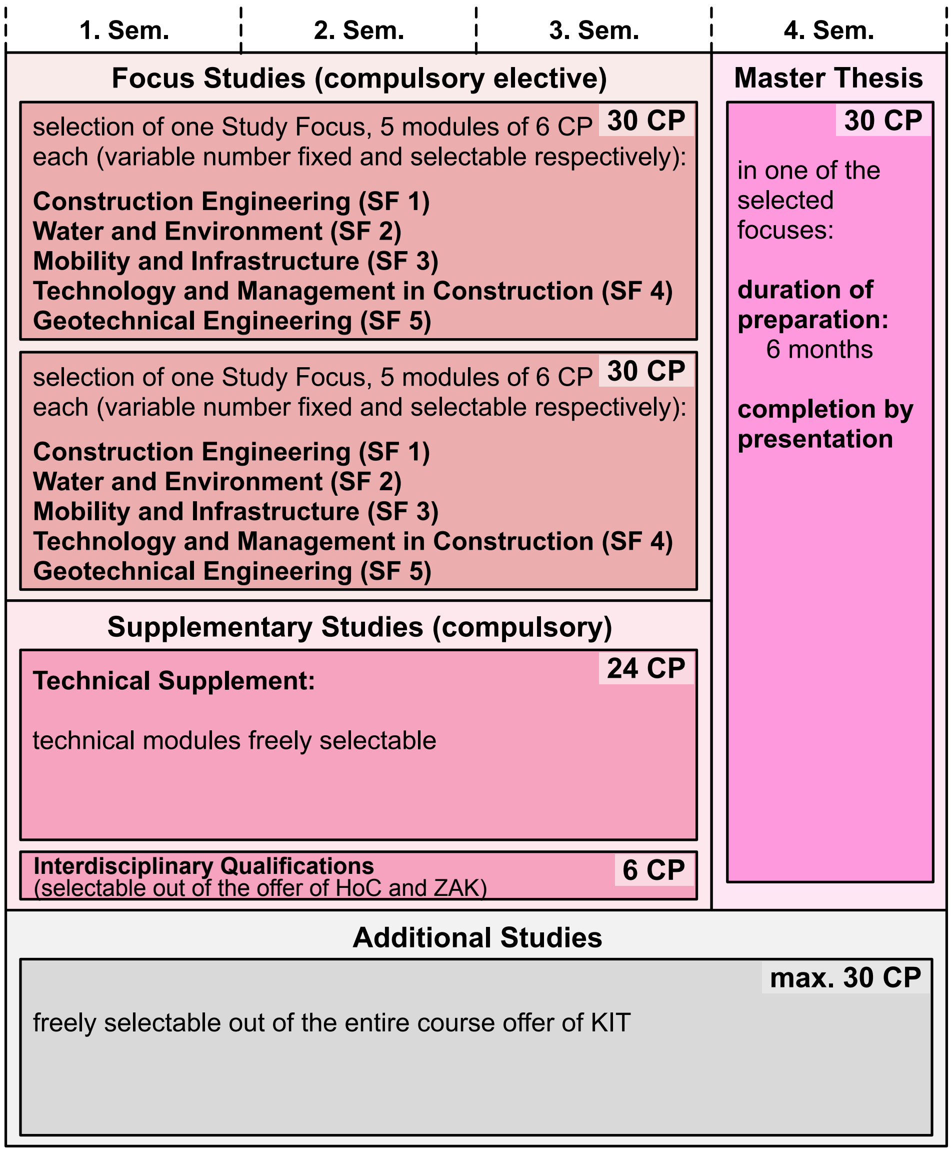
The master degree program **Civil Engineering** provides a deepened and research-oriented qualification in all typical professional fields of civil engineering. The main component of the qualification is the engineering applications of the qualifications acquired during the bachelor studies added by advanced and extended knowledge in at least two of the five study focuses '*Structural Engineering*', '*Water and Environment*', '*Mobility and Infrastructure*', '*Technology and Management in Construction*' and '*Geotechnical Engineering*'.
The graduates are able to apply self-reliantly their scientific profound and interdisciplinary knowledge and methods in the fields of system analysis, measurement techniques, modeling and management also across disciplines. They evaluate their significance and scope for the solution of complex scientific and societal problems. They develop innovative problem solutions beyond the application of established structurally engineered and scientific rules, and enter new fields of engineering. Because of the increasing complexity of these problems they develop overall economic, socially and ecologically acceptable solutions within an interdisciplinary team.
They have the capability to present technically complex issues understandably and to perform convincingly which let them also be prepared very well for executive functions - also in an interdisciplinary team. They are qualified for responsible activities in planning offices and consultants, industry, administration and science. They obtain the qualification for Ph.D. studies as well.

1.2 Structure of the master degree program

The master degree program Civil Engineering comprises 120 credit points (CP). It is structured in a compulsory elective section, the **Focus Study** (60 CP), a compulsory section, the **Complementary Study** (30 CP), and the **Master Thesis** (30 CP) (comp. ER/SPO § 19). Within the Focus Study two of the five subject-related **Study Focuses**

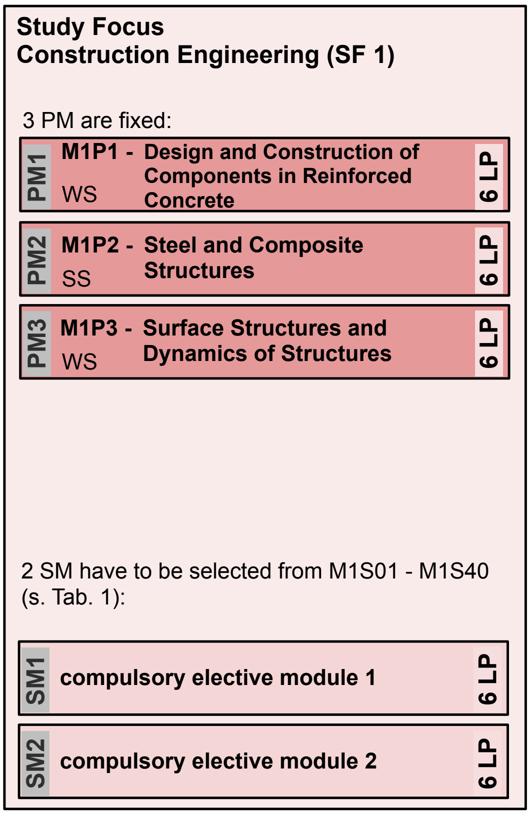
I - Construction Engineering
II - Water and Environment
III - Mobility and Infrastructure
IV - Technology and Management in Construction
V - Geotechnical Engineering

have to be selected as compulsory elective subjects. These represent the different characteristics of the occupational profile. They comprises 30 CP each and are structured differently regarding the assigned compulsory modules (PM) and compulsory elective modules (SM). All modules in the master degree program comprise 6 CP each and are integrated into these subject-related study focuses (s. Tab. 1 - 5) as described in the following sections. A curriculum by example in the appendix shows how to finish the study within the standard period of study. The selected start of studies as well as the selected study focuses and modules are not at all any recommendation.
The Complementary Study comprises the two compulsory subjects **Subject-Specific Supplements** (24 CP) and **Interdisciplinary Qualification** (6 CP). Within the subject Subject-Specific Supplements all modules from all study focuses have to be selected freely. Obtaining the interdisciplinary qualifications basically courses from the respective course catalog on key competences offered by the House of Competence (HoC) or of the Centre for Cultural and General Studies (ZAK) can be selected.



1.2.1 Study Focus 'Construction Engineering' (SF 1)

Civil engineers in construction engineering are dealing with planing, design and calculation of structures and structural designs of all kinds. The graduates of the study focus '*Construction Engineering*' are able to design, plan and calculate structures and structural designs independently considering technological, ecological and economic aspects by means of their broad knowledge about building material properties and designing approaches.
All modules offered in the study focus 'Construction Engineering' are summarized in Table 1. This table provides also information in which semester the associated courses and how the course assessment take place.



In this study focus three compulsory modules are fixed:

- Design and Construction of Components in Reinforced Concrete
- Steel and Composite Structures
- Surface Structures and Dynamics of Structures

In addition two compulsory elective modules have to be selected from the offer of this study focus (Tab. 1).

For the compulsory module M1P2 (Steel and Composite Structures) the attendance of the compulsory elective module M1S14 (Non-linear Analysis of Beam Structures) in advance is recommended.
For the allocation of the modules M1S10, M1S11 and M1S13 the allocation of module M1S12 (Timber Structures) is recommended.
As part of several courses numerous field trips are offered. It is recommended to attend at least one field trip.

Table 1: Modules in Study Focus Construction Engineering

Module			Course				LC	
Code (baui)	Name	CP	Name (Language)	Type	HpW / W	SWS / S	Type	CP
compulsory modules								
M1P1:	Design and Construction of Components in Reinforced Concrete (p. 83)	6	Design and Construction of Components in Reinforced Concrete (G)	L/E	2/2		ngA wE	2 4
M1P2:	Steel and Composite Structures (p. 195)	6	Steel and Composite Structures (G)	L/E		2/2	ngA wE	2 4
M1P3:	Surface Structures and Dynamics of Structures (p. 201)	6	Surface Structures (G)	L	2		ngA wE	1 2
			Dynamics of Structures *) (G)	L	2		ngA wE	1 2
Sum compulsory modules		**18**			**8**	**4**		
compulsory elective modules								
M1S01:	Bracing and Stability in Reinforced Concrete (p. 56)	6	Bracing and Stability in Reinforced Concrete (G)	L/E		2/2	wE	6
M1S02:	Basics of Prestressed Concrete (p. 55)	6	Basics of Prestressed Concrete (G)	L/E		2/2	wE	6
M1S03:	Solid Construction Bridges (p. 185)	6	Solid Construction Bridges (G)	L/E	2/2		wE	6
M1S04:	Applied Dynamics of Structures 1) (p. 47)	6	Applied Dynamics of Structures (G)	L/E		1/1	oE	6
			Earthquake Engineering (G)	L/E	1/1			
M1S05:	Anchorage in Concrete 1) (p. 46)	6	Anchorage in Concrete I (G)	L/E		1/1	oE	6
			Anchorage in Concrete II (G)	L/E	1/1			
M1S06:	Material Science, Welding and Fatigue (p. 149)	6	Material Science, Welding and Fatigue (G)	L/E		4	wE	6
M1S07:	Construction of Steel and Composite Bridges (p. 70)	6	Construction of Steel and Composite Bridges (G)	L/E		2/2	wE	6
M1S08:	Hollow Section Structures (p. 124)	6	Hollow Section Structures (G)	L/E	2/2		oE	6
M1S09:	Glass, Plastic and Cable Structures (p. 115)	6	Glass, Plastic and Cable Structures (G)	L/E	3/1		oE	6
M1S10:	Structures in Steel and Timber (p. 197)	6	Supporting Steel Structures (G)	L/E	1/1		EoT	3
			Supporting Timber Structures (G)	L/E	2		oE	3
M1S11:	Building Preservation of Steel and Timber Structures (p. 62)	6	Building Preservation of Steel Structures (G)	L	2		wE	6
			Building Preservation of Timber Structures (G)	L/E	2			
M1S12:	Timber Structures (p. 212)	6	Timber Structures (G)	L/E		2/2	wE	6

*) Practical course Dynamics of Structure recommended as supplementary additional accomplishment

Table 1: Modules in Study Focus Construction Engineering (continued)

Module			Course				LC	
Code (baui)	Name	CP	Name (Language)	Type	HpW / SWS W	S	Type	CP
M1S13:	Timber and Wood-based Materials (p. 210)	6	Timber and Wood-based Materials (G)	L/E		4	oE	6
M1S14:	Non-linear Analysis of Beam Structures (p. 156)	6	Non-linear Analysis of Beam Structures (G)	L/E	2/2		wE	6
M1S15:	Computational Analysis of Structures (p. 67)	6	Computational Analysis of Structures (G)	L/E		2/2	ngA[5] oE	2 4
M1S16:	FE-Applications in Practical Engineering (p. 105)	6	FE-Applications in Practical Engineering (G)	L/E		2/2	oE	6
M1S17:	Shell Structures and Stability of Structures (p. 183)	6	Shell Structures (G)	L/E		1/1	ngA[5] oE	2 4
			Stability of Structures (G)	L/E		1/1		
M1S18:	Numerical Methods in Structural Analysis (p. 160)	6	Numerical Methods in Structural Analysis (G)	L/E	2/2		oE	6
M1S19:	Non-linear Analysis of Surface Structures (p. 157)	6	Non-linear Analysis of Surface Structures (G)	L/E	2/2		oE	6
M1S20:	Basics of Finite Elements (p. 51)	6	Basics of Finite Elements (G)	L/E	2/2		ngA oE	1 5
M1S21:	Fracture and Damage Mechanics (p. 109)	6	Fracture and Damage Mechanics (G)	L/E		2/2	oE	6
M1S22:	Material Models in Solid Mechanics (p. 147)	6	Material Models in Solid Mechanics (G)	L/E	2/2		oE	6
M1S24:	Concrete Construction Technology (p. 69)	6	Concrete Technology (G)	L/E	3		oE	6
			Deformation and Fracture Processes (G)	L	1			
M1S25:	Durability and Service Life Design (p. 85)	6	Corrosion Processes and Life Time (G)	L/E	3		oE	6
			Analytic Methods (G)	L	1			
M1S26:	Building Preservation of Concrete and Masonry Constructions (p. 60)	6	Protection, Rehabilitation and Reinforcement of Concrete and Masonry Constructions (G)	L/E		2/1	ngA oE	1 5
			Building Analysis (G)	L		1		
M1S27:	Building Physics I (p. 58)	6	Applied Building Physics (G)	L	2		oE	3
			Building Technology (G)	L	2		oE	3
M1S28:	Building Physics II (p. 59)	6	Practical Noise Control (G)	L		2	EoT oE	1 2
			Practical Fire Protection (G)	L		2	oE	3
M1S29:	Materials Testing and Measuring Techniques (p. 151)	6	Measuring Techniques in Civil Engineering (G)	L/E	1/1		oE	6
			Materials Testing in the Field of Concrete (G)	L	2			

Table 1: Modules in Study Focus Contructive Engineering (continued)

Module			Course				LC	
Code (baui)	Name	CP	Name (Language)	Type	HpW / SWS W	S	Type	CP
M1S32:	Continuum Mechanics of Heterogeneous Solids[2, 3] (p. 77)	6	Continuum Mechanics (G)	L	2		oE	3
			Micromechanics of Heterogeneous Solids (G)	L		2	oE	3
M1S37:	Finite Elements in Solid Mechanics (p. 106)	6	Finite Elements in Solid Mechanics (G)	L/E		2/2	oE	6
M1S38:	Numerical Structural Dynamics (p. 164)	6	Numerical Structural Dynamics (G)	L/E		4	oE	6
M1S39:	Tank Construction (p. 205)	6	Tank Construction (G)	L/E	3/1		EoT oE	3 3
M1S40:	Modeling in Solid Mechanics (p. 152)	6	Modeling in Solid Mechanics (G)	L/E		4	oE	6
M1S41:	Contact Mechanics[4] (p. 72)	6	Contact Mechanics (G)	L/E	2/2		oE	6
Sum compulsory elective modules		**204**			**70**	**66**		

explanations to Table 1:

general:

M1PX	Study Focus I, compulsory module
M1SXX	Study Focus I, compulsory elective module
LC	learning control
CP	credit point
HpW / SWS	hours per week
W / S	winter term / summer term
G / E	language German / English
1)	Starting the module in summer term (S) is recommended.
2)	Starting the module in winter term (W) is recommended.
3)	Module must not be selected together with module M5P4 (SF 5).
4)	Module is newly offered as from winter term 2019/20.

type of course:

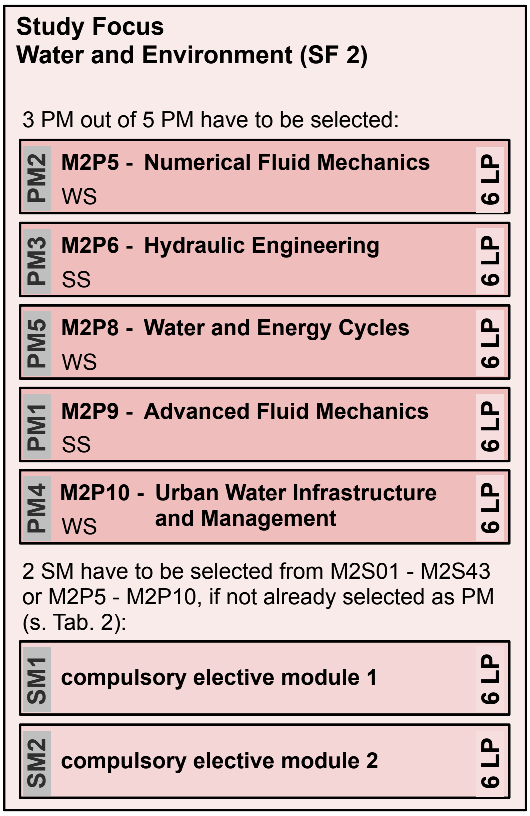
L	lecture
L/E	lecture and exercise, separate or integrated

type of learning control:

wE	written examination
oE	oral examination
EoT	examination of other type, graded
ngA	not graded accomplishment
ngA[5]	not graded accomplishment as examination prerequisite

1.2.2 Study Focus 'Water and Environment' (SF 2)

Civil engineers in water management and environmental engineering are dealing with the management of water resources, their interaction with soil and air as well as the handling of waste and waste water. The graduates of the study focus '*Water and Environment*' can develop efficient and adapted solutions for problems of any kind in water management based on a deepened understanding of fluid mechanical processes on water and mass transport as well as methods for their quantification.
All modules offered in the study focus 'Water and Environment' are summarized in Table 2. This table provides also information in which semester the associated courses and how the course assessment take place.



In this study focus five compulsory modules are predetermined:

- Advanced Fluid Mechanics
- Numerical Fluid Mechanics
- Hydraulic Engineering
- Urban Water Infrastructure and Management
- Water and Energy Cycles

At least three out of these five compulsory modules have to be selected. In case of selecting less than five compulsory modules the respective number of missing modules have to be selected from the offer of this study focus (Tab. 2).

Table 2: Modules in Study Focus Water and Environment

Module			Course				LC	
Code (baui)	Name	CP	Name (Language)	Type	HpW / W	SWS S	Type	CP
*compulsory modules *): 3 compulsory modules have to be selected, in total 18 CP.*								
M2P5:	Numerical Fluid Mechanics *) (p. 159)	6	Numerical Fluid Mechanics I (E)	L/E	4		wE	6
M2P6:	Hydraulic Engineering *) (p. 125)	6	Multiphase Flow in Hydraulic Engineering (E)	L/E		2	wE	6
			Design of Hydraulic Structures (E)	L/E		2		
M2P8:	Water and Energy Cycles *) (p. 231)	6	Water and Energy Cycles in Hydrological Systems: Processes, Predictions and Management (E)	L/E	4		oE	6
M2P9:	Advanced Fluid Mechanics *) (p. 39)	6	Advanced Fluid Mechanics (E)	L/E		4	wE	6
M2P10:	Urban Water Infrastructure and Management *) (p. 223)	6	Urban Water Infrastructure and Management (E)	L/E	4		wE	6
Sum compulsory modules		**30**			**12**	**8**		
*compulsory elective modules *): At least 2 modules out of the compulsory elective modules and the not already selected compulsory modules have to be selected, in total 12 CP.*								
M2S01:	Management of Water Resources and River Basins (p. 145)	6	Management of Water Resources and River Basins (E)	L/E		4	EoT	6
M2S03:	Subsurface Flow and Contaminant Transport (p. 199)	6	Transport and Transformation of Contaminants in Hydrological Systems (E)	L/E		4	oE	6
M2S04:	Analysis of Spatial Data (p. 42)	6	Geostatistics (E)	L/E		4	oE	6
M2S05:	Hydrological Measurements in Environmental Systems (p. 129)	6	Hydrological Measurements in Environmental Systems (E)	L/E/P		4	EoT	6
M2S06:	Aquatic Ecosystems [4] (p. 50)	6	Aquatic Ecosystems (G)	L/S/F	4		ngA [7] EoT	0 6
M2S07:	Environmental Communication [4] (p. 90)	6	Environmental Communication (G)	S	2		ngA [7] EoT	0 6
M2S08:	Groundwater Management [1] (p. 120)	6	Groundwater Hydraulics (E)	L/E		2	oE	3
			Numerical Groundwater Modeling (E)	Pj	2		EoT	3
M2S11:	Hydro Power Engineering (p. 128)	6	Hydro Power Engineering (G)	L/E		4	oE	6
M2S12:	Waterway Engineering (p. 237)	6	Waterway Engineering (G)	L/E		4	ngA [7] oE	1 5

Table 2: Modules in Study Focus Water and Environment (continued)

Module			Course				LC	
Code (baui)	Name	CP	Name (Language)	Type	HpW / W	SWS S	Type	CP
M2S16:	Interaction Flow - Building Structure 3a) (p. 133)	6	Interaction Flow - Hydraulic Structures (G)	L/E	2		oE	3
			Building and Environmental Aerodynamics (G)	L/E	1/1		oE	3
M2S17:	Technical Hydraulics (p. 207)	6	Steady and Unsteady-state Operation of Hydraulic Systems**) (G)	L/E		4	wE	6
M2S19:	Environmental Fluid Mechanics (p. 91)	6	Environmental Fluid Mechanics (E)	L/E	4		wE	6
M2S21:	Advanced Computational Fluid Dynamics (p. 37)	6	Numerical Fluid Mechanics II (E)	L/E		2	oE	3
			Parallel Programing Techniques for Engineering Problems (E)	L/E	2		oE	3
M2S29:	Industrial Water Management (p. 131)	6	Industrial Water Management (E)	L/E		4	ngA 7) oE	1 5
M2S32:	Analysis of Turbulent Flows 1) (p. 44)	6	Fluid Mechanics of Turbulent Flows (E)	L		2	oE	6
			Modeling of Turbulent Flows - RANS and LES (E)	L		2		
M2S33:	Project Studies in Water Resources Management (p. 172)	6	Project Studies in Water Resources Management (G)	L/E	4		EoT	6
M2S34:	Numerical Flow Modeling in Hydraulic Engineering (p. 158)	6	Numerical Flow Modeling in Hydraulic Engineering (G)	L/E	4		oE	6
M2S35:	Flow and Sediment Dynamics in Rivers (p. 107)	6	Morphodynamics (E)	L/E		2	ngA 7) oE	2 4
			Flow Behavior of Rivers (E)	L/E		2		
M2S36:	Hydraulic Structures 3b) (p. 126)	6	Groundwater Flow around Structures (E)	L/E		2	oE	3
			Interaction Flow - Hydraulic Structures (G)	L/E	2		oE	3
M2S37:	Experimental Hydraulics and Measuring Techniques(p. 97)	6	Flow Measuring Technique (G)	L/E	2		oE	3
			Experimental Hydraulics II (G)	L/E	1/1		EoT	3
M2S38:	Water Distribution Systems (p. 233)	6	Water Distribution Systems (E)	L/E	2/2		ngA 7) oE	2 4
M2S39:	Experiments in Fluid Mechanics (p. 101)	6	Experimental Methods and Physical Experiments (E)	L/E		1/3	EoT	6

**) Course will not be offered in summer term 2019.

Table 2: Modules in Study Focus Water and Environment (continued)

Module			Course				LC	
Code (baui)	Name	CP	Name (Language)	Type	HpW / SWS W	S	Type	CP
M2S40:	Wastewater and Storm Water Treatment Facilities [5] (p. 227)	6	Wastewater and Storm Water Treatment Facilities (E)	L/F		4	EoT	6
M2S41:	Freshwater Ecology [5] (p. 111)	6	Applied Ecology and Water Quality (E)	L/S		3	EoT	3
			Field Training Water Quality (E)	E		1	EoT	3
M2S42:	River Basin Modeling [1] (p. 175)	6	Mass Fluxes in River Basins (E)	L		2	EoT	6
			Modeling Mass Fluxes in River Basins (E)	E	2			
M2S43:	Wastewater Treatment Technologies [6] (p. 229)	6	Municipal Wastewater Treatment (E)	L/E	2		ngA [7] wE	1 5
			International Sanitary Engineering (E)	L/E	2			
M2S44:	Introduction to Environmental Data Analysis and Statistical Learning [6] (p. 139)	6	Introduction to Environmental Data Analysis and Statistical Learning (E)	L/E	4		ngA [7] wE	2 4
Sum compulsory elective modules		**162**			**48**	**58**		

explanations to Table 2:

general:

M2PX	Study Focus II, compulsory module
M2SXX	Study Focus II, compulsory elective module
LC	learning control
CP	credit point
HpW / SWS	hours per week
W / S	winter term / summer term
G / E	language German / English
1)	Starting this module in summer semester (S) is recommended.
2)	Starting this module in winter semester (W) is recommended.
3a)	Module must not be selected together with module M2S36.
3b)	Module must not be selected together with module M2S16.
4)	Module will not be offered anymore as from winter term 2019/20.
5)	Module will be offered newly as from summer term 2019.
6)	Module will be offered newly as from winter term 2019/20.

type of course:

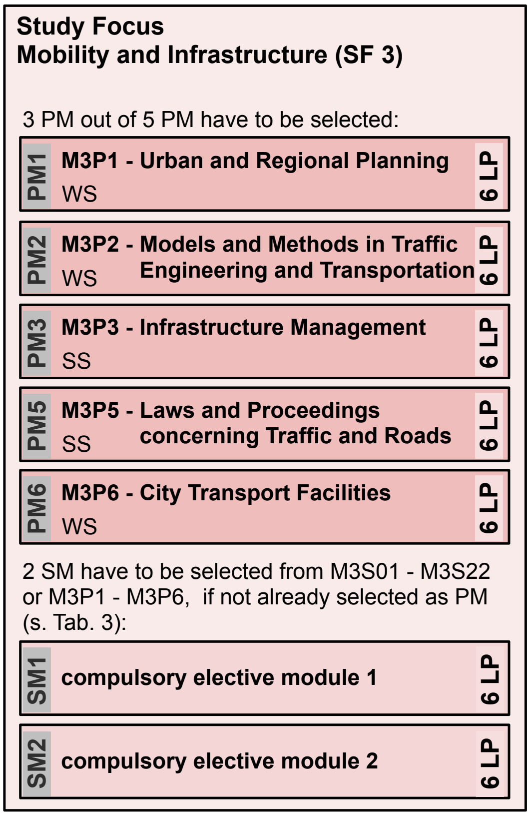
L	lecture
L/E	lecture and exercise, separate or integrated
L/P	lecture and practical course integrated
L/S	lecture and seminar integrated
E	exercise
S	seminar
F	field trip
Pj	study project

type of learning control:

wE	written examination
oE	oral examination
EoT	examination of other type, graded
ngA	not graded accomplishment
ngA [7]	not graded accomplishment as examination prerequisite

1.2.3 Study Focus 'Mobility and Infrastructure' (SF 3)

Civil Engineers in urban, regional and federal state planning or transportation, highway engineering and railroad are dealing with the provision and maintenance of transportation infrastructure. The graduates of the study focus '*Mobility and Infrastructure*' are able to design, construct and operate transportation systems under logistical, ecological and socio-economic aspects by means of deepened knowledge of the interrelationships between urban planing, regional planning, mobility behavior and required infrastructure.
All modules offered in the study focus 'Mobility and Infrastructure' are summarized in Table 3. This table provides also information in which semester the associated courses and how the course assessment take place.



In this study focus five compulsory modules are predetermined:

- Urban and Regional Planning
- Models and Methods in Traffic Engineering and Transportation Planning
- Infrastructure Management
- Laws and Proceedings concerning Traffic and Roads
- City Transport Facilities

At least three out of these five compulsory modules have to be selected. In case of selecting less than five compulsory modules the respective number of missing modules have to be selected from the offer of this study focus (Tab. 3).

Students selecting the study focus 'Mobility and Infrastructure' are recommended to attend one field trip of several days' duration. Normally, this takes place annually in the week following the Whitsun holidays.

Table 3: Modules in Study Focus Mobility and Infrastructure

Please note:
Only one module about railroads can be offered currently. Already begun modules can be completed.

Module Code (baui)	Module Name	Module CP	Course Name (Language)	Course Type	HpW / SWS W	HpW / SWS S	LC Type	LC CP
*compulsory modules *): 3 compulsory modules have to be selected, in total 18 CP.*								
M3P1:	Urban and Regional Planning *) (p. 220)	6	Urban Planning (G)	L/E	2		oE	6
			Regional Planning (G)	L	2			
M3P2:	Models and Methods in Traffic Engineering and Transportation Planning *) (p. 154)	6	Methods and Models in Transportation Planning (G)	L/E	2		oE	6
			Traffic Engineering (G)	L/E	2			
M3P3:	Infrastructure Management *) (p. 132)	6	Design and Construction of Highways (G)	L		2	wE	6
			Operation and Maintenance of Highways (G)	L		2		
M3P5:	Laws and Proceedings concerning Traffic and Roads *) (p. 141)	6	Laws concerning Traffic and Roads (G)	L		2	wE	6
			Environmental Impact Assessment (G)	L		1		
			Assessment and Evaluation Techniques (G)	L		1		
M3P6: (M3S17)	City Transport Facilities *) (p. 66)	6	City Transport Facilities (G)	L/E	4		ngA 4) oE	2 4
Sum compulsory modules		**30**			**12**	**8**		
*compulsory elective modules *): At least 2 modules out of the compulsory elective modules and the not already selected compulsory modules have to be selected, in total 12 CP.*								
M3S01:	Urban Renewal (p. 221)	6	Urban Management (G)	L/E		2	oE	3
			History of Urban Planning (G)	L		2	oE	3
M3S02:	Space and Infrastructure (p. 186)	6	Logistics, Supply and Disposal (G)	L/E		2	oE	6
			Fundamentals of Geographic Information Systems for Modelling and Planning (G)	L/E		2/2		
M3S03:	Traffic Management and Simulation Methods (p. 215)	6	Traffic Management and Transport Telematics (G)	L/E		2	oE	6
			Traffic Flow Simulation (G)	L/E		2		
M3S04:	Planning of Transportation Systems (p. 165)	6	Characteristics of Transportation Systems (G)	L		2	oE	6
			Strategic Transport Planning (G)	L		2		

Table 3: Modules in Study Focus Mobility and Infrastructure (continued)

Module Code (baui)	Module Name	Module CP	Course Name (Language)	Type	HpW / SWS W	HpW / SWS S	LC Type	LC CP
M3S05:	Highway Design (p. 122)	6	IT-based Road Design (G)	L/E	2		ngA [4] oE	1 5
			Highway Design Project Study (G)	L/E	2			
M3S06:	Road Construction (p. 177)	6	Practical Laboratory Training in Road Construction (G)	L/E	2		oE	6
			Pavement Structural Design and Failure Analysis (G)	L	2			
M3S09:	Project Integrated Planning [1] (p. 169)	6	Project Integrated Planning (G)	Pj	4		ngA [4] oE	5 1
M3S11:	Intermodality in Freight, Long-distance and Air Transport (p. 137)	6	Freight Transport (G)	L/E		2	wE	3
			Long-distance and Air Traffic (G)	L	2		wE	3
M3S12:	Road Safety (p. 178)	6	Safety Management in Highway Engineering (G)	L/E	2		ngA [4] oE	2 4
			Seminar in Highway Engineering (G)	S	2			
M3S13:	Special Topics in Highway Engineering (p. 191)	6	Technical and Economic Management Tools in Highway Engineering (G)	L		2	oE	6
			Simulations and Analysis Methods in Highway Engineering (G)	L		1		
			Special Topics in Highway Engineering (G)	L		1		
M3S18:	Track Guided Transport Systems - Operation and Capacity **#)** (p. 213)	6	Operation Track Guided Systems (G)	L		2	oE	6
			Operation Systems and Track Guided Infrastructure Capacity (G)	L		2		
M3S20:	Analysis and Evolution of Mobility (p. 41)	6	Transportation Data Analysis (G)	L/E	2		oE	6
			Mobility Services and new Forms of Mobility (G)	L		2		
M3S22:	Special Issues of Public Transport [2] (p. 188)	6	Tendering, Planning and Financing in Public Transport (G)	L		2	oE	3
			Seminar in Transportation [3] (G)	S	2	2	EoT	3
			Information Management for public Mobility Services (G)	L/E		2	EoT	3
Sum compulsory elective modules		**78**			**22**	**36**		

#) is the only module further offered about railroads !

explanations to Table 3:

general:

M3PX	Study Focus III, compulsory module
M3SXX	Study Focus III, compulsory elective module
LC	learning control
CP	credit point
HpW / SWS	hours per week
W / S	winter term / summer term
G / E	language German / English
1)	Taking this module in the first semester is not recommended.
2)	2 of these courses with the related learning controls have to be selected.
3)	Course is offered every semester.

type of course:

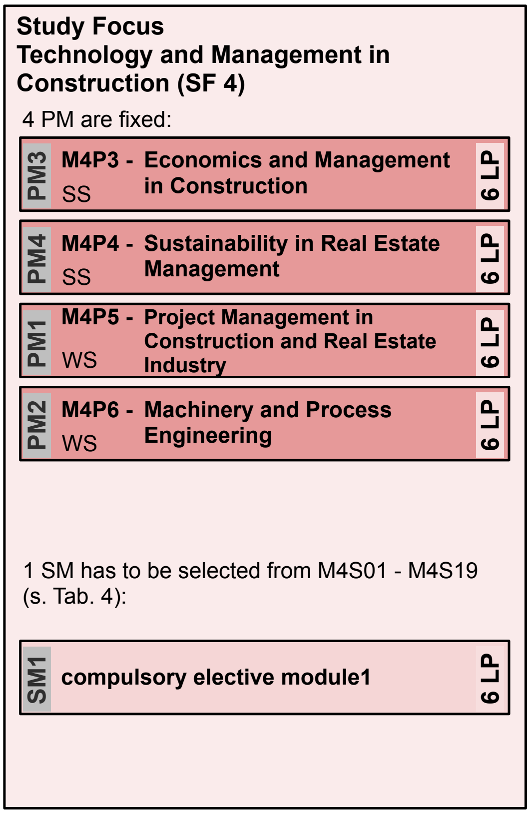
L	lecture
L/E	lecture and exercise, separate or integrated
E	exercise
S	seminar
Pj	study project

type of learning control:

wE	written examination
oE	oral examination
EoT	examination of other type, graded
ngA 4)	not graded accomplishment as examination prerequisite

1.2.4 Study Focus 'Technology and Management in Construction' (SF 4)

Civil engineers in construction management are dealing comprehensively with the life cycle of a building from planning to construction to demolition at the end of utilization. The graduates of the study focus '*Technology and Management in Construction*' can apply specifically their deepened knowledge in project management, process engineering and economics in construction operation as well as their knowledge in methods of project development and facility management for the solution of all problems, in order to realize optimally buildings in all fields of civil engineering by means of their broad understanding of the legal, economic and technical interrelationships.
All modules offered in the study focus 'Technology and Management in Construction' are summarized in Table 4. This table provides also information in which semester the associated courses and how the course assessment take place.



In this study focus four compulsory modules are predetermined:

- Project Management in Construction and Real Estate Industry
- Machinery and Process Engineering
- Economics and Management in Construction
- Sustainability in Real Estate Management

In addition one compulsory elective module has to be selected from the offer of this study focus (Tab. 4).

Beside numerous field trips as part of several lectures a one day field trip takes place annually at the beginning of the winter term. The attendance at this fall field trip is obligatory for students selected the study focus 'Technology and Management in Construction' (SF 4).
Furthermore, a 'large' field trip of several days' duration is offered also annually in the week following the Whitsun holidays. All students planning to prepare their master thesis in this study focus shall attend this once.

Table 4: Modules in Study Focus Technology and Management in Construction

Module			Course				LC	
Code (baui)	Name	CP	Name (Language)	Type	HpW / SWS W	S	Type	CP
compulsory modules								
M4P3:	Economics and Management in Construction (p. 88)	6	Cost Estimation (G)	L/E		2	ngA wE	1 5
			Building Laws (G)	L		2		
M4P4:	Sustainability in Real Estate Management (p. 203)	6	Sustainability in Real Estate Management (G)	L/E		2	wE	6
			Real Estate Life Cycle Management (G)	L		1		
			Facility and Real Estate Management II (G)	L		1		
M4P5:	Project Management in Construction and Real Estate Industry (p. 170)	6	Project Management in Construction and Real Estate Industry (G)	L/E	3/1		ngA ngA wE	1 1 4
M4P6:	Machinery and Process Engineering (p. 143)	6	Construction Equipement (G)	L	2		ngA wE	1 5
			Process Engineering (G)	L	2			
Sum compulsory modules		**24**			**8**	**8**		
compulsory elective modules								
M4S01:	Business and Human Resource Management (p. 64)	6	Business and Human Resources (G)	L/E		3	wE	6
			Site Management (G)	L		1		
M4S06:	Environmentally-friendly Recycling and Disassembly of Buildings (p. 94)	6	Project Studies (G)	L/E		1/1	oE	6
			Disassembly Process Engineering (G)	L		1/1		
M4S07:	Upgrading of Existing Buildings and Energetic Refurbishment (S. 218)	6	Upgrading of Existing Buildings (G)	L/E	3		EoT wE	1,5 4,5
			Energetic Refurbishment (G)	L	1			
M4S08:	Real Estate Management (p. 173)	6	Controlling in Real Estate Management (G)	L	1		oE	6
			Basics of Real Estate Valuation (G)	L	1			
			Corporate and Public Real Estate Management (G)	L	1			
			Project Development with Case Study (G)	L	1			
M4S09:	Lean Construction (p. 142)	6	Lean Construction (G)	L/E	4		EoT wE	1,5 4,5
M4S10:	Advanced Studies in Construction Engineering (p. 40)	6	Tunnel Construction and Blasting Engineering (G)	L	2		wE	6
			Operation Methods for Foundation and Marine Construction (G)	L	1			
			Operation Methods for Earthmoving (G)	L	1			

Table 4: Modules in Study Focus Technology and Management in Construction (continued)

Module Code (baui)	Module Name	Module CP	Course Name (Language)	Course Type	HpW / SWS W	HpW / SWS S	LC Type	LC CP
M4S12:	Decommissioning of Nuclear Facilities (p. 81)	6	Removal and Decontamination of Nuclear Facilities (G)	L/E	2		oE	6
			New Development and Optimization of Decommissioning Machine Technology (G)	L/E	2			
M4S13:	Facility Management in Hospitals and Hospital Management (p. 103)	6	Facility Management in Hospitals (G)	L/E	3		EoT	6
			Hospital Management (G)	L	1			
M4S15:	Turnkey Construction (p. 216)	6	Turnkey Construction I - Processes and Methods (G)	L		1	wE	6
			Turnkey Construction II - Trades and Technology (G)	L/E		2		
			Claim Management (G)	L		1		
M4S16:	Building Information Modeling (BIM) (p. 57)	6	Building Information Modeling (G)	L/E		4	EoT	6
M4S17:	Research Seminar Construction Management (p. 174)	6	Research Seminar Construction Management I (G)	S		2	oE	6
			Research Seminar Construction Management II (G)	S	2			
M4S18:	Equipement and special Construction Techniques in Building Practice (p. 96)	6	Equipement and special Construction Techniques in Building Practice I (G)	L	2		oE	6
			Equipement and special Construction Techniques in Building Practice II (G)	L		2		
M4S19:	Digitalization in Facility and Real Estate Management (p. 84)	6	Digitalization in Facility and Real Estate Management (G)	L/E	4		EoT	6
Sum compulsory elective modules		**78**			**32**	**20**		

explanations to Table 4:

general:

M4PX	Study Focus IV, compulsory module
M4SXX	Study Focus IV, compulsory elective module
LC	learning control
CP	credit point
HpW / SWS	hours per week
W / S	winter term / summer term
G / E	language German / English

type of course:

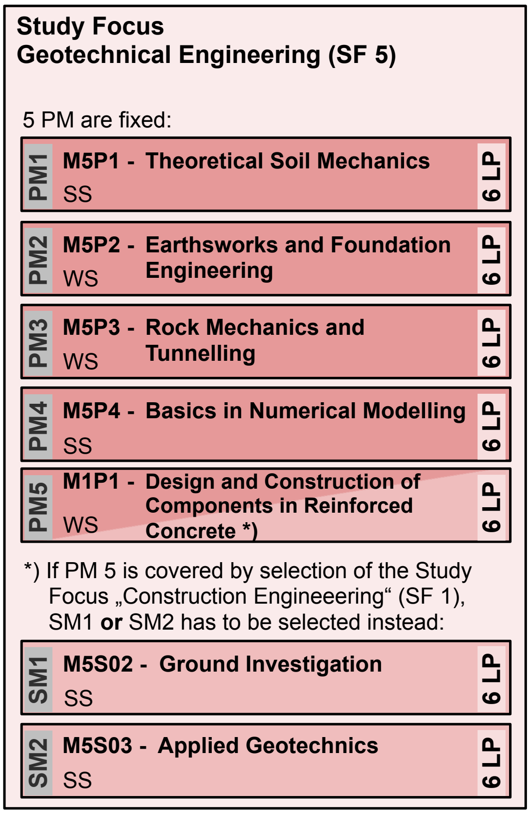
L	lecture
L/E	lecture and exercise, separate or integrated
S	seminar

tpye of learning control:

wE	written examination
oE	oral examination
EoT	examination of other type, graded
ngA	not graded accomplishment

1.2.5 Study Focus 'Geotechnical Engineering' (SF 5)

Civil engineers in geotechnics are dealing with all aspects of the interaction between (underground) structures or infrastructures and the surrounding soil or rock. The graduates of the study focus '*Geotechnical Engineering*' are prepared very well for the interface of civil engineering and geosciences regarding problems of preservation, utilization and design of the ground as living and cultural space, in particular of planning, designing and constructing underground structures and infrastructure, by their broad professional expertise in material science and construction.
All modules offered in the study focus 'Geotechnical Engineering' are summarized in Table 5. This table provides also information in which semester the associated courses and how the course assessment take place.



In this study focus five compulsory modules are predetermined:

- Theoretical Soil Mechanics
- Earthworks and Foundation Engineering
- Rock Mechanics and Tunnelling
- Basics in Numerical Modelling
- Design and Construction of Components in Reinforced Concrete

In case that the compulsory module Design and Construction of Components in Reinforced Concrete (M1P1) is already allocated by the selection of Construction Engineering as second focus one of the compulsory elective modules M5S02 and M5S03 has to be selected instead.

Starting the study in the winter term it is recommended to attend the compulsory module Basics in Numerical Modelling (M5P4) in advance to the compulsory module Theoretical Soil Mechanics (M5P1) if the basics in mathematics and continuum mechanics are not obtained otherwise. Generally, the study can be started with M5P2, M5P4 and M1P1 in winter term and likewise with M5P1, M5P3 and eventually M5S02 or M5S03 in summer term.
A few compulsory elective modules are depending in content and difficulty on compulsory modules, so that the compliance of an order is recommended. These are:

- Special Issues of Soil Mechanics (M5S01) following Theoretical Soil Mechanics (M5P1)
- Applied Geotechnics (M5S03) following Earthworks and Foundation Engineering (M5P2)
- Ground Water and Earth Dams (M5S04) following Earthworks and Foundation Engineering (M5P2)
- Rock Engineering and Underground Construction (M5S05) following Rock Mechanics and Tunnelling (M5P3)
- Numerical Modelling in Geotechnics (M5S06) following Basics in Numerical Modelling (M5P4)
- Coupled Geomechanical Processes (M5S10) following Rock Mechanics and Tunnelling (M5P3)

The attendance of the annual Whitsun excursion of the Institute of Soil Mechanics and Rock Mechanics (IBF) is recommended at least once during the master program.

Table 5: Modules in Study Focus Geotechnical Engineering

Module			Course				LC	
Code (baui)	Name	CP	Name (Language)	Type	HpW / SWS W	S	Type	CP
compulsory modules								
M5P1:	Theoretical Soil Mechanics (p. 208)	6	Theoretical Soil Mechanics (G)	L/E		4	wE	6
M5P2:	Earthworks and Foundation Engineering (p. 86)	6	Foundation Types (G)	L/E	2		ngA wE	2 4
			Basics in Earthworks and Embankment Dams (G)	L/E	2			
M5P3:	Rock Mechanics and Tunnelling (p. 181)	6	Basics in Rock Mechanics (G)	L/E		2	ngA wE	1 5
			Basics in Tunnel Construction (G)	L/E		2		
M5P4:	Basics in Numerical Modelling 1) (p. 53)	6	Continuum Mechanics (G)	L	2		oE	3
			Numerics in Geotechnics (G)	L	2		oE	3
M1P1:	Design and Construction of Components in Reinforced Concrete *) (p. 83)	6	Design and Construction of Components in Reinforced Concrete (G)	L/E	2/2		ngA wE	2 4
Sum compulsory modules		**30**			**12**	**8**		
compulsory elective modules								
M5S01:	Special Issues of Soil Mechanics (p. 190)	6	Unsaturated, Viscous and Cyclic Soil Behaviour - Theory and Element Tests (G)	L/E	2		oE	6
			Soil Dynamics (G)	L/E	2			
M5S02:	Ground Investigation *) (p. 117)	6	Soil Mechanical Laboratory Exercises (G)	E		2	oE	6
			Geomechanical Field Exercise (G)	E		2		
M5S03:	Applied Geotechnics *) (p. 48)	6	Foundations and Retaining Structures (G)	L/E		2	oE	6
			Special Foundation Engineering and Design (G)	L/E		2		
M5S04:	Ground Water and Earth Dams (p. 118)	6	Geotechnical Ground Water Problems (G)	L/E		2	oE	6
			Embankment Dams (Advanced) (G)	L/E		2		
M5S05:	Rock Engineering and Underground Construction (p. 179)	6	Aboveground Rock Engineering (G)	L/E	2		wE	6
			Tunnel Construction in Soils and in Existence (G)	L/E	2			
M5S06:	Numerical Modelling in Geotechnics (p. 162)	6	Exercises in Numerical Modelling (G)	E		2	oE	6
			FEM Applications in Geotechnical Modelling (G)	L		2		

*) Since module M1P1 is already taken by combination with Study Focus I 'Construction Engineering', module M5S02 or M5S03 has to be selected instead.

Table 5: Modules in Study Focus Geotechnical Engineering (continued)

Module			Course				LC	
Code (baui)	Name	CP	Name (Language)	Type	HpW / SWS W	S	Type	CP
M5S07:	Geotechnical Testing and Measuring Technology (p. 113)	6	Rock Testing (G)	L	1		oE	6
			Testing in Dam and Wastefill Engineering (G)	L	1			
			Geotechnical Measuring Technology (G)	L/E	2			
M5S08:	Special Underground Engineering (p. 193)	6	Ground Improvement, Grouting and Soil Freezing (G)	L/E		2	oE	3
			Anchoring, Piling and Slurry Wall Technology (G)	L/E		2	oE	3
M5S09:	Environmental Geotechnics (p. 92)	6	Landfills (G)	L/E	2		oE	3
			Brownfield Sites - Investigation, Evaluation, Rehabilitation (G)	L	2		oE	3
M5S10:	Coupled Geomechanical Processes (p. 79)	6	Special Issues in Rock Mechanics (G)	L/E	2		oE	6
			Coupled Phenomena in Geomechanics (G)	L/E	2			
Sum compulsory elective modules		**60**			**20**	**20**		

explanations to Table 5:

general:

M5PX	Study Focus V, compulsory module
M5SXX	Study Focus V, compulsory elective module
LC	learning control
CP	credit point
HpW / SWS	hours per week
W / S	winter term / summer term
G / E	language German / English
1)	Module must not be selected together with module M1S32 (SF 1).

type of course:

L	lecture
L/E	lecture and exercise, separate or integrated
E	exercise

type of learning control:

wE	written examination
oE	oral examination
ngA	not graded accomplishment

1.3 Mentoring, module selection, individual curriculum

The selection options within the study require that each student compiles an individual curriculum (comp. ER/SPO § 19 Par. 4). This comprises the selection of the two study focuses with the respective modules and the selection of the modules within the subject Subject-Specific Supplements (supplementary modules). This selection has to be supervised by a mentor chosen by the student (comp. ER/SPO § 17a). The mentor has to be a professor of the KIT-Department Civil Engineering, Geo and Environmental Sciences and to be involved in one of the selected study focuses.
By the selection of the study focuses the respective **compulsory modules** are determined (s. Tab. 1-5). According to the predefined number of compulsory modules the necessary number of **compulsory elective modules** have to be taken from the list of the respective selected study focus in order to take modules in amount of 30 CP within the respective study focus. Within the subject Subject-Specific Supplements four **compulsory or compulsory elective modules** from all study focuses of the master degree program Civil Engineering, if not already selected, or from any related one have to be selected freely.
The module **Interdisciplinary Qualifications** (p. 135, comp. also ER/SPO § 15a) compiles the student by herself or himself respectively with an extent of 6 CP from the respective offering of the KIT House of Competence (HoC) or the Centre for Cultural and General Studies (ZAK). In special cases the Examination Committee Master can accept further suitable courses as interdisciplinary qualifications which are not included in the offers of HoC and ZAK as mentioned above. The module Interdisciplinary Qualifications is completed without grade. After consultation with the lecturer a grade can be reported but is not included in the calculation of the grade.
For the selection of the modules within the study focuses and the complementary studies the forms for module selection available on the web page of the Examination Committee Master, `https://www.tmb.kit.edu/PAM.php`, has to filled in by the student and to by transferred by the mentor to the study program coordinator (s. p. 34) to be stored in the Campus Management System. The module selection shall be stored there in time to register for the exams in the first semester of the master degree program (comp. ER/SPO § 19 Par. 4), so that the management of the examinations (registration, deregistration if applicable, result booking etc.) can be processed smoothly. The individual curriculum can be viewed any time via the portal Campus Management for Students, `https://campus.studium.kit.edu`.
The selection of the modules have to be made with care. On the one hand, the assignment of the modules to the respective part of the program, Focus Study or Complementary Study respectively, will be transferred to the master degree certificate. On the other hand, changes of the module selection has to be agreed by the selected mentor and should be limited to exceptional cases, e.g. if a compulsory elective module is not offered at short notice. As far as the respective module is not yet begun, changes of the module selection are generally possible.

1.4 Beginning and completion of a module

Every module and every examination is allowed to be credited only once (comp. ER/SPO § 7 Par. 5). The binding decision whether a module is selected is made by the student at the time of registering for the corresponding examination, also partial examination (comp. ER/SPO § 5 Par. 2). The student can reset this binding selection by deregistration in time. After attendance of the examination, especially of a partial examination, a module cannot be replaced by another one any more. By request to the examination committee the assignment can be changed.
A module is **completed** if the general examination of the module has been passed (grade min. 4.0). In case that the module examination consists of several partial examinations, it holds: The module is completed if all partial examinations are passed (grade min. 4.0) so that the minimum requirement of credits of this module have been met.

1.5 Registration, deregistration, repetition of examinations

The **registration** to examinations, also to not graded accomplishments and examination prerequisites, takes place online via the portal Campus Management for Students, `https://campus.studium.kit.edu`. The following functions can be accessed there after login:

- register to and deregister from examinations
- retrieve examination results
- print transcript of records

A successful online registration covers the admission to the examination. A confirmation for this is provided by the portal Campus Management for Students and can serve as proof for a made registration in case of doubts. If there occurs a problem with an attempt of an online registration the study program coordinator (s. p. 34) has to be informed as soon as possible in addition to the examiner. In case of an oral examination the online registration is to be combined directly with the negotiation of an examination date with the examiner.
A registered examination is either to be taken or a **deregistration** has to be made in advance to the deadline of deregistration. In particular, this is valid if e.g. the date of on oral examination is shifted to the next semester because

the management of the examinations has to be made in terms of the semester. The rules for the deregistration from an examination are given by the ER/SPO § 10. The deregistration from examinations of other kinds as well as from not graded accomplishments (ER/SPO § 10 Par. 3) have to be made latest at the date of submission or presentation.
Principally, a failed examination can be repeated once, latest by the end of the examination period of the next but one semester to this examination (comp. ER/SPO § 8 Par. 6). If failing a written repeat examination an oral repeat examination can be taken. This is part of the repeat examination and will not be evaluated independently. After an oral repeat examination the overall grade of the repeat examination is determined, either grade 4.0 (passed) or grade 5.0 (failed).
If the **repeat examination** (including an oral repeat examination) will be failed as well, the **examination claim** is lost. A potential request for a **second repetition** has to be made without delay after loosing the examination claim. Requests for a second repetition of an examination require the approval of the examination committee. A counseling interview is mandatory.
Further information is available in the examination regulation (ER/SPO, http://www.sle.kit.edu/imstudium/master-bauingenieurwesen.php) and from the Examination Committee Master or the 'Fachschaft' (student council) (s. p. 34).

1.6 Students with disability or chronic disease

Students with disability or chronic disease have the opportunity to get preferred access to participation limited courses, to adapt the order of taking certain courses to their requirements, or to take examinations of single modules in individually arranged form or period ('Nachteilsausgleich' - reconcilement of disadvantage , comp. ER/SPO § 13). The student has to present the respective attests.
The student submits an informal request with the respective attests to the examination committee. The examination committee defines in agreement with the examiner the details for the respective examination and informs the student in time.

1.7 Crediting and recognition of already obtained accomplishments

Already obtained accomplishments can by recognized generally under the conditions of the ER/SPO (comp. ER/SPO § 18). The recognition has to be made with the respective recognition form of the Examination Committee Master (https://www.tmb.kit.edu/PAM.php). There, it has to be stated unambiguously at which place in the curriculum the recognized accomplishment has to be credited.
If the accomplishments are mainly **identical** with modules from the curriculum (name, objectives, content) this is confirmed on the form by the respective lecturer.
If the accomplishments are **not identical** with modules from the curriculum they can be recognized as well, if the obtained competences contribute to achieve the qualification goals of the study program. These are included into the individual curriculum in agreement with the mentor. The recognition is made by the Examination Committee Master. Usually, modules in extent of 12 CP at maximum can be credited in the subject Subject-Specific Supplements. Additional credit points get lapsed.
The recognition of accomplishments obtained **outside of the higher education system** is made also with the respective recognition form of the Examination Committee Master (https://www.tmb.kit.edu/PAM.php). A recognition is possible if the obtained competences contribute to achieve the qualification goals of the study program. The Examination Committee Master examines in which extent the obtained knowledge and skills can be recognized and which parts of the higher education study can be replaced by them. It is allowed to replace not more than 50 % of the higher education study. These are included in the individual curriculum in agreement with the mentor.
The recognition form has to be submitted to the Examination Committee Master which transfers it for booking the accomplishments. Further information about recognitions can be found on the web page of the Examination Committee Master (https://www.tmb.kit.edu/PAM.php).

1.8 Admission, preparation and completion of the master thesis

The **Master Thesis** has to be prepared usually in semester 4 in one of the selected study focuses (p. 155, comp. also ER/SPO § 14). The topic of the master thesis has to be assigned by a professor either of the Department of Civil Engineering, Geo- and Environmental Sciences or of a domestic or foreign institution of higher education of the state or officially recognized by the state. The wishes of the students may be respected when formulating the topic. In case that the master thesis shall be prepared outside of KIT the leaflet 'Merkblatt - Externe Abschlussarbeiten' (http://www.haa.kit.edu/downloads/KIT_ALLGEMEIN_Merkblatt_Externe_Abschlussarbeiten.pdf) has to be considered.
Those are admitted to the master thesis who has passed successfully modules of extent of minimum 42 CP within the master program Civil Engineering. Obtained results in the module Interdisciplinary Qualifications cannot be counted for this purpose. The **application for admission** has to be made online via the portal Campus Management for Students. The **admission** to the master thesis is made by the study program coordinator (s. p. 34) after approval of the prerequisites, e.g. by submitting an up to date transcript of records. The registration for the master thesis is made at the 'Studierendenservice' (students' service) with the form http://www.sle.kit.edu/downloads/Sonstige/Pruefungszulassung-Abschlussarbeit.pdf.
The duration of preparation is six months. The master thesis can be written in another language than German. It has to be completed by a **presentation** that is considered in the grading within one month after submission. It is very much recommended to have gained already all technical and soft skills required for the preparation of the topic of the master thesis before beginning the thesis project.

1.9 Additional accomplishments

An **additional accomplishment** is a voluntarily taken examination, which is not considered in the overall grade (comp. ER/SPO § 15). In total, additional accomplishments can be taken in extent of 30 CP at maximum from the entire offer of KIT. An additional accomplishment has to be admitted as such by the Study Program Service of the department ('Studiengangservice Bau-Geo-Umwelt'; s. p. 34) with the examination form available there. The examination form has to be delivered to the examiner as registration and for the transfer of the obtained grade within the registration period. By request to the examination committee the assignment can by changed subsequently.
All taken additional accomplishments are listed in the transcript of records. If a module is completed this module can be included in the master degree certificate as additional module on request by the student at the Study Program Service ('Studiengangservice Bau-Geo-Umwelt', s. p. 34). This applies also to additional accomplishments which were recognized by the examination committee.

2 Further information

2.1 About the module handbook ...

The **module handbook** is the relevant document in which the structure of the program is described and therefore it provides assistance for the orientation during the study. It describes the modules belonging to the program and contains information about:

- the structure of the modules,
- the extent of the modules (in CP),
- the interdependencies of the modules,
- the learning outcomes of the modules,
- the type of assessment and examinations,
- the computation of the grade of the module and
- the placement of the module in the course of study.

Each module consists of one or more interrelated courses, which are completed by one or more **examinations** or **not graded accomplishment**. The extent of each module is characterized by 6 CP, which will be credited after the successful completion of the module. The module handbook provides the necessary information that the students can customize content and time schedule of the interdisciplinary study according to personal needs, interest and job perspective.
In addition to the module handbook the **course catalog** and the institutes (web pages) provide important information. These are updated every semester concerning variable course details (e.g. time and location of the course) as well as short-term modifications.

2.2 About module examinations, examination committee ...

The module examinations can be taken as a general examination or as several partial examinations. If the module examination is offered as a **general examination**, the entire content of the module will be reviewed in a single examination. If the module examination consists of **partial examinations**, the content of each course will be reviewed in corresponding partial examinations. Then the module examination can be taken over several semesters. Also not graded accomplishments can be part of the module examination, e.g. as examination prerequisites.
The Examination Committee Master (`https://www.tmb.kit.edu/PAM.php`) is responsible for all legal questions in the context of examinations. For instance, all requests on second repetition, extension of deadlines or recognitions are submitted to this. It decides about their approval.

2.3 About changes in module offer ...

The offer of modules changes in the course of the semesters. Modules can be discontinued or added or the module examination may change. If possible, such changes are announced in the module handbook with sufficient time in advance, at latest at the beginning of the semester as from they are valid (s. p. 35).
Usually, it is valid that students started a module (s. selection and completion of a module) can complete this in that form as started. The respective examinations are provided onwards over a certain time period usually at least one semester after time of change. In general, a consultation with the examiner is recommended in such a case.

2.4 Contact persons

Dean of Study Affairs:

Prof. Dr. Peter Vortisch
Institute for Transport Studies, Bldg. 10.30, R. 305
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2.5 Abbreviations

LP/CP	credit points	Leistungspunkte
LV	course	Lehrveranstaltung
P	practical training	Praktikum
Pj	project	Projekt
S	seminar / summer term	Seminar / Sommersemester
Sem.	semester	Semester
ER/SPO	examination regulations	Studien- und Prüfungsordnung
ÜQ	Interdisciplinary Qualifications	Überfachliche Qualifikationen
HpW/SWS	contact hour per week	Semesterwochenstunde
E/Ü	exercise	Übung
L/V	lecture	Vorlesung
W	winter term	Wintersemester

3 Current changes

In the following, the important changes are listed as from summer term 2019. Although this process was done with great care, other/minor changes may exist.

modules not offered any more as from summer term 2019:

Contact Mechanics - Fundamentals and Basics [bauiM1S35-KONTMECH-BASICS]
Contact Mechanics - Computational Algorithms in a geometrically exact Form [bauiM1S36-KONTMECH-ALGOR]
Experimental Techniques II: Measurement Techniques [bauiM2S18-SM4]
Wastewater and Storm Water Treatment [bauiM2S40-SW7]
Water Ecology [bauiM2S41-SW8]
Process Engineering in Wastewater Treatment [bauiM2S43-SW10]

modules offered newly as from summer term 2019:

Wastewater and Storm Water Treatment Facilities [bauiM2S40-SW7], replaces module Wastewater and Storm Water Treatment [bauiM2S40-SW7]
Freshwater Ecology [bauiM2S41-SW8], replaces module Water Ecology [bauiM2S41-SW8]

modules not offered any more as from winter term 2019/20:

Aquatic Ecosystems [bauiM2S06-HY6]
Environmental Communication [bauiM2S07-HY7]

modules offered newly as from winter term 2019/20:

Contact Mechanics [bauiM1S41-KONTMECH], replaces modules Contact Mechanics - Fundamentals and Basics [bauiM1S35-KONTMECH-BASICS] and Contact Mechanics - Computational Algorithms in a geometrically exact Form [bauiM1S36-KONTMECH-ALGOR]
Wastewater Treatment Technologies [bauiM2S43-SW10], replaces module Process Engineering in Wastewater Treatment [bauiM2S43-SW10]
Introduction to Environmental Data Analysis and Statistical Learning [baui2S44-ENVDAT]

changes of the courses assigned to the modules as from summer term 2019:

Industrial Water Management [bauiM2S29-SW6]:
The course Industrial Water Management (6223810), 4 HpW / SWS, is newly offered.
Urban and Regional Planning [bauiM3P1-PLSTAREG]:
The course Urban Planning (6231701), 2 HpW / SWS, is offered one time only in summer term 2019.

changed examinations and not graded accomplishments as from summer term 2019:

All not graded accomplishments are assigned with credit points. Therefore, the credit points of the examinations are adapted.

Basics of Finite Elements [bauiM1S20-GRUNDFE]:
The not graded accomplishment 'Homework Basics of Finite Elements' is additional part of the module.
Building Physics II [bauiM1S28-BAUPH-II]:
The partial examination 'Homework Practical Noise Control' consists of an examination of other type and is additional part of the module.
Industrial Water Management [bauiM2S29-SW6]:
The not graded accomplishment 'Lab report Industrial Water Management' is additional part of the module as examination prerequisite.

City Transport Facilities [bauiM3S17-STRIVA]:

The not graded accomplishment 'Exercises and student research project City Transport Facilities' is additional part of the module as examination prerequisite.

Highway Design [bauiM3S05-STRENTW]:

The not graded accomplishment 'Study project Design of a Rural Road' is additional part of the module as examination prerequisite.

Project Integrated Planning [bauiM3S09-PROJEKTIP]:

The not graded accomplishment 'Group exercise Project Integrated Planning' is additional part of the module as examination prerequisite.

Road Safety [bauiM3S12-STRVSICH]:

The not graded accomplishment 'Seminar paper Road Safety' is additional part of the module as examination prerequisite.

Part II
Modules

M Module: Advanced Computational Fluid Dynamics (bauiM2S21-NS2) [M-BGU-103384]

Responsibility: Markus Uhlmann

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften
Curricular Embedding: Compulsory Elective
Contained in: Study Focus / Water and Environment

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each summer term	1 term	English	2

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-106769	Parallel Programming Techniques for Engineering (S. 348)	3	Markus Uhlmann
T-BGU-106768	Numerical Fluid Mechanics II (S. 343)	3	Markus Uhlmann

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-106768 with oral examination according to § 4 Par. 2 No. 2
- 'Teilleistung' T-BGU-106769 with oral examination according to § 4 Par. 2 No. 2
details about the learning controls see at the respective 'Teilleistung'

Grade of the Module
grade of the module is CP weighted average of grades of the partial exams

Prerequisites
module Numerical Fluid Mechanics [bauiM2P5-NUMFLMECH] must be completed

Modeled Conditions
The following conditions must be met:

- The module [M-BGU-103375] *Numerical Fluid Mechanics* must have been passed.

Qualification Goals
Students are able to numerically solve simplified flow problems based upon the Navier-Stokes equations in an independent fashion. This involves the design of a solution method, the analysis of its properties (concerning stability, precision, computational effort), the algorithmic implementation, the validation with respect to appropriate test cases, and the final documentation of the results. Furthermore, participants of this course are enabled to judge techniques for the use of massively parallel computer systems to solve fluid mechanics problems as to their efficiency and applicability. They are capable of applying the appropriate parallel programming techniques to selected model problems.

Content
In the present module, advanced skills in the numerical solution of fluid mechanics problems are imparted, building upon the material of the course Numerical Fluid Mechanics I. Here, various numerical solution methods for the time-dependent Navier-Stokes equations in several spatial dimensions are demonstrated with the aid of practical examples. This includes the following aspects: coupling and decoupling of velocity and pressure fields in incompressible flows, numerical treatment of discontinuities (shock waves, hydraulic jumps), computation of scalar transport, numerical tracking of inertial particles, linear stability analysis.The course Parallel Programing Techniques for Engineering Problems conveys the fundamental programming concepts for massively-parallel computer systems. First, the common parallel computer architectures and the most widely used programming paradigms are introduced. Then techniques for implementing standard algorithms of

numerical fluid mechanics (and other disciplines involving field problems) are presented, analyzed and practiced with the aid of the Message Passing Interface (MPI) standard.

Recommendations
Programing skills in at least one compiler language (C,C++, FORTRAN or equivalent)

Remarks
none

Literature
C. Hirsch “Numerical computation of internal and external flows” Butterworth-Heinemann, 2nd edition, 2007.J.H. Ferziger and M. Peric “Computational Methods for Fluid Dynamics”, Springer, 3rd edition, 2001.N. Carriero “How to Write Parallel Programs: A First Course”, MIT Press, 1990.T.G. Mattson, B.A. Sanders, B.L. Massingill “Patterns for Parallel Programming” Addison-Wesley, 2004.M. Snir, S. Otto, S. Huss-Lederman, D. Walker, J. Dongarra “MPI: The Complete Reference”, MIT Press, 1995.

Workload
contact hours (1 HpW = 1 h x 15 weeks):

- Parallel Programming Techniques for Engineering Problems lecture, exercise: 30 h
- Numerical Fluid Mechanics II lecture, exercise: 30 h

independent study:

- preparation and follow-up lectures, exercises Parallel Programming Techniques for Engineering Problems: 30 h
- examination preparation Parallel Programming Techniques for Engineering Problems (partial exam): 30 h
- preparation and follow-up lectures, exercises Numerical Fluid Mechanics II: 30 h
- examination preparation Numerical Fluid Mechanics II (partial exam): 30 h

total: 180 h

M Module: Advanced Fluid Mechanics (bauiM2P9-ADVFM) [M-BGU-103359]

Responsibility: Olivier Eiff

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Water and Environment

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each summer term	1 term	English	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-106612	Advanced Fluid Mechanics (S. 238)	6	Olivier Eiff

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-106612 with written examination according to § 4 Par. 2 No. 1
details about the learning control see at the 'Teilleistung'

Grade of the Module
grade of the module is grade of the exam

Prerequisites
none

Qualification Goals
Students acquire a firm understanding of the fundamental mechanics of fluids with emphasis towards environmental flows on the basis of the local conservation laws. They are able to differentiate and apply the different set of assumptions and methods in order to better understand the different flow classes and solutions. They are capable of solving basic flow problems after forming the relevant assumptions. Participants are able to use the knowledge and competence gained for more detailed and applied studies of environmental flows.

Content
This module covers the fundamental mechanics of fluids forming the foundation of environmental fluid mechanics. The approach is based on the basic local conservation laws. Emphasis is on the phenomena and the possible analytical solutions associated with the various flow classes. Topics covered include the general and special forms of the governing equations, flow kinematics, viscous incompressible flows, ideal-fluid flows, shallow flows, and buoyancy effects in fluids. Waves and turbulence are also addressed as well as different methods of analysis such as scaling.

Recommendations
modules Hydromechanics [bauiBGP04-HYDRO] and Advanced Mathematics for Civil Engineers [bauiBGP05-HM1, bauiBGP06-HM2, bauiBGP08-HM3, bauiBFW1-PDGL] (analysis, differential and integral calculus, ordinary and partial differential equations, linear algebra, Fourier analysis, complex numbers)

Remarks
none

Literature
I.G. Currie, Fundamental Mechanics of Fluids, Fourth Edition 2012

Workload
contact hours (1 HpW = 1 h x 15 weeks):
- lecture/exercise: 60 h

independent study:
- preparation and follow-up lecture/exercises: 30 h
- home work on exercises: 30 h
- examination preparation: 60 h

total: 180 h

M Module: Advanced Studies in Construction Engineering (bauiM4S10-) [M-BGU-100344]

Responsibility: Shervin Haghsheno

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Technology and Management in Construction

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each winter term	1 term	German	2

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-108003	Advanced Studies in Construction Engineering (S. 239)	6	Shervin Haghsheno

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-108003 with written examination according to § 4 Par. 2 No. 1
details about the learning control see at the 'Teilleistung'

Grade of the Module
grade of the module is grade of the exam

Prerequisites
none

Qualification Goals
see German version

Content
see German version

Recommendations
none

Remarks
none

Workload
contact hours (1 HpW = 1 h x 15 weeks):

- Tunnel Construction and Blasting Engineering lecture: 30 h
- Operation Methods for Foundation and Marine Construction lecture: 15 h
- Operation Methods for Earthmoving lecture: 15 h

independent study:

- preparation and follow-up lectures Tunnel Construction and Blasting Engineering: 30 h
- preparation and follow-up lectures Operation Methods for Foundation and Marine Construction: 15 h
- preparation and follow-up lectures Operation Methods for Earthmoving: 15 h
- examination preparation: 60 h

total: 180 h

M Module: Analysis and Evolution of Mobility (bauiM3S20-VERANAMOB) [M-BGU-100583]

Responsibility: Martin Kagerbauer

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Mobility and Infrastructure

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each term	2 terms	German	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-101004	Analysis and Evolution of Mobility (S. 240)	6	Martin Kagerbauer

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-101004 with oral examination according to § 4 Par. 2 No. 2
details about the learning control see at the 'Teilleistung'

Grade of the Module
grade of the module is grade of the exam

Prerequisites
none

Qualification Goals
The students master the methods to capture and to analyse the mobility behaviour of the people and recognize trends in the behaviour. They know up to date mobility offers and are able to evaluate these from the point of view of users and operators.

Content
- capturing mobility: measurements and surveys, data preparation
- analysis: statistical methods and software tools therefore (SAS, R), also practical exercises at PC
- new forms of mobility, e.g. sharing systems for cars and bicycles
- mobility services: rideshare services, intermodal information systems etc.
- analysis of functionality, interrelations and backgrounds of these mobility forms

Recommendations
course Transportation (6200406)

Remarks
none

Workload
contact hours (1 HpW = 1 h x 15 weeks):
- Transportation Data Analysis lectures/exercises: 30 h
- Mobility Services and new Forms of Mobility lectures/exercises: 30 h

independent study:
- preparation and follow-up Transportation Data Analysis lectures/exercises: 30 h
- preparation and follow-up Mobility Services and new Forms of Mobility lectures/exercises: 30 h
- examination preparation: 60 h

total: 180 h

M Module: Analysis of Spatial Data (bauiM2S04-HY4) [M-BGU-103762]

Responsibility: Erwin Zehe

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften
Curricular Embedding: Compulsory Elective
Contained in: Study Focus / Water and Environment

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each summer term	1 term	English	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-106605	Geostatistics (S. 297)	6	Erwin Zehe

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- ‘Teilleistung’ T-BGU-106605 with oral examination according to § 4 Par. 2 No. 2
details about the learning control see at the ‘Teilleistung’

Grade of the Module
grade of the module is grade of the exam

Prerequisites
none

Qualification Goals
Students can explain and apply methods for analysis and simulation of spatially and temporally distributed environmental data. Based on this, they are capable of setting up experimental designs for environmental monitoring and evaluate the suitability of available data for different tasks.
Students are able to critically assess the results of analysis and simulation tools and to quantify and evaluate the related uncertainties.

Content
- fundamentals of environmental systems theory, environmental monitoring and experimental design (data types, scale triplet, measuring methods)
- experimental variograms, directional variograms, indicator variograms, variogram fitting, anisotropy
- Kriging techniques: Ordinary Kriging, screening properties of Kriging, BLUE, pure nugget effect, cross validation, RMSE
- estimation of spatial patterns in nonstationary data (External Drift Kriging, Simple Updating)
- simulation of spatial patterns: turning Bands Simulation, smoothing problems of interpolation

Recommendations
basic knowledge in statistics
module Hydrological Measurements in Environmental Systems [bauiM2S05-HY5]
knowledge of programming with Matlab; otherwise, it is strongly recommended to attend the course ‘Introduction to Matlab’ (6224907)

Remarks
This module is offered newly as from summer term 2018.

Literature
Bárdossy, A. (2001): Introduction into Geostatistics. Inst. f. Wasserbau, Universität Stuttgart.
Kitanidis, P. K. (1999): Introduction into Geostatistics. Applications in Hydrogeology. Cambridge University Press.
Bras, R. L. and Rodriguez-Iturbe, I. (1985): Random Functions and Hydrology. Addison-Wesley Massachusetts.
Brooker, I. (1982): Two-dimensional simulation by turning bands. Math. Geology 17 (1).

Workload
contact hours (1 HpW = 1 h x 15 weeks):

- lecture/exercise: 60 h

independent study:

- preparation and follow-up lecture/exercises: 60 h
- examination preparation: 60 h

total: 180 h

M Module: Analysis of Turbulent Flows (bauiM2S32-NS3) [M-BGU-103363]

Responsibility: Markus Uhlmann

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Water and Environment

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each summer term	2 terms	English	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-103561	Analysis of Turbulent Flows (S. 241)	6	Markus Uhlmann

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-103561 with oral examination according to § 4 Par. 2 No. 2
details about the learning control see at the 'Teilleistung'

Grade of the Module
grade of the module is grade of the exam

Prerequisites
none

Qualification Goals
Participants are able to describe the characteristics of turbulent flows, and to quantify their effect upon the transport rates of momentum, heat and mass. They are aware of the problems associated with computationally determining turbulent flow quantities. With this knowledge, they are able to weigh the prosand cons of the different modeling approaches; they are further able to choose an appropriate approach for a given application. Participants have the ability to critically evaluate the expected outcome of a range of turbulence models with respect to their predictive capabilities and the required computational effort.

Content
The present module gives a general introduction to the analysis of turbulent flows. The mathematical description of the physics of turbulence is successively developed, i.e. the properties of the conservation laws, the required mathematical tools and the most useful modeling approaches for fluids engineering problems.
The course Fluid Mechanics of Turbulent Flows presents the phenomenology of turbulent flows, introduces the statistical description of turbulent flow processes, discusses the characteristics of free and wall-bounded shear flows, and presents an analysis of the turbulent energy cascade.
In the course Modeling of Turbulent Flows - RANS and LES, first the statistical approach to turbulence modeling, based upon Reynolds averaging (RANS) is presented, starting with the simplest algebraic model and ranging up to Reynolds stress transport models. Furthermore, an introduction to the concept of large-eddy simulation (LES) is given.

Recommendations
Basic fluid mechanics (experience in working with the Navier-Stokes equations)
Mathematics (analysis – partial differential equations, Fourier series, vectors/tensors, matrices and eigenvalues; statistics)
Knowledge in programming with Matlab is recommended; otherwise it is strongly recommended to participate in the course 'Introduction to Matlab'.

Remarks
none

Workload
contact hours (1 HpW = 1 h x 15 weeks):

- Fluid Mechanics of Turbulent Flows lecture/exercise: 30 h
- Modeling of Turbulent Flows - RANS and LES lecture, exercise: 30 h

independent study:

- preparation and follow-up lecture/exercises Fluid Mechanics of Turbulent Flows: 30 h
- preparation and follow-up lectures, exercises Modeling of Turbulent Flows - RANS and LES: 30 h
- examination preparation: 60 h

total: 180 h

Module: Anchorage in Concrete (bauiM1S05-BEFTECH) [M-BGU-100001]

Responsibility: Lothar Stempniewski

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Structural Engineering

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each summer term	2 terms	German	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-100022	Anchorage in Concrete (S. 242)	6	Lothar Stempniewski

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- term paper (internal)
- 'Teilleistung' T-BGU-100021 with oral examination according to § 4 Par. 2 No. 2
details about the learning control see at the 'Teilleistung'

Grade of the Module
grade of the module is grade of the exam

Prerequisites
none

Qualification Goals
The students can explain the importance of the use of the appropriate anchorage system. Hence, they are able to select it for the specific case and to apply it in an appropriate way.

Content
The anchorage systems relevant for the application in concrete and their load bearing behavior are presented. Furthermore, the importance of appropriate selection and economical design of the systems is explained.

Recommendations
none

Remarks
The term paper is part of the module and is managed internally at the institute.

Literature
Eligehausen, Mallée: 'Befestigungstechnik im Beton- und Mauerwerksbau'

Workload
contact hours (1 HpW = 1 h x 15 weeks):

- Anchorage in Concrete I lecture, exercise: 30 h
- Anchorage in Concrete II lecture, exercise: 30 h

independent study:

- preparation and follow-up lectures, exercises Anchorage in Concrete I: 20 h
- preparation and follow-up lectures, exercises Anchorage in Concrete II: 20 h
- preparation of term paper (internal): 20 h
- examination preparation: 60 h

total: 180 h

M Module: Applied Dynamics of Structures (bauiM1S04-BAUDYN) [M-BGU-100038]

Responsibility: Lothar Stempniewski

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Structural Engineering

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each summer term	2 terms	German	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-100021	Applied Dynamics of Structures (S. 245)	6	Lothar Stempniewski

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-100021 with oral examination according to § 4 Par. 2 No. 2
details about the learning control see at the 'Teilleistung'

Grade of the Module
grade of the module is grade of the exam

Prerequisites
none

Qualification Goals
The students can transfer their basic knowledge of the modules 'Dynamics' and 'Surface Structures and Dynamics of Structures' to the field of earthquake engineering. By that, the students can evaluate the dynamic behavior of structures in practical application. Based on material science and the modules 'Geology in Civil Engineering' and 'Bracing and Stability in Reinforced Concrete' the students can describe the basic seismological relationships regarding soil-building-interaction. The students can design basically design structures by impact of earthquake loads.

Content
- basics of dynamics of structures
- man-made excited, machinery excited, wind excited vibrations and counteractions
- basics in earthquake engineering
- presentation of practical relevant calculation methods
- modeling, calculation, designing, and construction of buildings

Recommendations
none

Remarks
none

Literature
Stempniewski, L.; Haag, B. (2010): Baudynamik-Praxis, Beuth

Workload
contact hours (1 HpW = 1 h x 15 weeks):
- Applied Dynamics of Structures lecture, exercise: 30 h
- Earthquake Engineering lecture, exercise: 30 h

independent study:
- preparation and follow-up lectures, exercises Applied Dynamics of Structures: 30 h
- preparation and follow-up lectures, exercises Earthquake Engineering: 30 h
- examination preparation: 60 h

total: 180 h

M Module: Applied Geotechnics (bauiM5S03-ANGEOTEC) [M-BGU-100072]

Responsibility: Theodoros Triantafyllidis

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Geotechnical Engineering

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each summer term	1 term	German	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-100073	Applied Geotechnics (S. 247)	6	Peter Kudella

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- ‘Teilleistung’ T-BGU-100073 with written examination according to § 4 Par. 2 No. 1
details about the learning control see at the ‘Teilleistung’

Grade of the Module
grade of the module is grade of the exam

Prerequisites
none

Qualification Goals
The students make a self-dependent reasonable design decisions for pile foundations and excavations with regard to geological engineering, site managing and economical boundary conditions. They can assess the interaction of building, foundation and subsoil and can establish simple mechanical models by themself and use numerical tools customary in practice as well. They can describe and use relevant guidelines and can link constructional experience, dimensioning rules and standardization to theoretical knowledge about soil mechanical laws.

Content
see German version

Recommendations
module Earthworks and Foundation Engineering [bauiM5P2-ERDGB]

Remarks
none

Literature

[1] Seitz, J. & Schmidt, H.-G. (2000), Bohrpfähle Ernst & S.
[2] Triantafyllidis, Th. (1990), Planung und Bauausführung im Spezialtiefbau, Teil 1, Ernst & S.
[3] Weißenbach, A. (2001), Baugruben, Teil 1-3, Wiley
[4] EA Pfähle (2007), Dt. Ges. f. Geotechnik, Ernst & S.
[5] EAB (2006), Deutsche Ges. f. Geotechnik, 4. Aufl., Ernst & S.
[6] EAU (2004), HTG und Deutsche Ges. f. Geotechnik, 10. Aufl., Ernst & S.
[7] EBGEO (2010), Deutsche Ges. f. Geotechnik, Ernst & S.
[8] Witt, J. Grundbau-Taschenbuch Teil 1-3, 7. Aufl. (2009), Ernst & S.

Workload
contact hours (1 HpW = 1 h x 15 weeks):

- Foundations and Retaining Structures lecture/exercise: 30 h
- Special Foundation Engineering and Design lecture/exercise: 30 h
- field trips: 10 h

independent study:

- preparation and follow-up lecture/exercises Foundations and Retaining Structures: 25 h
- preparation and follow-up lecture/exercises Special Foundation Engineering and Design: 25 h
- examination preparation: 60 h

total: 180 h

Module: Aquatic Ecosystems (bauiM2S06-HY6) [M-BGU-103400]

Responsibility:	Charlotte Kämpf
Institution:	KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften
Curricular Embedding:	Compulsory Elective
Contained in:	Study Focus / Water and Environment

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each winter term	1 term	German	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-106788	Examination Prerequisite Aquatic Ecosystems (S. 283)	0	Charlotte Kämpf
T-BGU-106789	Aquatic Ecosystems (S. 249)	6	Charlotte Kämpf

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017

- 'Teilleistung' T-BGU-106788 with not graded accomplishment according to § 4 Par. 3 as examination prerequisite
- 'Teilleistung' T-BGU-106789 with examination of other type according to § 4 Par. 2 No. 3

details about the learning controls see at the respective 'Teilleistung'

Grade of the Module

grade of the module is grade of the exam

Prerequisites

none

Qualification Goals

see German version

Content

see German version

Recommendations

none

Remarks

IMPORTANT:
The module will not be offered anymore as from winter term 2019/20.

Workload

contact hours (1 HpW = 1 h x 15 weeks):

- seminar (lecture)/exercise: 40 h

independent study:

- preparation and follow-up seminar (lectures)/exercises: 20 h
- preparation of literature annotations and short presentation (exam prerequisite): 45 Std.
- preparation of presentation, manuscript and poster (exam): 75 Std.

total: 180 h

M Module: Basics of Finite Elements (bauiM1S20-GRUNDFE) [M-BGU-100052]

Responsibility: Peter Betsch

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Structural Engineering

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each winter term	1 term	German	3

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-109908	Homework 'Basics of Finite Elements' (S. 313)	1	Peter Betsch
T-BGU-100047	Basics of Finite Elements (S. 250)	5	Peter Betsch

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-109908 with not graded accomplishment according to § 4 Par. 3
- 'Teilleistung' T-BGU-100027 with oral examination according to § 4 Par. 2 No. 2

details about the learning controls see at the respective 'Teilleistung'

Grade of the Module
grade of the module is grade of the exam

Prerequisites
none

Qualification Goals
The students can describe the structure and the functionality of FE codes. They can formulate the basics of variational principles of FEM as well as the Lagrangian element family of different order of projection for one-dimensional, planar and spatial problems in the fields of linear strength of materials and heat transport. They know, that it is an approximate solution method for boundary value problems, and they are aware of its limits. They can get familiar quickly with commercial FE codes and can use them reasonably.

Content
The theoretical principles as well as the numerical implementation of Finite Element Methods are covered. The major terms are discussed such as weak form of the boundary value problem, test function, projection function, continuity requirements, domain discretization, Galerkin approximation, stiffness matrix, assembly,iso-parametric concept, numerical integration and accuracy of finite element approximation.

Recommendations
none

Remarks
none

Literature
[1] Cook, Malkus, Plesha: Concept and Applications of Finite Element Analysis, 1989.
[2] Hughes: The Finite Element Method, 1987.
[3] Zienkiewicz, Taylor: The Finite Element Method, Volume 1,2 & 3, 2000.
[4] Bathe: Finite-Elemente-Methoden, 2001.

Workload

contact hours (1 HpW = 1 h x 15 weeks):

- lecture, exercise: 60 h

independent study:

- preparation and follow-up lectures, exercises: 45 h
- processing exercises sheets: 30 h
- examination preparation: 45 h

total: 180 h

Module: Basics of Numeric Modeling (bauiM5P4-NUMGRUND) [M-BGU-100070]

Responsibility: Theodoros Triantafyllidis

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Geotechnical Engineering

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each winter term	1 term	German	2

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-106196	Contimuum Mechanics (S. 268)	3	Marlon Franke
T-BGU-106197	Numerics in Geotechnics (S. 347)	3	Andrzej Niemunis

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-106196 with oral examination according to § 4 Par. 2 No. 2
- 'Teilleistung' T-BGU-106197 with oral examination according to § 4 Par. 2 No. 2
details about the learning controls see at the respective 'Teilleistung'

Grade of the Module
grade of the module is CP weighted average of grades of the partial exams

Prerequisites
This module must not be selected together with the module Continuum Mechanics of Heterogeneous Solids [bauiM1S32-KONTIMECH].

Modeled Conditions
The following conditions must be met:

- The module [M-BGU-100064] *Continuum Mechanics of Heterogeneous Solids* must not have been started.

Qualification Goals
The students are familiar with the general concepts of continuum mechanics and their application to engineering, specifically geotechnical, problems. They know operational methods for the discretization of the typical differential equations. They are able to comprehend the modelling of geomechanical boundary value problems using Finite Difference and Finite Element Methods and to work independently on standard problems. They can assess the failure potential of numerical calculations, select commercial FE-codes reasonably and test and evaluate FE results critically.

Content
see German version

Recommendations
course 'Introduction to Continuum Mechanics' (6200607) or similar basic knowledge

Remarks
none

Literature
[1] E. Becker, W. Bürger: Kontinuumsmechanik. Teubner, 1975
[2] J. Bonet, R.D., Wood: Nonlinear continuum mechanics for finite element analysis. Cambridge, 1997
[3] R. Greve: Kontinuumsmechanik. Springer, 2003
[4] L. Malvern: Introduction to the Mechanics of a Continuous Medium. Prentice Hall, 1969
[5] Th. Seelig: Kontinuumsmechanik. Skript zur Vorlesung
[6] Presss, W., e.a. (1992), Numerical Recipies, Cambridge Univ. Press
[7] Hughes, T.J.R. (2000): The FEM, Linear Static and Dynamic FE Analysis. Dover

[8] Bathe, K.-J. (200): Finite-Elemente-Methoden. Springer
[9] Smith, I.M.; Griffith, D.V. (2004): Programming the Finite Element Method. JWS
[10] Potts, D.M. Zdravkovic, L. (1999): Finite element analysis in geotechnical engineering. Thomas Telford Ltd
[11] Zienkewicz O.C. et.al. (2005): The Finite Element Method, Vol. 1, Wiley
[12] Hartmann, F. (1987): Methode der Randelemente, Springer
[13] Strang, G. (2007): Wissenschaftliches Rechnen, Springer

Workload
contact hours (1 HpW = 1 h x 15 weeks):

- Continuum Mechanics lecture: 30 h
- Numerics in Geotechnics lecture: 30 h

independent study:

- preparation and follow-up lectures Continuum Mechanics: 15 h
- examination preparation Continuum Mechanics (partial exam): 30 h
- preparation and follow-up lectures Numerics in Geotechnics: 15 h
- exercises with available software: 30 h
- examination preparation Numerics in Geotechnics (partial exam): 30 h

total: 180 h

M Module: Basics of Prestressed Concrete (bauiM1S02-GDLSPANNB) [M-BGU-100036]

Responsibility: Lothar Stempniewski

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Structural Engineering

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each summer term	1 term	German	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-100019	Basics of Prestressed Concrete (S. 251)	6	Lothar Stempniewski

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-100019 with written examination according to § 4 Par. 2 No. 1
details about the learning control see at the 'Teilleistung'

Grade of the Module
grade of the module is grade of the exam

Prerequisites
none

Qualification Goals
The students know the basics and can reconstruct the functional principle of prestressed concrete. The students can explain the already obtained knowledge in the subjects 'Strength of Materials', 'Structural Analysis' and 'Design and Construction of Components in Reinforced Concrete' and can transfer these to the methods in prestressed concrete. The students are able to conduct design of buildings in structural engineering safely and economically by reference to current standards.

Content

- Types and systems for prestressing
- loss of prestressing forces
- proof in ultimate limit state and in serviceability limit state

Recommendations
module Design and Construction of Components in Reinforced Concrete [bauiM1P1-BEMISTB]

Remarks
none

Literature
lecture notes

Workload
contact hours (1 HpW = 1 h x 15 weeks):

- lecture, exercise: 60 h

independent study:

- preparation and follow-up lectures, exercises: 45 h
- examination preparation: 75 h

total: 180 h

Module: Bracing and Stability in Reinforced Concrete (bauiM1S01-STABISTB) [M-BGU-100003]

Responsibility: Lothar Stempniewski

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Structural Engineering

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each summer term	1 term	German	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-100018	Bracing and Stability in Reinforced Concrete (S. 252)	6	Lothar Stempniewski

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-100018 with written examination according to § 4 Par. 2 No. 1
details about the learning control see at the 'Teilleistung'

Grade of the Module
grade of the module is grade of the exam

Prerequisites
none

Qualification Goals
Based on the module 'Basics in Reinforced Concrete', 'Design and Construction of Components in Reinforced Concrete' and cross-cutting modules such as 'Structural Analysis' the students can transfer and apply the methods from the module 'Non-linear Analysis of Beam Structures' to the subject of reinforced concrete with respect to bracing and stability of buildings. Furthermore, the students can analyse and solve problems in special issues of reinforced concrete. Given problems can be assigned to the respective design problems, be conducted subsequently and the current standards can be applied.

Content
- bracing and stability of buildings
- design of columns
- fire protection, fatigue, determination of stress resultants

Recommendations
course Basics of Reinforced Concrete I (6200601),module Design and Construction of Components in Reinforced Concrete [bauiM1P1-BEMISTB]

Remarks
none

Literature
lecture notes

Workload
contact hours (1 HpW = 1 h x 15 weeks):
- lecture, exercise: 60 h

independent study:
- preparation and follow-up lectures, exercises: 45 h
- examination preparation: 75 h

total: 180 h

M Module: Building Information Modeling (BIM) (bauiM4S16-) [M-BGU-103916]

Responsibility: Shervin Haghsheno

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Technology and Management in Construction

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each summer term	1 term	German	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-108007	Building Information Modeling (BIM) (S. 255)	6	Shervin Haghsheno

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-108007 with examination of other type according to § 4 Par. 2 No. 3
details about the learning control see at the 'Teilleistung'

Grade of the Module
grade of the module is grade of the exam;
the grade of the exam is defined by the evaluation of the project report by 75% and by the evaluation of the presentation by 25%.

Prerequisites
none

Qualification Goals
see German version

Content
see German version

Recommendations
course Computer Aided Design (CAD) (6200520)
course Cost Estimation (6241801) from the module Economics and Management in Construction [bauiM4P3-]

Remarks
registration procedure:
see German version

Literature
[1] Borrmann, André; Köni, Markus; Koch, Christian; Beetz, Jakob; König, Markus (Hg.) (2015): Building information modeling // Building Information Modeling. Technologische Grundlagen und industrielle Praxis. Wiesbaden: Springer Vieweg (VDI-Buch).
[2] Bundesministerium für Verkehr und digitale Infrastruktur (Hg.) (2015): Stufenplan Digitales Planen und Bauen. Einführung moderner, IT-gestützter Prozesse und Technologien bei Planung, Bau und Betrieb von Bauwerken.
[3] Hausknecht, Kerstin; Liebich, Thomas (2016): BIM-Kompendium. Building Information Modeling als neue Planungsmethode. Stuttgart: Fraunhofer IRB Verlag.

Workload
contact hours (1 HpW = 1 h x 15 weeks):

- lecture/exercise: 60 h

independent study:

- preparation and follow-up lecture/exercises, tutorials: 60 h
- project work, preparation of report and presentation (exam): 60 h

total: 180 h

M Module: Building Physics I (bauiM1S27-BAUPH-I) [M-BGU-103950]

Responsibility:

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften
Curricular Embedding: Compulsory Elective
Contained in: Study Focus / Structural Engineering

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each winter term	1 term	German	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-100039	Applied Building Physics (S. 244)	3	Engin Kotan
T-BGU-100040	Building Technology (S. 258)	3	Stefan Wirth

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-100039 with oral examination according to § 4 Par. 2 No. 2
- 'Teilleistung' T-BGU-100040 with oral examination according to § 4 Par. 2 No. 2
details about the learning controls see at the respective 'Teilleistung'

Grade of the Module
grade of the module is CP weighted average of grades of the partial exams

Prerequisites
none

Qualification Goals
see German version

Content
see German version

Recommendations
none

Remarks
none

Workload
contact hours (1 HpW = 1 h x 15 weeks):

- Applied Building Physics lecture: 30 h
- Building Technology lecture: 30 h

independent study:

- preparation and follow-up lectures Applied Building Physics: 30 h
- examination preparation Applied Building Physics (partial exam): 30 h
- preparation and follow-up lectures Building Technology: 30 h
- examination preparation Building Technology (partial exam): 30 h

total: 180 h

M Module: Building Physics II (bauiM1S28-BAUPH-II) [M-BGU-100060]

Responsibility: Engin Kotan

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Structural Engineering

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each summer term	1 term	German	3

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-109946	Homework 'Practical Noise Control' (S. 315)	1	Reiner Grigo
T-BGU-108024	Practical Noise Control (S. 351)	2	Reiner Grigo
T-BGU-100042	Practical Fire Protection (S. 350)	3	Hermann Schröder

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-109946 with examination of other type according to § 4 Par. 2 No. 3
- 'Teilleistung' T-BGU-108024 with oral examination according to § 4 Par. 2 No. 2
- 'Teilleistung' T-BGU-100042 with oral examination according to § 4 Par. 2 No. 2
details about the learning controls see at the respective 'Teilleistung'

Grade of the Module
grade of the module is CP weighted average of grades of the partial exams

Prerequisites
none

Qualification Goals
see German version

Content
see German version

Recommendations
none

Remarks
none

Workload
contact hours (1 HpW = 1 h x 15 weeks):

- Practical Noise Control lecture: 30 h
- Practical Fire Protection lecture: 30 h

independent study:

- preparation and follow-up lectures Practical Noise Control: 15 h
- preparation of Homeworks 'Practical Noise Control' (partial exam): 20 h
- examination preparation Practical Noise Control (partial exam): 25 h
- preparation and follow-up lectures Practical Fire Protection: 30 h
- examination preparation Practical Fire Protection (partial exam): 30 h

total: 180 h

M Module: Building Preservation of Concrete and Masonry Constructions (bauiM1S26-BBM) [M-BGU-100058]

Responsibility: Engin Kotan

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Structural Engineering

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each summer term	1 term	German	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-100175	Student Research Project 'Building Preservation of Concrete and Masonry Constructions' (S. 382)	1	Engin Kotan
T-BGU-100038	Building Preservation of Concrete and Masonry Constructions (S. 256)	5	Engin Kotan

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-100175 with not graded accomplishment according to § 4 Par. 3
- 'Teilleistung' T-BGU-100038 with oral examination according to § 4 Par. 2 No. 2

details about the learning controls see at the respective 'Teilleistung'

Grade of the Module
grade of the module is grade of the exam

Prerequisites
none

Qualification Goals
After successful completion of the module the students have detailed knowledge about the relevant causes and processes of degradation in concrete and masonry constructions. Thus they are able to take appropriate measures to enhance the durability of solid buildings and to plan and execute effective measures to repair damaged concrete and masonry constructions. Moreover the students have also the knowledge about the main aspects and basic techniques of building reinforcement.

Content
This course provides fundamental knowledge of the possibilities to preserve concrete and masonry constructions. Besides an introduction into the characteristics of masonry, plaster, concrete and reinforced concrete structures, various damage patterns and their origins are discussed. Based on the knowledge of the essential damage processes, efficient measures for the increase of the durability are described, which include material and constructional precautions as well as additional preventive measures. Furthermore the course focuses on the repair of already damaged concrete and masonry constructions. In this connection different research methods for the analysis of damages are presented and various possibilities are shown to predict the time-development of these damages. Finally repair materials as well as procedures are described which are necessary for the realization of a durable repair measure. A further main part of the course covers the different possibilities of an additional reinforcement of concrete and masonry constructions. Applicable materials and their characteristics in design and construction are introduced and discussed. In the accompanying exercises the subject matter shall independently be developed and the practical realization will be practised by means of several design problems.

Recommendations
none

Remarks
none

Literature

Hand-outs and (selection):

[1] Blaich, J.: Bauschäden - Analyse und Vermeidung; EMPA; Stuttgart, 1999
[2] Pfefferkorn, W.: Rißschäden an Mauerwerk, Ursachen erkennen - Rißschäden vermeiden; Stuttgart, IRB Verlag, 1994
[3] Reichert, H.: Konstruktiver Mauerwerksbau, Bildkommentar zur DIN 1053-1, Rudolf Müller Verlag, Köln, 1999
[4] Ruffert, G.: Ausbessern und Verstärken von Betonbauteilen; 2. Aufl.; Beton Verlag, 1982
[5] SIVV - Handbuch: Schützen, Instandsetzen, Verbinden und Verstärken von Betonbauteilen; Verarbeiten von Kunststoffen im Betonbau beim Deutschen Beton- und Bautechnik-Verein E.V.; IRB Verlag, Stuttgart, 2008
[6] Stark, J.; Wicht, B.: Dauerhaftigkeit von Beton - Der Baustoff als Werkstoff, Hrsg.: Bauhaus-Univ. Weimar, F.A. Finger-Institut für Baustoffkunde -FIB-; 2001
[7] Tausky, R.: Betontragwerke mit Außenbewehrung; Birkhäuser Verlag, Basel, 1993

Workload

contact hours (1 HpW = 1 h x 15 weeks):

- Protection, Rehabilitation and Reinforcement of Concrete and Masonry Constructions lecture, exercise: 45 h
- Building Analysis lecture: 15 h

independent study:

- preparation and follow-up lectures, exercises Protection, Rehabilitation and Reinforcement of Concrete and Masonry Constructions: 25 h
- preparation and follow-up lectures Building Analysis: 15 h
- preparation of student research project “Building Preservation of Concrete and Masonry Constructions”: 40 h
- examination preparation: 40 h

total: 180 h

M Module: Building Preservation of Steel and Timber Structures (bauiM1S11-BAUING-BSH) [M-BGU-100043]

Responsibility: Matthias Frese

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Structural Engineering

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each winter term	1 term	German	2

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-100027	Building Preservation of Steel and Timber Structures (S. 257)	6	Matthias Frese, Thomas Ummenhofer

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017

- 'Teilleistung' T-BGU-100027 with written examination according to § 4 Par. 2 No. 1

details about the learning control see at the 'Teilleistung'

Grade of the Module

grade of the module is grade of the exam

Prerequisites

none

Qualification Goals

The students can explain the procedure of investigation and evaluation of old building fabric. They can describe the characteristics of old steel and cast productions made of iron materials as well as the timber quality (in-situ strength grading of timber). They are able to name typical defects of steel and timber structures. They conduct realistic static computations of old constructions and determine the remaing lifetime. They can explain methods for repairing and strengthening of steel and timber structures on the base of concepts conserving cultural heritage and taking into consideration carpentry and engineered solutions.

Content

- historical overview
- properties of old steels, cast materials and old, built-in timber
- investigation of structures and building parts
- damage-mechanisms in steel and timber structures
- investigation of bearing capacity and remaining lifetime
- restoration and strengthening procedures

Recommendations

participation in module Timber Structures [bauiM1S12-BAUING-HB]

Remarks

none

Literature

lecture accompanying documents

Workload

contact hours (1 HpW = 1 h x 15 weeks):

- Preservation of Steel Structures lecture: 30 h
- Preservation of Timber Structures lecture/exercise: 30 h

independent study:

- preparation and follow-up lectures Preservation of Steel Structures: 30 h
- preparation and follow-up lectures/exercises Preservation of Timber Structures: 30 h
- examination preparation: 60 h

total: 180 h

M Module: Business and Human Resource Management (bauiM4S01-) [M-BGU-100111]

Responsibility: Shervin Haghsheno

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Technology and Management in Construction

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each summer term	1 term	German	2

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-108002	Business and Human Resource Management (S. 259)	6	Shervin Haghsheno

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-108002 with written examination according to § 4 Par. 2 No. 1
details about the learning control see at the 'Teilleistung'

Grade of the Module
grade of the module is grade of the exam

Prerequisites
none

Qualification Goals
Students are able to explain principles of business and human resource management as well as key corporate functions in construction companies. They are able to name and describe the different forms of organizations and can distinguish between these forms. Furthermore, students achieve knowledge to identify and analyze different types of strategies in construction companies.
In the area of communication and motivation, students gain basic knowledge and are able to implement methods of human resources management.
In the course site management, students know about technical, business and organizational tasks and are able to analyze and evaluate the individual process steps.

Content
In the area of operational management generic strategies for contractors and their implementation in the context of organizational structures and legal forms are discussed. Moreover, procedures and processes to develop and implement a corporate strategy are explained. Basic principles and methods of human resource management are exemplified, implying the topics determination of personnel requirements, development, acquisition, and motivation.
In addition, communication and motivation are highlighted in context to human resources management.
The course site management presents the work of foreman, site manager, and project manager and contains significant aspects of management processes of the construction site.

Recommendations
none

Remarks
none

Workload

contact hours (1 HpW = 1 h x 15 weeks):

- Business and Human Resources lecture/exercise: 45 h
- Site Management lecture: 15 h

independent study:

- preparation and follow-up lecture/exercises Business and Human Resources: 45 h
- preparation and follow-up lectures Site Management: 15 h
- examination preparation: 60 h

total: 180 h

M Module: City Transport Facilities (bauiM3S17-STRIVA) [M-BGU-100026]

Responsibility: Ralf Roos

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Mobility and Infrastructure

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each winter term	1 term	German	2

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-109912	Exercises and student research project City Transport Facilities (S. 285)	2	Ralf Roos
T-BGU-100083	City Transport Facilities (S. 260)	4	Ralf Roos

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-109912 with not graded accomplishment according to § 4 Par. 3 as examination prerequisite
- 'Teilleistung' T-BGU-100083 with oral examination according to § 4 Par. 2 No. 2

details about the learning controls see at the respective 'Teilleistung'

Grade of the Module
grade of the module is grade of the exam

Prerequisites
none

Qualification Goals
The graduates are able to plan and design city transport facilities related to car, bicycle, pedestrian and public traffic as well as to test, evaluate and optimize existing infrastructure. Further, they are able to assess the different usage requirements of different types of transportation and to consider them appropriately in design planning.

Content
Manifold requirements are put on city transport facilities in contrast to overland roads: usage from transit to access traffic, usage for stationary traffic, weak road users such as bicyclist and pedestrians, the demand of moving traffic, for stay and recreation activities up to the designing of the transport facilities considering the cityscape. Contemporarily, a variety of carriers of traffic are found within urban areas which have to be taken into consideration for designing roads and junctions as well as the network of transportation routes. All aspects are covered, discussed and their handling is practised at practically relevant case studies within this module.

Recommendations
none

Remarks
none

Workload
contact hours (1 HpW = 1 h x 15 weeks):

- lectures/exercises: 45 h

independent study:

- preparation and follow-up lectures/exercises: 30 h
- preparation of exercises and student research project (examination prerequisite): 70 h
- examination preparation: 40 h

total: 185 h

M Module: Computational Analysis of Structures (bauiM1S15-CTWM) [M-BGU-100047]

Responsibility: Werner Wagner

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Structural Engineering

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each summer term	1 term	German	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-100174	Student Research Project 'Computational Analysis of Structures' (S. 383)	2	Werner Wagner
T-BGU-100031	Computational Analysis of Structures (S. 261)	4	Werner Wagner

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017

- 'Teilleistung' T-BGU-100174 with not graded accomplishment according to § 4 Par. 3 as examination prerequisite
- 'Teilleistung' T-BGU-100031 with oral examination according to § 4 Par. 2 No. 2

details about the learning controls see at the respective 'Teilleistung'

Grade of the Module

grade of the module is grade of the exam

Prerequisites

none

Qualification Goals

The students can formulate and apply the essential principles for the computational modeling of structures (FE models for beam and surface structures, modeling of practical problems, error analysis) as basis for design and construction.

Content

- numerical simulation of 2D/3D beams, surface structures
- modeling of 2D/3D beams, surface structures
- exactness and improvement of the solutions
- folded plates
- rotational shells
- adaptive mesh generation
- stationary heat conduction 2D/3D and further problems of building physics
- commercial software for design and construction

Recommendations

module Surface Structures and Dynamics of Structures [bauiM1P3-FTW-BD]

Remarks

none

Literature

lecture notes 'Computergestützte Tragwerksmodellierung'
Krätzig, W.B., Basar, Y. (1997): Tragwerke 3 - Theorie und Anwendung der Methode der Finiten Elemente, Springer.
Werkle, H. (2007): Finite Elemente in der Baustatik, Statik und Dynamik der Stab- und Flächentragwerke, Vieweg.

Workload
contact hours (1 HpW = 1 h x 15 weeks):

- lecture, exercise: 60 h

independent study:

- preparation and follow-up lectures, exercises: 30 h
- preparation of student research project (exam prerequisite): 50 h
- examination preparation: 40 h

total: 180 h

M Module: Concrete Construction Technology (bauiM1S24-BETONTECH) [M-BGU-100056]

Responsibility: Frank Dehn

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Structural Engineering

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each winter term	1 term	German	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-100036	Concrete Construction Technology (S. 263)	6	Frank Dehn

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- ‘Teilleistung’ T-BGU-100036 with oral examination according to § 4 Par. 2 No. 2
details about the learning control see at the ‘Teilleistung’

Grade of the Module
grade of the module is grade of the exam

Prerequisites
none

Qualification Goals
see German version

Content
see German version

Recommendations
none

Remarks
none

Workload
contact hours (1 HpW = 1 h x 15 weeks):

- Concrete Technology lecture/exercise: 45 h
- Deformation and Fracture Processes lecture: 15 h

independent study:

- preparation and follow-up lecture/exercises Concrete Technology: 45 h
- preparation and follow-up lectures Deformation and Fracture Processes: 15 h
- examination preparation: 60 h

total: 180 h

M Module: Construction of Steel and Composite Bridges (bauiM1S07- STAHLBRÜ) [M-BGU-100040]

Responsibility: Thomas Ummenhofer

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Structural Engineering

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each summer term	1 term	German	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-100024	Construction of Steel and Composite Bridges (S. 264)	6	Thomas Ummenhofer

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-100024 with written examination according to § 4 Par. 2 No. 1
details about the learning control see at the 'Teilleistung'

Grade of the Module
grade of the module is grade of the exam

Prerequisites
none

Qualification Goals
The students can evaluate steel and steel composite bridges with respect to design, construction, production, conduct design calculations and design constructive details.

Content
- historical development
- design basics
- construction types for main beams
- bridge bearings
- assembly process
- design examples

Recommendations
course Basics in Steel Structures (6200504),
module Steel and Composite Structures [bauiM1P2-STAHLBAU]

Remarks
none

Literature
lecture accompanying documents
DIN EN 1993-1-1, Dezember 2010: Eurocode 3: Bemessung und Konstruktion von Stahlbauten - Teil 1-1: Allgemeine Bemessungsregeln und Regeln für den Hochbau: Beuth Verlag GmbH, Berlin.
DIN EN 1993-2 (Dezember 2010): Eurocode 3: Bemessung und Konstruktion von Stahlbauten - Teil 2: Stahlbrücken. Beuth Verlag GmbH. Berlin.
DIN EN 1994-1-1, Dezember 2010: Eurocode 4: Bemessung und Konstruktion von Verbundtragwerken aus Stahl und Beton - Teil 1-1: Allgemeine Bemessungsregeln und Anwendungsregeln für den Hochbau: Beuth Verlag GmbH, Berlin.
DIN EN 1994-2 (Dezember 2010): Eurocode 4: Bemessung und Konstruktion von Verbundtragwerken aus Stahl und Beton - Teil 2: Allgemeine Bemessungsregeln und Anwendungsregeln für Brücken. Beuth Verlag GmbH. Berlin.
Mehlhorn, Gerhard: Handbuch Brücken - Entwerfen, Konstruieren, Berechnen, Bauen und Erhalten. Springer-Verlag. Berlin. 2007

Workload
contact hours (1 HpW = 1 h x 15 weeks):

- lecture, exercise: 60 h

independent study:

- preparation and follow-up lectures, exercises: 45 h
- examination preparation: 75 h

total: 180 h

M Module: Contact Mechanics (bauiM1S41-KONTMECH) [M-BGU-104916]

Responsibility: Marlon Franke

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften
Curricular Embedding: Compulsory Elective
Contained in: Study Focus / Structural Engineering

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each summer term	1 term	German	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-109947	Contact Mechanics (S. 265)	6	Marlon Franke

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-109947 with oral examination according to § 4 Par. 2 No. 2
details about the learning control see at the 'Teilleistung'

Grade of the Module
grade of the module is grade of the exam

Prerequisites
none

Modeled Conditions
The following conditions must be met:

1. The module [M-BGU-100336] *Contact Mechanics - Fundamentals and Basics* must not have been started.
2. The module [M-BGU-100337] *Contact Mechanics - Computational Algorithms in a Geometrically Exact Form* must not have been started.

Qualification Goals
The students gain the ability to name the basics for the numerical simulation of contact problems. They can transfer these capabilities to the discussion of deformable bodies in contact. The students can describe the handling of general interface problems, non-smooth dynamics and inequality constraints. The students are able to apply formulations of interfaces based on collocation methods and recent integral formulations.

Content
The continuum mechanical description of deformable bodies (continua) with second-order condition is imparted. The formulation of contact conditions and friction laws is discussed. Further, methods for claiming of constraints is discussed. The contact contribution is emphasised particularly by the subsequent numerical implementation.

Recommendations
course Introduction to Continuum Mechanics (6200607),module Basics of Finite Elements [bauiM1S20-GRUNDFE]

Remarks
This module is offered newly as from winter term 2019/20.

Literature
[1] Laursen: Computational Contact and Impact Mechanics
[2] Wriggers: Computational Contact Mechanics

Workload

contact hours (1 HpW = 1 h x 15 weeks):

- lecture, exercise: 60 h

independent study:

- preparation and follow-up lectures, exercises: 45 h
- examination preparation: 75 h

total: 180 h

M Module: Contact Mechanics - Computational Algorithms in a Geometrically Exact Form (bauiM1S36-KONTMECH-ALGOR) [M-BGU-100337]

Responsibility: Alexander Konyukhov

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Structural Engineering

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each winter term	1 term	German	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-100618	Contact Mechanics - Computational Algorithms in a Geometrically Exact Form (S. 266)	6	Alexander Konyukhov

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017

- 'Teilleistung' T-BGU-100618 with oral examination according to § 4 Par. 2 No. 2
details about the learning control see at the 'Teilleistung'

Grade of the Module

grade of the module is grade of the exam

Prerequisites

none

Qualification Goals

The students are able to select appropriately a coordinate system for the geometric exact contact formulation and contact interaction. The students can describe the principles of applied differential geometry, contact kinematics, formulation of the weak form and the linearization in covariant coordinates. The students can present formulations for 1D, 2D and 3D. The students are able to apply finite element discretization and to integrate numerical algorithms for their implementation.

Content

- continuum formulation of a contact problem (Signorini's problem): weak and strong formulation
- necessary information from the differential geometry of curves and surfaces
- curvilinear coordinate systems necessary for the various contact types
- geometry and kinematics for arbitrary two body contact problem in a covariant form
- abstract form of formulations in computational mechanics.
- weak formulation in a covariant form
- various methods of enforcement contact constraints in a covariant and in operator form
- consistent linearization in a covariant form: normal and tangential parts
- various discretization techniques of both the weak form and its linearization: residual and tangent matrix
- a set of analytical solution used for verification of the implemented contact algorithms (Hertz solution, contact patch tests for non-frictional and frictional cases
- modelling of frictional contact: elastoplastic analogy, return-mapping scheme
- a possible way of generalization of Coulomb friction law

Recommendations

course Introduction to Continuum Mechanics (6200607),module Basics of Finite Elements [bauiM1S20-GRUNDFE]

Remarks

IMPORTANT:

The module will not be offered anymore as from winter term 2019/20.

Literature

[1.] Johnson K. L. Contact Mechanics. Cambridge University Press. 1987.[2.] Kikuchi N., Oden J. T. Contact

Problems in Elasticity: A Study of Variational Inequalities and Finite Element Methods. SIAM. 1988.[3.] Konyukhov A., Schweizerhof K. 2012 Computational Contact Mechanics Geometrically Exact Theory for Arbitrary Shaped Bodies. Springer. 2012.[4.] Laursen T. Computational Contact and Impact Mechanics Fundamentals of Modeling Interfacial Phenomena in Nonlinear Finite Element Analysis. Springer, Berlin. 2002.[5.] Sofonea M., Matei A. Mathematical Models in Contact Mechanics. Cambridge University Press. 2012.[6.] Taylor R.L. FEAP electronic resourcesa aa http://www.ce.berkeley.edu/projects/feap/[7.] Wriggers P. Computational Contact Mechanics. John Wiley and Sons. 2002.[8.] Yastrebov A. Numerical Methods in Contact Mechanics. Wiley-ISTE. 2013

Workload

contact hours (1 HpW = 1 h x 15 weeks):

- lecture, exercise: 60 h

independent study:

- preparation and follow-up lectures, exercises: 45 h
- examination preparation: 75 h

total: 180 h

M Module: Contact Mechanics - Fundamentals and Basics (bauiM1S35-KONTMECH-BASICS) [M-BGU-100336]

Responsibility: Peter Betsch

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Structural Engineering

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each summer term	1 term	German	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-100617	Contact Mechanics - Fundamentals and Basics (S. 267)	6	Marlon Franke

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-100617 with oral examination according to § 4 Par. 2 No. 2
details about the learning control see at the 'Teilleistung'

Grade of the Module
grade of the module is grade of the exam

Prerequisites
none

Qualification Goals
The students gain the ability to name the basics for the numerical simulation of contact problems. They can transfer these capabilities to the discussion of deformable bodies in contact. The students can describe the handling of general interface problems, non-smooth dynamics and inequality constraints. The students are able to apply formulations of interfaces based on collocation methods and recent integral formulations.

Content
The continuum mechanical description of deformable bodies (continua) with second-order condition is imparted. The formulation of contact conditions and friction laws is discussed. Further, methods for claiming of constraints is discussed. The contact contribution is emphasised particularly by the subsequent numerical implementation.

Recommendations
course Introduction to Continuum Mechanics (6200607),module Basics of Finite Elements [bauiM1S20-GRUNDFE]

Remarks
IMPORTANT:
The module will not be offered anymore as from summer term 2019.

Literature
[1] Laursen: Computational Contact and Impact Mechanics[2] Wriggers: Computational Contact Mechanics

Workload
contact hours (1 HpW = 1 h x 15 weeks):

- lecture, exercise: 60 h

independent study:

- preparation and follow-up lectures, exercises: 45 h
- examination preparation: 75 h

total: 180 h

M Module: Continuum Mechanics of Heterogeneous Solids (bauiM1S32-KONTIMECH) [M-BGU-100064]

Responsibility: Thomas Seelig

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Structural Engineering

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each winter term	2 terms	German	2

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-106196	Contimuum Mechanics (S. 268)	3	Marlon Franke
T-BGU-108879	Micromechanics of Heterogeneous Solids (S. 336)	3	Ingo Schmidt

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-106196 with oral examination according to § 4 Par. 2 No. 2
- 'Teilleistung' T-BGU-108879 with oral examination according to § 4 Par. 2 No. 2
details about the learning controls see at the respective 'Teilleistung'

Grade of the Module
grade of the module is CP weighted average of grades of the partial exams

Prerequisites
This module must not be selected together with the module Basics of Numeric Modeling [bauiM5P4-NUMGRUND].

Modeled Conditions
The following conditions must be met:

- The module [M-BGU-100070] *Basics of Numeric Modeling* must not have been started.

Qualification Goals
see German version

Content
see German version

Recommendations
none

Remarks
none

Literature
Seelig, T.: Kontinuumsmechanik. Skript zur Vorlesung
Bonet, J., Wood, R.D.: Nonlinear continuum mechanics for finite element analysis. Cambridge, 1997
Doghri, I.: Mechanics of Deformable Solids. Springer, 2000
Fung, Y.C.: Foundations of Solid Mechanics. Prentice Hall, 1965
Malvern, L.: Introduction to the Mechanics of a Continuous Medium. Prentice Hall, 1969
Parisch, H.: Festkörper-Kontinuumsmechanik. Teubner, 2003
Literatur Mechanik heterogener Festkörper:
Aboudi, J.: Mechanics of Composite Materials - A Unified Micromechanical Approach, Elsevier, 1991
Christensen, R.M.: Mechanics of Composite Materials, Wiley, 1979
Mura, T.: Micromechanics of Defects in Solids, Martinus Nijhoff Publishers, 1982

Nemat-Nasser, S., Hori, M.: Micromechanics - Overall Properties of Heterogeneous Materials, North-Holland, 1993
Gross, D., Seelig, Th.: Bruchmechanik - Mit einer Einführung in die Mikromechanik, Springer, 2011

Workload
contact hours (1 HpW = 1 h x 15 weeks):

- Continuum Mechanics lecture: 30 h
- Mechanics of Heterogeneous Solids lecture: 30 h

independent study:

- preparation and follow-up lectures Continuum Mechanics: 30 h
- preparation and follow-up lectures Mechanics of Heterogeneous Solids: 30 h
- examination preparation Continuum Mechanics: 30 h
- examination preparation Mechanics of Heterogeneous Solids: 30 h

total: 180 h

M Module: Coupled Geomechanic Processes (bauiM5S10-GEKOPPRO) [M-BGU-100077]

Responsibility: Theodoros Triantafyllidis

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Geotechnical Engineering

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each winter term	1 term	German	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-100085	Coupled Geomechanic Processes (S. 269)	6	Theodoros Triantafyllidis

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-100085 with oral examination according to § 4 Par. 2 No. 2
details about the learning control see at the 'Teilleistung'

Grade of the Module
grade of the module is grade of the exam

Prerequisites
none

Qualification Goals
The students can explain supplementary knowledge about strength and deformation properties of rocks as well as of rock testing in-situ and in laboratory. They recognize and evaluate the basic physical and chemical alteration parameters of geomaterials. They are able to describe the involved hydromechanical, chemomechanical, thermomechanical and biomechanical processes and to express mathematically their interdependence with mechanical properties.

Content
The module takes into account unconsolidated and hard rock as multiphase systems, in which mechanical processes takes place coupled with hydraulic, chemical, biological and thermal processes and their material behavior being therefore typically time-dependent. Phenoma of swelling, shrinking, creeping, fracture hydraulics and rock dynamics, moisture conditions, solute transport, internal erosion, climatic influence of precipitation and freeze-thaw changes as well as influences of bacteria and flora.

Recommendations
module Rock Engineering and Tunneling [bauiM5P3-FMTUB]

Remarks
none

Literature

[1] Brady, B.H.G. & Brown, E.T. (2004), Rock Mechanics for Underground Mining, 3rd Ed., Kluwer.
[2] Fecker, Edwin, 1997: Geotechnische Messgeräte und Feldversuche im Fels, Ferdinand Enke Verlag Stuttgart.
[3] Hoek, Evert, 2007: Practical Rock Engineering (free download from
http://www.rocscience.com/education/hoeks_corner)

Workload

contact hours (1 HpW = 1 h x 15 weeks):

- Special Issues in Rock Mechanics lecture/exercise: 30 h
- Coupled Phenomena in Geomechanics lecture/exercise: 30 h

independent study:

- preparation and follow-up lecture/exercises Special Issues in Rock Mechanics: 30 h
- preparation and follow-up lecture/exercises Coupled Phenomena in Geomechanics: 30 h
- examination preparation: 60 h

total: 180 h

M Module: Decommissioning of Nuclear Facilities (bauiM4S12-) [M-BGU-100345]

Responsibility: Sascha Gentes

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften
Curricular Embedding: Compulsory Elective
Contained in: Study Focus / Technology and Management in Construction

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each winter term	1 term	German	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-100627	Decommissioning of Nuclear Facilities (S. 271)	6	Sascha Gentes

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-100627 with oral examination according to § 4 Par. 2 No. 2
details about the learning control see at the 'Teilleistung'

Grade of the Module
grade of the module is grade of the exam

Prerequisites
none

Qualification Goals
The students can name the processes, equipments and machinery for decommissioning nuclear facilities. They can explain analytical methods for the procedure, the required techniques and processes for decommissioningand can develop decommissioning concepts. They are able to analyse self-reliantly decommissioning projects of nuclear facilities and to work in teams. They can prepare proposal for approval considereing the respective laws.

Content
This course provides an overview about the state of research and technology in mechanical process engineering for the decommissioning of nuclear facilities. This involves decontamination procedures, remote-handled procedures, and procedures for the separation of reinforced concrete, etc.
The required approvals and licenses and the involved authorities will be introduced and discussed using examples and legal sources, e.g. the German Atomic Energy Act (Atomgesetz). The basics of radiation protection together with the pertaining measurement technology will be explained in step with actual practice. Furthermore, a suitable system to successfully manage decommissioning projects will be presented as well as the numerous stakeholders involved.
A visit to a nuclear facility currently under decommissioning is part of the course. The new findings will be further discussed in conjunction with existing decommissioning projects which will also be presented by the involved industry partners.

Recommendations
none

Remarks
none

Literature
1) Kohli, Rajiv [Hrsg.]: Developments in surface contamination and cleaning - fundamentals and applied aspects, Knovel library, USA, 2008.
2) Rahman, A.: Decommissioning and radioactive waste management, Whittles, Dunbeath, 2008.
3) Thierfeldt, S.; Schartmann,F.: Stillegung und Rückbau kerntechnischer Anlagen - Erfahrungen und Perspektiven, 4. Neu bearbeitete Auflage, Brenk Systemplanung Aachen, 2012.
4) Zeiher, Marco: Ein Entscheidungsunterstützungsmodell für den Rückbau massiver Betonstrukturen in kerntechnischen Anlagen, Karlsruhe, Univ., Diss., 2009.

5) Fortschrittsbericht über den Stand der BMBF – Stilllegungsprojekte und der vom BMBF geförderten FuE-Arbeiten zu 'Stilllegung / Rückbau kerntechnischer Anlagen'

Workload

contact hours (1 HpW = 1 h x 15 weeks):

- Removal and Decontamination of Nuclear Facilities lecture, exercise: 30 h
- New Development and Optimization of Decommissioning Machine Technology lecture, exercise: 30 h

independent study:

- preparation and follow-up lectures, exercises Removal and Decontamination of Nuclear Facilities: 30 h
- preparation and follow-up lectures, exercises New Development and Optimization of Decommissioning Machine Technology: 30 h
- examination preparation: 60 h

total: 180 h

M Module: Design and Construction of Components in Reinforced Concrete (bauiM1P1-BEMISTB) [M-BGU-100033]

Responsibility: Lothar Stempniewski

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Structural Engineering
Study Focus / Geotechnical Engineering

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each winter term	1 term	German	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-100170	Student Research Project 'Reinforced Concrete' (S. 389)	2	Lothar Stempniewski
T-BGU-100015	Design and Construction of Components in Reinforced Concrete (S. 272)	4	Lothar Stempniewski

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-100170 with not graded accomplishment according to § 4 Par. 3
- 'Teilleistung' T-BGU-100015 with written examination according to § 4 Par. 2 No. 1
details about the learning controls see at the respective 'Teilleistung'

Grade of the Module
grade of module is grade of the exam

Prerequisites
none

Qualification Goals
Based on the module 'Basics in Reinforced Concrete' and cross-cutting modules such as 'Structural Analysis' the students can recognize complex subjects of reinforced concrete and apply their methods. They can assign given problems to the respective design problems, conduct these subsequently and apply the current standards. Furthermore, the students can interpretate the results of a design and evaluate them with respect to their correctness and profitability.

Content
Design and Construction of Components, Design for bending and Torsion, Biaxial Bending, Punching, Truss Analogy

Recommendations
courses Basics of Reinforced Concrete I+II (6200509, 6200601)

Remarks
none

Literature
lecture notes

Workload
contact hours (1 HpW = 1 h x 15 weeks):

- lecture, exercise: 60 h

independent study:

- preparation and follow-up lectures, exercises: 30 h
- preparation of student research project: 60 h
- examination preparation: 30 h

total: 180 h

M Module: Digitalization in Facility and Real Estate Management (bauiM4S19-) [M-BGU-104348]

Responsibility: Kunibert Lennerts

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Technology and Management in Construction

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each winter term	1 term	German	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-108941	Digitalization in Facility and Real Estate Management (S. 273)	6	Kunibert Lennerts

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017

- 'Teilleistung' T-BGU-108941 with examination of other type according to § 4 Par. 2 No. 3
details about the learning control see at the 'Teilleistung'

Grade of the Module

grade of the module is grade of the exam

Prerequisites

none

Qualification Goals

Students can specify and characterize concepts of digitalization in facility and real estate management. They have basic knowledge of sensor electronics and can implement them independently in building automation. In addition, students gain insight into the 'Internet of Things´ in the area of facility and real estate management. Furthermore, students are able to create building services with Building Information Modeling and also to visualize exemplary maintenance and inspection work through 'augmented reality´ using a HoloLens.

Content

- basic information of concepts of digitalization
- consideration of the technical building equipment in Building Information Modeling
- execute Internet of Things in building automation
- processing of sensor signals by sensor electronics
- visualize of maintenance and inspection work through 'augmented reality´ (HoloLens)
- producing project work during the semester colloquium

Recommendations

none

Remarks

none

Workload

contact hours (1 HpW = 1 h x 15 weeks):

- Digitalization in Facility and Real Estate Management lecture/exercise: 60 h

independent study:

- preparation and follow-up lecture/exercises Digitalization in Facility and Real Estate Management: 40 h
- preparation of project Digitalization in Facility and Real Estate Management, incl. report and presentation (examination): 80 h

total: 180 h

M Module: Durability and Service Life Design (bauiM1S25-DAUERLEB) [M-BGU-100057]

Responsibility: Michael Vogel

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Structural Engineering

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each winter term	1 term	German	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-100037	Durability and Service Life Design (S. 274)	6	Michael Vogel

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-100037 with oral examination according to § 4 Par. 2 No. 2
details about the learning control see at the 'Teilleistung'

Grade of the Module
grade of the module is grade of the exam

Prerequisites
none

Qualification Goals
see German version

Content
see German version

Recommendations
course Building Chemistry (6200108)

Remarks
none

Workload
contact hours (1 HpW = 1 h x 15 weeks):

- Corrosion Processes and Life Time lecture/exercise: 45 h
- Analytic Methods lecture: 15 h

independent study:

- preparation and follow-up lecture/exercises Corrosion Processes and Life Time: 45 h
- preparation and follow-up lectures Analytic Methods: 15 h
- examination preparation: 60 h

total: 180 h

Module: Earthworks and Foundation Engineering (bauiM5P2-ERDGB) [M-BGU-100068]

Responsibility: Theodoros Triantafyllidis

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Geotechnical Engineering

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each winter term	1 term	German	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-100068	Earthworks and Foundation Engineering (S. 276)	4	Theodoros Triantafyllidis
T-BGU-100178	Student Research Project 'Earthworks and Foundation Engineering' (S. 386)	2	Theodoros Triantafyllidis

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017

- 'Teilleistung' T-BGU-100178 with not graded accomplishment according to § 4 Par. 3
- 'Teilleistung' T-BGU-100068 with written examination according to § 4 Par. 2 No. 1

details about the learning controls see at the respective 'Teilleistung'

Grade of the Module

grade of the module is grade of the exam

Prerequisites

none

Qualification Goals

With regard to geotechnical constructions the students are able to select and apply appropriate methods for exploration, modelling, dimensioning, realization and control in the case of complex requirements on average. They can apply this knowledge to earthworks and embankment engineering, can identify all geotechnically relevant problems occurring with dams and can apply self-reliantly design and dimensioning rules in outline. They gained geotechnical competence in solving problems for all kind of constructions in and with unconsolidated rocks, also with respect to the managerial organization, expense budgeting, use of documents and presentation of results.

Content

The module deepens the safety concepts in earthworks and foundation engineering and the project design for foundation problems by means of several examples (foundations on soft soil, variants of construction pit supporting system, stabilization and drainage of embankments, slope stabilization, retaining structure, underpinning) and explains the observation method. Basics of earthworks and foundation engineering are presented such as building materials for dams, design requirements, construction of dams, sealing and stability of filled dams. Further basics are computation of seepage and the evaluation of erosion, suffosion, piping, colmatation and joint erosion.

Recommendations

basic knowledge of Soil Mechanics and Foundation Engineering;
compilation and submission of student research project as examination preparation until examination date

Remarks

none

Literature

[1] Witt. K.J. (2008), Grundbau-Taschenbuch, Teil 1,
[2] Ernst & S. Smoltczyk, U. (2001), Grundbau-Taschenbuch, Teil 2-3,
[3] Ernst & S. Schmidt, H.G. & Seitz, J. (1998), Grundbau , Bilfinger & Berger

[4] Striegler (1998), Dammbau in Theorie und Praxis, Verlag für Bauwesen Berlin
[5] Kutzner (1996), Erd- und Steinschüttdämme für Stauanlagen, Enke Verlag Stuttgart

Workload
contact hours (1 HpW = 1 h x 15 weeks):

- Foundation Types lecture/exercise: 30 h
- Basics in Earthworks and Embankment Dams lecture/exercise: 30 h

independent study:

- preparation and follow-up lecture/exercises Foundation Types: 10 h
- preparation and follow-up lecture/exercises Basics in Earthworks and Embankment Dams: 10 h
- preparation of student research project: 60 h
- examination preparation: 40 h

total: 180 h

M Module: Economics and Management in Construction (bauiM4P3-) [M-BGU-100102]

Responsibility: Shervin Haghsheno

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Technology and Management in Construction

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each summer term	1 term	German	2

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-100143	Economics and Management in Construction (S. 278)	5	Shervin Haghsheno
T-BGU-108010	Student Research Project 'Cost Estimation in Structural Engineering and Earthworks' (S. 384)	1	Harald Schneider

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017

- 'Teilleistung' T-BGU-108010 with not graded accomplishment according to § 4 Par. 3
- 'Teilleistung' T-BGU-100143 with written examination according to § 4 Par. 2 No. 1

details about the learning controls see at the respective 'Teilleistung'

Grade of the Module

grade of the module is grade of the exam

Prerequisites

none

Qualification Goals

Students can define the term accounting and can explain the various components and tasks. They gain the ability to apply the various types of depreciation. The students can explain the different methods of calculation and the structure of a calculation. They have the knowledge to create tenders and unit prices independently. Furthermore, students can apply current software for the calculation.

Students have the ability to assign the different stakeholders to partnerships and corporate enterprises and to explain the construction contract laws as well as the difference between BGB and VOB. Furthermore, students can explain the different types of procuration. Students can explain legal bases of construction law and are able to assess and evaluate the contents of a construction contract. Moreover, students develop legal thinking regarding contract and employment law and can apply the basic to construction projects.

Content

This module covers the calculation of various factors (Mittellohn, EKT, BGK, AGK and W&G). After a manual example for tendering, the result will be transferred to currently applied software. Furthermore following topics are discussed within the lectures: ▪ financing ▪ investing ▪ basics of contolling ▪ forms of organisation

Recommendations

none

Remarks

none

Literature

1) Bronner, Albert: Angebots- und Projektkalkulation - Leitfaden für Praktiker, Springer, 3., aktualisierte Aufl., Berlin, Heidelberg, 2008.

2) Drees, Gerhard u. Paul, Wolfgang: Kalkulation von Baupreisen - Hochbau, Tiefbau, Schlüsselfertiges Bauen, Bauwerk, 10., erw. und aktualisierte Aufl., Berlin, 2008.

3) Leimböck, Egon; Klaus, Ulf Rüdiger u. Hölkermann Oliver: Baukalkulation und Projektcontrolling unter Berücksichtigung der KLR Bau und der VOB, Vieweg, 11., überarb. Aufl., Wiesbaden, 2007.
4) Girmscheid, Gerhard, Motzko, Christoph: Kalkulation und Preisbildung in Bauunternehmen - Grundlagen, Methodik und Organisation, Springer, Berlin, Heidelberg, 2007.
5) Handwörterbuch der Betriebswirtschaft (HWB), Herausgegeben von: Prof. Dr. Dr. h.c. Richard Köhler, Prof. Dr. Dr. h.c. Hans-Ulrich Küpper, Prof. Dr. Andreas Pfingsten, Schäffer Pöeschel, 6. Auflage, 2007

Workload
contact hours (1 HpW = 1 h x 15 weeks):

- Cost Estimation lecture/exercise: 30 h
- Building Laws lecture: 30 h

independent study:

- preparation and follow-up lecture/exercises Cost Estimation: 20 h
- preparation and follow-up lectures Building Laws: 20 h
- preparation of student research project: 30 h
- examination preparation: 50 h

total: 180 h

M Module: Environmental Communication (bauiM2S07-HY7) [M-BGU-101108]

Responsibility: Charlotte Kämpf

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Water and Environment

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each winter term	1 term	German	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-106620	Examination Prerequisite Environmental Communication (S. 284)	0	Charlotte Kämpf
T-BGU-101676	Environmental Communication (S. 279)	6	Charlotte Kämpf

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-106620 with not graded accomplishment according to § 4 Par. 3 as examination prerequisite
- 'Teilleistung' T-BGU-101676 with examination of other type according to § 4 Par. 2 No. 3
details about the learning controls see at the respective 'Teilleistung'

Grade of the Module
grade of the module is grade of the exam

Prerequisites
none

Qualification Goals
(see German version)

Content
(see German version)

Recommendations
none

Remarks
IMPORTANT:
The module will not be offered anymore as from winter term 2019/20.

Literature
(see German version)

Workload
contact hours (1 HpW = 1 h x 15 weeks):

- seminar (lecture): 20 h

independent study:

- preparation and follow-up seminar: 40 h
- preparation of literature annotations and short presentation (exam prerequisite): 45 Std.
- preparation of presentation, manuscript and poster (exam): 75 Std.

total: 180 h

M Module: Environmental Fluid Mechanics (bauiM2S19-SM5) [M-BGU-103383]

Responsibility: Olivier Eiff

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Water and Environment

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each winter term	1 term	English	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-106767	Environmental Fluid Mechanics (S. 280)	6	Olivier Eiff

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-106767 with written examination according to § 4 Par. 2 No. 1
details about the learning control see at the 'Teilleistung'

Grade of the Module
grade of the module is grade of the exam

Prerequisites
none

Qualification Goals
Students identify fundamental hydrodynamic processes in the natural environment in water and air applications and solve related problems. They can relate the observed phenomena to fundamental principles of hydrodynamics and to the specific nature of the flow conditions. They can critically evaluate the different models and approximations made to obtain solutions and predictions and can make first estimates.

Content
This module covers the fundamental concepts and flow models of environmental fluid mechanics in both water and air. The topics include turbulence structure in rivers and open channels, diffusion and dispersion, atmospheric boundary layers, internal waves, instabilities and mixing, stratified turbulence, buoyant jets and plumes.

Recommendations
modules Advanced Fluid Mechanics [bauiM2P9-ADVFM], Analysis of Turbulent Flow [bauiM2S32-NS3]

Remarks
none

Workload
contact hours (1 HpW = 1 h x 15 weeks):

- lecture/exercise: 60 h

independent study:

- preparation and follow-up lecture/exercises: 60 h
- examination preparation: 60 h

total: 180 h

M Module: Environmental Geotechnics (bauiM5S09-UMGEOTEC) [M-BGU-100079]

Responsibility: Theodoros Triantafyllidis

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Geotechnical Engineering

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each winter term	1 term	German	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-100084	Landfills (S. 326)	3	Andreas Bieberstein
T-BGU-100089	Brownfield Sites - Investigation, Evaluation, Rehabilitation (S. 253)	3	Andreas Bieberstein

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017

- 'Teilleistung' T-BGU-100084 with oral examination according to § 4 Par. 2 No. 2
- 'Teilleistung' T-BGU-100089 with oral examination according to § 4 Par. 2 No. 2

details about the learning control see at the 'Teilleistung'

Grade of the Module

grade of the module is CP weighted average of grades of the partial exams

Prerequisites

none

Qualification Goals

Knowledge of the legal requirements regarding the depositing of waste. Presentation of the geotechnical concerns in the construction of landfill sites depending on the particular landfill classification, landfill elements, their relevant requirements and necessary certifications. Knowledge of the permitted limits for brown-fields. Interdisciplinary cross-linking of chemical, mineralogical, biological, hydraulic and geotechnical aspects of the treatment of brown-fields. Knowledge of the relevant procedures of decontamination, their limitations and risks.

Content

Waste-situation and waste catalogue, Requirements from the authorities, legal basis, Planning landfill sites, Multi-barrier system, Construction elements, Hydraulic analysis, Technical equipment for gas treatment of landfills, Statical analysis, Serviceability analysis, Construction, Special design solutions, strengthening of landfills. Introduction to the problematic of brownfields, Investigation and location assessment of brownfields, Harmful substances and their behavior in the environment, Environmental-chemical and mineralogical aspects of the accumulation of harmful substances in soil, Natural attenuation and active microbiological decontamination procedures, Reactive walls and electro-kinetic decontamination procedures, Soil washing, combustion, pyrolysis, immobilization and compression, Geotechnical aspects of the containment of industrial waste landfills, Hydraulic and pneumatic decontamination procedures, Case-studies, Excursion.

Recommendations

none

Remarks

none

Literature

DGGT, GDA-Empfehlungen – Geotechnik der Deponien und Altlasten, Ernst und Sohn, Berlin
Drescher (1997), Deponiebau, Ernst und Sohn, Berlin
Reiersloh, D und Reinhard, M. (2010): Altlastenratgeber für die Praxis, Vulkan-V. Essen

Workload

contact hours (1 HpW = 1 h x 15 weeks):

- Landfills lecture/exercise: 30 h
- Brownfield Sites - Investigation, Evaluation, Rehabilitation lecture: 30 h
- Excursion: 10 h

independent study:

- preparation and follow-up lecture/exercises Landfills: 25 h
- examination preparation Landfills (partial exam): 30 h
- preparation and follow-up lectures Brownfield Sites - Investigation, Evaluation, Rehabilitation: 25 h
- examination preparation Brownfield Sites - Investigation, Evaluation, Rehabilitation (partial exam): 30 h

total: 180 h

M Module: Environmentally-friendly Recycling and Disassembly of Buildings (bauiM4S06-) [M-BGU-100110]

Responsibility: Sascha Gentes

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Technology and Management in Construction

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each summer term	1 term	German	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-100146	Environmentally-Friendly Recycling and Disassembly of Buildings (S. 281)	6	Sascha Gentes

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-100146 with oral examination according to § 4 Par. 2 No. 2
details about the learning control see at the 'Teilleistung'

Grade of the Module
grade of the module is grade of the exam

Prerequisites
none

Qualification Goals
see German version

Content
Information about the state of research and technology with respect to machined disassembly, transport, conditioning, dumping, and disposal of demolition waste, as well as the latest developments in machine technology is imparted. The entire approval process from the demolition license application to machine deployment plans will be discussed in addition to technical aspects. This also involves occupational safety, immission control, as well as handling pollutants in buildings to be demolished. Specific tasks, e.g. the partial demolition of existing buildings, will be explained and calculated using existing examples. VDI (The Association of German Engineers) guidelines pertaining to demolition projects will be introduced and an excursion to a recycling facility will provide the opportunity to discuss landfill directives.

Recommendations
none

Remarks
none

Literature
1) Seemann, Axel: Entwicklung integrierter Rückbau- und Recyclingkonzepte für Gebäude - ein Ansatz zur Kopplung von Demontage, Sortierung und Aufbereitung, Shaker, Aachen, 2003.
2) RAL, Deutsches Institut für Gütesicherung und Kennzeichnung e.V.: Ausbau und Entsorgung von Gefahrstoffen in Bauwerken - Gütesicherung, Beuth, Ausg. Juni 2004, Berlin, 2004.
3) Schröder, Marcel [Red.]: Abbrucharbeiten - Grundlagen, Vorbereitung, Durchführung, Müller, 3., aktualisierte und erw. Aufl., Köln, 2015.
4) VDI 6202 'Schadstoffsanierung'
5) VDI 6210 'Abbruch'

Workload
contact hours (1 HpW = 1 h x 15 weeks):

- Project Studies lecture, exercise: 30 h
- Disassembly Process Engineering lecture, exercise: 30 h

independent study:

- preparation and follow-up lectures, exercises Project Studies: 30 h
- preparation and follow-up lectures, exercises Disassembly Process Engineering: 30 h
- examination preparation: 60 h

total: 180 h

M Module: Equipment and special Construction Techniques in Building Practice (bauiM4S18-) [M-BGU-103918]

Responsibility:	Sascha Gentes
Institution:	KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften
Curricular Embedding:	Compulsory Elective
Contained in:	Study Focus / Technology and Management in Construction

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each term	2 terms	German	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-108009	Equipment and special Construction Techniques in Building Practice (S. 282)	6	Sascha Gentes

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-108009 with oral examination according to § 4 Par. 2 No. 2
details about the learning control see at the 'Teilleistung'

Grade of the Module
grade of the module is grade of the exam

Prerequisites
none

Qualification Goals
see German version

Content
see German version

Recommendations
none

Remarks
This module will be offerd newly as from summer term 2018.

Workload
contact hours (1 HpW = 1 h x 15 weeks):

- Equipment and specific Methods in Construction I lecture: 30 h
- Equipment and specific Methods in Construction II lecture: 30 h

independent study:

- preparation and follow-up lectures Equipment and specific Methods in Construction I: 30 h
- preparation and follow-up lectures Equipment and specific Methods in Construction II: 30 h
- examination preparation: 60 h

total: 180 h

M Module: Experimental Hydraulics and Measuring Techniques (bauiM2S37-WB10) [M-BGU-103388]

Responsibility: Frank Seidel

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Water and Environment

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each winter term	1 term	German	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-106773	Experimental Hydraulics II (S. 286)	3	Frank Seidel
T-BGU-103562	Flow Measuring Technique (S. 294)	3	Christof-Bernhard Gromke

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017

- 'Teilleistung' T-BGU-106773 with examination of other type according to § 4 Par. 2 No. 3
- 'Teilleistung' T-BGU-103562 with oral examination according to § 4 Par. 2 No. 2
details about the learning controls see at the respective 'Teilleistung'

Grade of the Module

grade of the module is CP weighted average of grades of the partial exams

Prerequisites

The module must not be selected together with the module Experimental Techniques II: Measurement Techniques [bauiM2S18-SM4].

Modeled Conditions

The following conditions must be met:

- The module [M-BGU-103904] *Experimental Techniques II: Measurement Techniques* must not have been started.

Qualification Goals

Students are able to describe the principles of different flow measurement methods and combine this information with the basics of today's flow measurement technology. They have basic knowledge about the structure and can analyze the suitability of measurement methods and set application boundaries.
Students have basic knowledge about experimentation in hydraulics. They know the similarity mechanical requirements and assign them to the hydromechanical basics. Students are able to analyze applications in the field of multiphase hydraulics and select suitable model concepts. They can present their own thoughts and ideas in a structured manner and discuss the themes with specialists.

Content

In this module, the following topics will be discussed in depth:

- basic equations in fluid mechanics
- measurement methods and their fields of application
- experimental models with movable beds
- experiments related to multiphase flow problems (water-air, water-solid)

Recommendations

module Experiments in Fluid Mechanics [bauiM2S39-SM6],
hydraulic lab practice

Remarks

none

Workload

contact hours (1 HpW = 1 h x 15 weeks):

- Flow Measuring Techniques lecture/exercise: 30 h
- Experimental Hydraulics II lecture/exercise: 30 h

independent study:

- preparation and follow-up lecture/exercises Flow Measuring Techniques: 30 h
- examination preparation Flow Measuring Techniques (partial exam): 30 h
- preparation and follow-up lecture/exercises Experimental Hydraulics II: 30 h
- preparation of term paper (partial exam): 30 h

total: 180 h

M Module: Experimental Techniques II: Measurement Techniques (bauiM2S18-SM4) [M-BGU-103904]

Responsibility: Bodo Ruck

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Water and Environment

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each winter term	2 terms	German	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-103562	Flow Measuring Technique (S. 294)	3	Christof-Bernhard Gromke
T-BGU-107961	Signal Processing (S. 373)	3	Bodo Ruck

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-103562 with oral examination according to § 4 Par. 2 No. 2
- 'Teilleistung' T-BGU-107961 with oral examination according to § 4 Par. 2 No. 2
details about the learning controls see at the respective 'Teilleistung'

Grade of the Module
grade of the module is CP weighted average of grades of the partial exams

Prerequisites
The module must not be selected together with the module Hydraulic Structures [bauiM2S37-WB10].

Modeled Conditions
The following conditions must be met:

- The module [M-BGU-103388] *Experimental Hydraulics and Measuring Techniques* must not have been started.

Qualification Goals
The students can describe the principles of today's measurement techniques and can explain different flow measuring techniques regarding setup and application. They are able to describe the principles of signal processing in experimental fluid mechanics and the options of analyses of different mesasurement techniques and systems. They can explain how flow velocities are determined by pressure, electrical, acoustic or optical signals and from that further information about the flow, e.g. turbulence and spectra, is derived.

Content
This module imparts the fundamentals in flow measuring techniques as used nowadays in different technical fields. Measurement techniques based on mechanical, electrical and optical principles are discussed in detail. Methods of signal processing in fluid mechanics are presented by explaining basic processing techniques. This includes techniques of processing in time and frequency domain, analysis by quadrants and image analysis in fluid mechanics.

Recommendations
none

Remarks
IMPORTANT:
The module will not be offered anymore as from summer term 2019.

Literature
Profos, P., Pfeifer, T., 1993: "Grundlagen der Messtechnik", Oldenburg-Verlag, ISBN 3-486-22537-5Ruck, B., 1987: "Laser-Doppler-Anemometrie", AT-Fachverlag Stuttgart, ISBN 3-921 681-00-6Ruck, B. (Hrsg.), 1990: "Lasermethoden

in der Strömungsmesstechnik", AT-Fachverlag Stuttgart, ISBN 3-921681-01-4Schlichting, H., Gersten, K., 2006: "Grenzschichttheorie", Springer-Verlag, ISBN: 978-3-540-23004-5

Workload
contact hours (1 HpW = 1 h x 15 weeks):

- Flow Measuring Technique lecture/exercise: 30 h
- Signal Processing in Fluid Mechanics lecture, exercise: 30 h

independent study:

- preparation and follow-up lectures/exercises Flow Measuring Technique: 30 h
- examination preparation Flow Measuring Technique (partial exam): 30 h
- preparation and follow-up lectures, exercises Signal Processing in Fluid Mechanics: 30 h
- examination preparation Signal Processing in Fluid Mechanics (partial exam): 30 h

total: 180 h

M Module: Experiments in Fluid Mechanics (bauiM2S39-SM6) [M-BGU-103377]

Responsibility: Olivier Eiff

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Water and Environment

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each summer term	1 term	English	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-106760	Experiments in Fluid Mechanics (S. 287)	6	Olivier Eiff

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-106760 with examination of other type according to § 4 Par. 2 No. 3
details about the learning control see at the 'Teilleistung'

Grade of the Module
grade of the module is grade of the exam

Prerequisites
none

Qualification Goals
Students relate the hydrodynamics theory and physical concepts to the observed physical reality. They apply their knowledge and skills for the comparative analysis of basic flow situations in physical models, using appropriate measurement technologies. They assess and evaluate the results and limitations by comparing their results with theoretical deductions. They extend their results of phenomena-oriented experiments with regard to practical applications in technical hydraulics and environmental flows. Acquired competence: operation of test facilities and instrumentation, data analysis and basic statistical error analysis, team work, written and oral communication.

Content
Lecture:

- typical set-up of hydraulic and aerodynamic models
- dimensional analysis, dimensionless parameters
- measurement instrumentation
- introduction to statistical error analysis
- analogy numerical/physical modeling, model distortion
- technical writing and oral presentation

Physical experiments:

- pipe flow with orifice plate
- open channel flow with gates and hydraulic jumps
- Venturi pipe flow with cavitation- Settling velocities of spheres
- diffusion of a turbulent air jet
- turbulent wake
- dam leakage

Recommendations
module Advanced Fluid Mechanics (bauiM2P9)

Remarks
none

Literature
Tropea, C. et.al., 2007, Springer Handbook of Experimental Fluid Mechanics, Springer Verlag Berlin

Muste, M., Aberle, J., Admiraal, D., Ettema, R., Garcia, M. H., Lyn, D., Nikora, V., Rennie, C., 2017, Experimental Hydraulics: Methods, Instumentation, Data Processing and Management, Taylor and Francis

Workload

contact hours (1 HpW = 1 h x 15 weeks):

- lecture/lab exercise: 60 h

independent study:

- preparation and follow-up lectures: 30 h
- preparation of laboratory reports (part of the examination): 60 h
- preparation of oral examination (part of the examination): 30 h

total: 180 h

M Module: Facility Management in Hospitals and Hospital Management (bauiM4S13-) [M-BGU-100347]

Responsibility: Kunibert Lennerts

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Technology and Management in Construction

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each winter term	1 term	German	2

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-109291	Facility Management in Hospitals and Hospital Management (S. 288)	6	Kunibert Lennerts

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-109291 with examination of other type according to § 4 Par. 2 No. 3
details about the learning control see at the 'Teilleistung'

Grade of the Module
grade of the module is grade of the exam

Prerequisites
none

Qualification Goals
Students are able to describe and understand the principle of funding hospitals the basics of the German health care system. You know the cost structures in a hospital and are able to understand the basis of the hospital accounting.Students are able to distinguish primary and secondary processes in a hospital each other. For selected facility management processes (secondary) processes, students can carry out strategic planning. Students understand the basic principles of hospital planning with a focus on master planning, space and function program and layout planning.Furthermore, students can give an overview over a wide range of hospital management.

Content
- hospital financing
- cost structures of a hospital
- facility management processes in hospitals
- strategic planning of selected facility management services
- sustainable hospitals
- master planning, space and function program and layout planning of hospitals
- introduction to hospital management
- internal organizational structures, working conditions and working environment in the hospital

Recommendations
course Facility and Real Estate Management (6200414)

Remarks
none

Workload
contact hours (1 HpW = 1 h x 15 weeks):

- Facility Management in Hospitals lecture/exercise: 45 h
- Hospital Management lecture: 15 h

independent study:

- preparation and follow-up lecture/exercises Facility Management in Hospitals: 30 h
- preparation and follow-up lectures Hospital Management: 15 h
- preparation of term paper Facility Management in Hospitals and Haospital Management: 75 h

total: 180 h

M Module: FE-Applications in Practical Engineering (bauiM1S16-FE-PRAXIS) [M-BGU-100048]

Responsibility: Werner Wagner

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Structural Engineering

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each summer term	1 term	German	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-100032	FE-Applications in Practical Engineering (S. 289)	6	Werner Wagner

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-100032 with oral examination according to § 4 Par. 2 No. 2
details about the learning control see at the 'Teilleistung'

Grade of the Module
grade of the module is grade of the exam

Prerequisites
none

Qualification Goals
The students can conduct and check computer aided modeling of structures by using commercial FE-codes (beams, surface structures) for practical civil engineering projects.

Content
- application of different commercial software for the modeling of beam- and surface structures
- structural analysis and design
- discussion of approximation behaviour of numerical methods at examples
- analytical comparative calculations
- software comparisons
- control options.

Recommendations
module Computational Analysis of Structures [bauiM1S15-CTWM]

Remarks
none

Literature
lecture notes Computational Analysis of Structures

Workload
contact hours (1 HpW = 1 h x 15 weeks):
- lecture, exercise: 60 h

independent study:
- preparation and follow-up lectures, exercises: 45 h
- examination preparation: 75 h

total: 180 h

M Module: Finite Elements in Solid Mechanics (bauiM1S37-FEFKM) [M-BGU-100578]

Responsibility: Peter Betsch

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Structural Engineering

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each summer term	1 term	German	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-100998	Finite Elements in Solid Mechanics (S. 292)	6	Peter Betsch

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-100998 with oral examination according to § 4 Par. 2 No. 2
details about the learning control see at the 'Teilleistung'

Grade of the Module
grade of the module is grade of the exam

Prerequisites
none

Qualification Goals
see German version

Content
see German version

Recommendations
module 'Basics in Finite Elements'

Remarks
none

Workload
contact hours (1 HpW = 1 h x 15 weeks):

- lectures, exercises: 60 h

independent study:

- preparation and follow-up: 45 h
- working on programming exercises: 30 h
- examination preparation and examination: 45 h

total: 180 h

M Module: Flow and Sediment Dynamics in Rivers (bauiM2S35-WB8) [M-BGU-104083]

Responsibility: Franz Nestmann

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Water and Environment

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each summer term	1 term	English	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-108466	Seminar Paper 'Flow Behavior of Rivers' (S. 369)	2	Franz Nestmann, Frank Seidel
T-BGU-108467	Flow and Sediment Dynamics in Rivers (S. 293)	4	Franz Nestmann

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017

- 'Teilleistung' T-BGU-108466 with not graded accomplishment according to § 4 Par. 3 as examination prerequisite
- 'Teilleistung' T-BGU-108467 with oral examination according to § 4 Par. 2 No. 2

details about the learning controls see at the respective 'Teilleistung'

Grade of the Module

grade of the module is grade of the exam

Prerequisites

none

Qualification Goals

Students are able to name and explain the basic relationships and interactions between topography, flow and morphodynamics in natural streams. They can describe and apply the respective design approaches. Students are able to analyze the engineering design methods and combine this information with the basics of hydromechanics. They actively and independently inform themselves about the latest state in technology and can use adequate methods to solve engineering problems. They can present their findings and discuss the themes with specialists.

Content

In this module, the following topics are discussed in depth:

- geomorphic cycle
- space-time approach in morphology
- anthropogenic influences on streams
- vegetation hydraulics
- approaches to interactions
- bed load and sediment management in streams
- practical examples

Recommendations

basics in fluid mechanics, module Hydraulic Engineering [bauiM2P6-ADVHYENG]

Remarks

This module is offered purely in English as from summer term 2018. It replaces the module M-BGU-103393 Flow and Sediment Dynamics in Rivers (offered in German).

Workload

contact hours (1 HpW = 1 h x 15 weeks):

- Morphodynamics lecture/exercise: 30 h
- Flow Behavior of Rivers lecture/exercise: 30 h

independent study:

- preparation and follow-up lecture/exercises Morphodynamics: 15 h
- preparation and follow-up lecture/exercises Flow Behavior of Rivers: 15 h
- preparation of the seminar paper (exam prerequisite): 45 h
- examination preparation: 45 h

total: 180 h

M Module: Fracture and Damage Mechanics (bauiM1S21-BRUCHMECH) [M-BGU-100053]

Responsibility: Thomas Seelig

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Structural Engineering

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each winter term	1 term	German	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-100087	Fracture and Damage Mechanics (S. 295)	6	Thomas Seelig

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017

- 'Teilleistung' T-BGU-100087 with oral examination according to § 4 Par. 2 No. 2
details about the learning control see at the 'Teilleistung'

Grade of the Module

grade of the module is grade of the exam

Prerequisites

none

Qualification Goals

The students are able to apply the basic principles and methods of fracture and damage mechanics as used for the analysis of fissured structures and the description of complex material behavior. They can establish relationships between continuum mechanical descriptions and material specific aspects.

Content

- phenomenology and mechanisms of fracture
- linear elastic fracture mechanics (crack tip fields, K-concept, energy balance, J-integral, small scale yielding)
- elastic plastic fracture mechanics (Dugdale model, HRR-field, J-controlled crack growth)
- dynamic fracture mechanics (dynamic loading, fast running cracks)
- micromechanics of heterogeneous solids (defects and eigenstrain, RVE-concept, homogenization)
- damage mechanics (mechanisms of brittle and ductile damage, micromechanical and phenomenological models, softening and localization)

Recommendations

course Introduction to Continuum Mechanics (6200607)

Remarks

none

Literature

[1] Anderson, T.L.: Fracture Mechanics - Fundamentals and Application. CRC Press, 1995
[2] Gdoutos, E.E.: Fracture Mechanics - An Introduction. Kluwer Acad. Publ., 1993
[3] Gross, D., Seelig, Th: Bruchmechanik - mit einer Einführung in die Mikromechanik, Springer, 2016
[4] Knott, J.F.: Fundamentals of Fracture Mechanics. Butterworth, 1973
[5] Krajcinovic, D.: Damage Mechanics. Elsevier, 1996
[6] Kuna, M.: Numerische Beanspruchungsanalyse von Rissen. Springer, 2008
[7] Mura, T.: Micromechanics of Defects in Solids. Martinus Nijhoff Publishers, 1982
[8] Nemat-Nasser, S., Hori, M.: Micromechanics - Overall Properties of Heterogeneous Materials. North-Holland, 1993
[9] Zehnder, A.T.: Fracture Mechanics. Springer, 2012

Workload
contact hours (1 HpW = 1 h x 15 weeks):

- lecture, exercise: 60 h

independent study:

- preparation and follow-up lectures, exercises: 60 h
- examination preparation: 60 h

total: 180 h

M Module: Freshwater Ecology (bauiM2S41-SW8) [M-BGU-104922]

Responsibility: Stephan Fuchs

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Water and Environment

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each summer term	1 term	English	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-109956	Applied Ecology and Water Quality (S. 246)	3	Stephan Fuchs, Stephan Hilgert
T-BGU-109957	Field Training Water Quality (S. 290)	3	Stephan Fuchs, Stephan Hilgert

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-109956 with examination of other type according to § 4 Par. 2 No. 3
- 'Teilleistung' T-BGU-109957 with examination of other type according to § 4 Par. 2 No. 3
details about the learning controls see at the respective 'Teilleistung'

Grade of the Module
grade of the module is CP weighted average of grades of the partial exams

Prerequisites
none

Modeled Conditions
The following conditions must be met:

- The module [M-BGU-103361] *Water Ecology* must not have been started.

Qualification Goals
Students get familiar with the basic principles of water ecology in surface waters. They are able to explain interactions between abiotic control factors (flow, chemistry, structure) and their relevance for the ecological status of standing waters and streams and to evaluate them critically. They become acquainted with field and laboratory techniques to establish water quality.With the help of these methods, they evaluate data-quality of information collected in the field regarding chemical, biological and structural water quality and determine the level of uncertainty intrinsic to the data-collection methods.Using case studies, students are able to convey and evaluate positive results as well as restrictions from water restoration processes.

Content
As part of the module, water ecology principles, their practical significance and implementation of restoring measures are presented. The following topics are covered:

- pollutants loads discharged into water bodies: discharge points, pollutants, sediment problems
- sampling methods
- oxygen content
- methods for the assessment of water quality and water general status
- practical exercises to measure water quality and condition in the field

Students get acquainted with practical examples of water protection and water remediation measures and they interpret and discuss them as part of an individual assignment. For this purpose, they implement their own framework, based on visible requirements and achievable targets.

Recommendations
none

Remarks

The module is offered newly as from summer term 2019 and replaces the module Water Ecology.

The number of participants in the courses is limited to 20 persons. The registration is to be made via ILIAS. The places are allocated with priority to students from *Water Science and Engineering*, then *Civil Engineering* and *Geoecology* and further study programs. The allocation is made by consideration of the semester and the time of entry of the registration. The attendance at the first meeting is mandatory. In case of absence the place will be assigned to a person on the waiting list.

Literature

Wetzel, Limnology, 3rd Edition, Academic Press 2001
Jürgen Schwörbel, Methoden der Hydrobiologie, UTB für Wissenschaft 1999
kursbegleitende Materialien

Workload

contact hours (1 HpW = 1 h x 15 weeks):

- Applied Ecology and Water Quality lecture/seminar: 45 h
- Field Training Water Quality (block): 20 h

independent study:

- preparation of the report on Field Training Water Quality (partial examination): 55 h
- preparation of the seminar paper with presentation (partial examination): 60 h

total: 180 h

M Module: Geotechnical Testing and Measuring Technology (bauiM5S07-VERSMESS) [M-BGU-100076]

Responsibility:	Theodoros Triantafyllidis
Institution:	KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften
Curricular Embedding:	Compulsory Elective
Contained in:	Study Focus / Geotechnical Engineering

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each winter term	1 term	German	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-100075	Geotechnical Testing and Measuring Technology (S. 298)	6	Theodoros Triantafyllidis

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-100075 with oral examination according to § 4 Par. 2 No. 2
details about the learning control see at the 'Teilleistung'

Grade of the Module
none

Prerequisites
none

Qualification Goals
The students can classify the procedures and methods for subsoil exploration and testing techniques even those surpassing standard procedures. They are able to select reasonably appropriate combinations of techniques based on the specific application conditions and prerequisites. They can explain basic knowledge in geophysics, measurement technologies and the functioning principles of sensors and data acquisition. As a result of this they can select equipment reasonably with respect to resolution, accuracy, long term stability and interpretation. They have own experiences with the handling of sensor application, wiring, data acquisition, control elements, measuring and analysis procedures.

Content
The module deepens aspects of geotechnical experiments. Specific experiments from rock mechanics and dam and embarkment construction as well as the test of rheologic properties are presented. The students obtain also insight into geophysical exploratory methods. Further, basics with respect to the selection of appropriate sensors measuring physical, dynamic and electrical quantities, optical methods, correlation measurement techniques, influences of errors, data transfer, data acquisition as well as controlling concepts. The setup and test of a measurement chain for field measurements is practiced.

Recommendations
none

Remarks
none

Workload
contact hours (1 HpW = 1 h x 15 weeks):

- Rock Testing lecture: 15 h
- Testing in Dam and Wastefill Engineering lecture: 15 h
- Geotechnical Measuring Technology lecture/exercise: 30 h
- preparation and follow-up of experiments in the laboratory, own repeting experiments: 25 h

independent study:

- preparation and follow-up lecture Rock Testing: 10 h
- preparation and follow-up lecture Testing in Dam and Wastefill Engineering: 10 h
- preparation and follow-up lecture/exercise Geotechnical Measuring Technology: 15 h
- examination preparation: 60 h

total: 180 h

M Module: Glass, Plastic and Cable Structures (bauiM1S09- GlaKunSe) [M-BGU-100041]

Responsibility: Daniel Ruff

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Structural Engineering

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each winter term	1 term	German	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-100025	Glass, Plastic and Cable Structures (S. 300)	6	Daniel Ruff

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-100025 with oral examination according to § 4 Par. 2 No. 2
details about the learning control see at the 'Teilleistung'

Grade of the Module
grade of the module is grade of the exam

Prerequisites
none

Qualification Goals
The students can describe the historical evolution of glass materials, the material characteristics of currently used glass products in construction engineering as well as structural behavior of products of glass and glass-steel structures considering the specific properties of stainless steels. They are able to conduct proofs of load-carrying capacity according to current technical standards (e.g. DIN 18008).
The students can explain the manufacturing, characteristics, processing capacities and applications of plastics in construction engineering. In addition, the students can describe the principles of construction and design of adhesive bonds.
The students can describe the assembly, production and characteristics of high-strength tension members (steel cables, cords, tension bar members), the associated end-connections and their application in construction engineering. They are able to conduct simple proofs of structural safety for high-strength tension members according to Eurocode for predominantly statically stresses structures. In addition, they can explain the assembly of large structures with cables (stadium roofs, suspension bridges).

Content

- glass in civil engineering
- stainless steels, upgrading products
- construction details, design of glass structures
- plastics in civil engineering, adhesive bonds, construction details
- design of wires, cables, cords
- tension bar systems
- end-connections, buffles
- static structural behavior
- dynamic structural behavior
- design of structures with high-strength tension members
- construction details of high-strength tension members
- assembly of cable structures

Recommendations
course Basics in Steel Structures (6200504)

Remarks
none

Literature
lecture accompanying documents
Siebert, G., Maniatis, I: Tragende Bauteile aus Glas: Grundlagen, Konstruktion, Bemessung, Beispiele. Verlag Ernst & Sohn, Berlin, 2012.
DIN 18008 Teil 1 bis Teil 6: Glas im Bauwesen. Beuth-Verlag, Berlin, 2010 bis 2015.
Domininghaus, H. et. al.: Kunststoffe: Eigenschaften und Anwendungen. Springer-Verlag, Berlin, 2012.
Hellerich, W.: Werkstoff-Führer Kunststoffe. Springer-Verlag, Berlin, 2010.
DIN EN 1993-1-11: 2010-12: Eurocode 3: Bemessung und Konstruktion von Stahlbauten – Teil 1-11: Bemessung und Konstruktion von Tragwerken mit Zuggliedern aus Stahl. Beuth-Verlag, Berlin.
Feyrer, K: Drahtseile: Bemessung, Betrieb, Sicherheit. Springer-Verlag, Berlin, 2001.
Seidel, M: Textile Hüllen - Bauen mit biegeweichen Tragelementen: Materialien, Konstruktion, Montage. Verlag Ernst & Sohn, Berlin, 2008.

Workload
contact hours (1 HpW = 1 h x 15 weeks):

- lecture, exercise: 60 h

independent study:

- preparation and follow-up lectures, exercises: 45 h
- examination preparation: 75 h

total: 180 h

M Module: Ground Investigation (bauiM5S02-BERKUND) [M-BGU-100071]

Responsibility: Theodoros Triantafyllidis

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Geotechnical Engineering

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each summer term	1 term	German	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-100072	Ground Investigation (S. 302)	6	Theodoros Triantafyllidis

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-100072 with oral examination according to § 4 Par. 2 No. 2
details about the learning control see at the 'Teilleistung'

Grade of the Module
grade of the module is grade of the exam

Prerequisites
none

Qualification Goals
The students can conduct the standard experiments common in soil mechanics by themself, define appropriate experimental conditions, analyse and control the experiments purposefully and derive constructionally conclusions. They are familiar with the common field experiments in unconsolidated rocks, they can plan, control, analyse and interpret these. They conducted experiments exemplarily by themselves.

Content
The module covers standard tests in soil mechanics, starting with indexing experiments, determination of shear parameters and water permeability through to different triaxial tests. The different types of explorations, measurement of density and stiffness as well as determination of interface structures in rocks are demonstrated in field experiments. It is discussed which requirements the types of experiments define for exploratory drilling and sample quality, which laboratory and field experiment or experimental conditions respectively are required for the evaluation of the ground and foundation and how drillings can be converted to monitoring wells.

Recommendations
none

Remarks
none

Workload
contact hours (1 HpW = 1 h x 15 weeks):

- Soil Mechanical Laboratory Exercises: 30 h
- Geomechanical Field Exercise: 30 h
- preparation and follow-up of experiments in the laboratory, own repeating experiments: 30 h

independent study:

- preparation and follow-up Soil Mechanical Laboratory Exercises: 15 h
- preparation and follow-up Geomechanical Field Exercise: 15 h
- examination preparation: 60 h

total: 180 h

M Module: Ground Water and Earth Dams (bauiM5S04-GWDAMM) [M-BGU-100073]

Responsibility: Theodoros Triantafyllidis

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Geotechnical Engineering

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each summer term	1 term	German	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-100091	Ground Water and Earth Dams (S. 303)	6	Andreas Bieberstein

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-100091 with oral examination according to § 4 Par. 2 No. 2
details about the learning control see at the 'Teilleistung'

Grade of the Module
grade of the module is grade of the exam

Prerequisites
none

Qualification Goals
The students can describe the deepened knowledge about different geotechnical groundwater problems. They can dimension dewatering under very different boundary conditions and demonstrate geohydraulic relationships by example calculations. They are able to develop own solution approaches for dam construction problems, to evaluate construction techniques and to conduct the requested geotechnical proofs.

Content
The module discusses the investigation of the groundwater conditions in laboratory and field. Geohydraulic fundamentals are extended with respect to anisotropy, saturation fronts, air permeability and groundwater drawdown under specific boundary conditions. The construction of flow nets is applied to seepage problems and the underseepage of dams. The hydrologic hydraulic and geotechnical design of dams is deepened. Hereby, the design of artificial sealings and filters is linked to the geo-mechanical proofs such as sliding, spread and uplift stability, deformation and earthquake design. Buried auxiliary structures, dams designed for overtopping as well as metrological monitoring of dams are mentioned, too.

Recommendations
module Earthworks and Foundation Engineering [bauiM5P2-ERDGB]

Remarks
none

Literature

[1] Cedergren, H.R. (1989), Seepage, Drainage, and Flow Nets, 3. Aufl. Wiley
[2] Herdt, W. & Arndts, E. (1985), Theorie und Praxis der Grundwasserabsenkung, 2. Aufl. Ernst & S.

Workload

contact hours (1 HpW = 1 h x 15 weeks):

- Geotechnical Ground Water Problems lecture/exercise: 30 h
- Embankment Dams (Advanced) lecture/exercise: 30 h
- field trips: 10 h

independent study:

- preparation and follow-up lecture/exercises Geotechnical Ground Water Problems: 25 h
- preparation and follow-up lecture/exercises Embankment Dams (Advanced): 25 h
- examination preparation: 60 h

total: 180 h

M Module: Groundwater Management (bauiM2S08-HY8) [M-BGU-100340]

Responsibility: Ulf Mohrlok

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Water and Environment

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each summer term	2 terms	English	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-100624	Groundwater Hydraulics (S. 306)	3	Ulf Mohrlok
T-BGU-100625	Numerical Groundwater Modeling (S. 344)	3	Ulf Mohrlok

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-100624 with oral examination according to § 4 Par. 2 No. 2
- 'Teilleistung' T-BGU-100625 with examination of other type according to § 4 Par. 2 No. 3
details about the learning controls see at the respective 'Teilleistung'

Grade of the Module
grade of the module is CP weighted average of grades of the partial exams

Prerequisites
none

Qualification Goals
Based on the understanding of hydrogeological settings and fluid-mechanical processes in the subsurface students can characterize different kinds of groundwater systems by means of hydraulics. They can quantify the relevant flow and transport processes with simple analytical and numerical methods for different problems regarding groundwater quantity and quality. Thereby, they are able to conceive and evaluate the relations important for the management of groundwater resources.

Content
- groundwater systems
- fluid-mechanical processes in porous media
- methods of balancing groundwater flow and solute transport processes
- examples of groundwater management
- project work

Recommendations
basic knowledge in fluid mechanics, hydrology, solute transport and numerical methods

Remarks
none

Literature

Bear, J. (1979). Hydraulics of Groundwater. McGraw Hill.
Chiang, W.H. (2005). 3D - Groundwater Modeling with PMWIN: A Simulation System for Modeling Groundwater Flow and Transport Processes, 2/e, incl. CD-Rom. Berlin, Heidelberg, D.: Springer.
Fetter, C.W. (1999). Contaminant Hydrogeology , 2/e. Upper Saddle River, NJ, U.S.A.: Prentice Hall.
Mohrlok, U. (2009). Bilanzmodelle in der Grundwasserhydraulik: quantitative Beschreibung von Strömung und Transport im Untergrund, Karlsruhe, D.: Universitätsverlag.
Schwartz, F. and H. Zhang (2003). Fundamentals of Ground Water. New York, NY, U.S.A.: John Wiley & Sons.

Workload

contact hours (1 HpW = 1 h x 15 weeks):

- Groundwater Hydraulics lecture/exercise: 30 h
- Numerical Groundwater Modeling presentations/project discussions: 15 h

independent study:

- preparation and follow-up lecture/exercises, working on exercises Groundwater Hydraulics: 40 h
- examination preparation Groundwater Hydraulics (partial exam): 20 h
- project work Numerical Groundwater Modeling, incl. presentation and preparation of the report (partial exam): 80 h

total: 185 h

M Module: Highway Design (bauiM3S05-STRENTW) [M-BGU-100017]

Responsibility: Matthias Zimmermann

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Mobility and Infrastructure

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each term	1 term	German	2

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-109917	Study project Design of a Rural Road (S. 396)	2	Ralf Roos, Matthias Zimmermann
T-BGU-100057	Highway Design (S. 309)	4	Ralf Roos, Matthias Zimmermann

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017

- 'Teilleistung' T-BGU-109917 with not graded accomplishment according to § 4 Par. 3 as examination prerequisite
- 'Teilleistung' T-BGU-100057 with oral examination according to § 4 Par. 2 No. 2

details about the learning controls see at the respective 'Teilleistung'

Grade of the Module

grade of the module is grade of the exam

Prerequisites

none

Qualification Goals

The graduates can apply methods as well as manual and computer aided procedures for the design of a road in position elevation and cross section and design new roads. Furthermore, they are able to develop and evaluate variants of new roads considering traffic, topographic, ecologic and economic requirements as well as to assess road designs in compliance with the technical regulations.

Content

In this module the procedure of finding the route of a bypass road will be discussed and applied to a specific planning example. After defining the boundary conditions for the draft of this bypass road design solutions are developed in the map, in the gradient diagram and in the cross-section manually by small teams. The results are discussed. Here also, tests are made whether the standards are satisfied and related to requirements of the spatial route planning. In parallel to this manual route planning of the road, the procedure of a computer aided road design is addressed in theory as well as practically at basic design examples. The exercises are conducted by use of the both most popular design codes.

Recommendations

preliminary attendance of compulsory module Infrastructure Management [bauiM3P3-STRINFRA]

Remarks

none

Workload

contact hours (1 HpW = 1 h x 15 weeks):

- IT-based Road Design lectures/exercises: 30 h
- Highway Design Project Study lectures/exercises: 30 h

independent study:

- preparation and follow-up IT-based Road Design lectures/exercises: 30 h
- preparation and follow-up Highway Design Project Study lectures/exercises: 30 h
- attestation of study project (examination prerequisite): 20 h
- examination preparation: 40 h

total: 180 h

M Module: Hollow Section Structures (bauiM1S08-HOHLPROFIL) [M-BGU-100004]

Responsibility: Stefan Herion

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Structural Engineering

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each winter term	1 term	German	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-100086	Hollow Section Structures (S. 312)	6	Stefan Herion

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-100086 with oral examination according to § 4 Par. 2 No. 2
details about the learning control see at the 'Teilleistung'

Grade of the Module
grade of the module is grade of the exam

Prerequisites
none

Qualification Goals
The students can design and construct predominantly static and non predominantly static stressed constructions made of hollow sections considering their connections.

Content

- appliance in steel- and bridge engineering
- joint constructions
- fatigue behavior
- calculation examples

Recommendations
course Basics in Steel Structures (6200504)

Remarks
none

Literature
lecture notes: 'Hohlprofilkonstruktionen', Karlsruher Institut für Technologie (KIT), Versuchsanstalt für Stahl, Holz und Steine

Workload
contact hours (1 HpW = 1 h x 15 weeks):

- lecture, exercise: 60 h

independent study:

- preparation and follow-up lectures, exercises: 45 h
- examination preparation: 75 h

total: 180 h

M Module: Hydraulic Engineering (bauiM2P6-ADVHYENG) [M-BGU-103376]

Responsibility: Franz Nestmann

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Water and Environment

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each summer term	1 term	English	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-106759	Hydraulic Engineering (S. 316)	6	Franz Nestmann

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-106759 with written examination according to § 4 Par. 2 No. 1
details about the learning control see at the 'Teilleistung'

Grade of the Module
grade of the module is grade ot the exam

Prerequisites
none

Qualification Goals
Students are able to describe and analyze interactive water management processes (water-air and water-solid). They are able to assign these basic interactive processes to engineering tasks and carry out the dimensioning of hydraulic structures with suitable approaches. Based on the acquired process knowledge, they are able to analyze the different results of these dimensioning in a critical manner.
Students are able to use and link their knowledge logically. They can work in a reflexive and self-critical manner.

Content
The module provides students with basic theoretical and practical aspects of water-air and water-solid interactions as well as the relevance to engineering. Beginning with the basics in morphodynamics approaches for motion and mass fluxes at the river bed are presented. As another focus buildings in hydraulic engineering are addressed as well as their embedding in the river system.

Recommendations
none

Remarks
none

Workload
contact hours (1 HpW = 1 h x 15 weeks):

- Multiphase Flow in Hydraulic Engineering lecture/exercise: 30 h
- Design of Hydraulic Structures lecture/exercise: 30 h

independent study:

- preparation and follow-up lecture/exercises Multiphase Flow in Hydraulic Engineering: 30 h
- preparation and follow-up lecture/exercises Design of Hydraulic Structures: 30 h
- examination preparation: 60 h

total: 180 h

M Module: Hydraulic Structures (bauiM2S36-WB9) [M-BGU-103389]

Responsibility: Olivier Eiff

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Water and Environment

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each term	2 terms	German/English	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-106774	Groundwater Flow around Structures (S. 305)	3	Luca Trevisan
T-BGU-106775	Interaction Flow – Hydraulic Structures (S. 322)	3	Michael Gebhardt

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-106774 with oral examination according to § 4 Par. 2 No. 2
- 'Teilleistung' T-BGU-106775 with oral examination according to § 4 Par. 2 No. 2
details about the learning controls see at the respective 'Teilleistung'

Grade of the Module
grade of the module is CP weighted average of grades of the partial exams

Prerequisites
The module must not be selected together with the module Interaction Flow - Building Structure [bauiM2S16-SM2].

Modeled Conditions
The following conditions must be met:

- The module [M-BGU-103897] *Interaction Flow - Building Structure* must not have been started.

Qualification Goals
Students are able to analyze and calculate steady and unsteady flow forces on hydraulic structures. They can describe groundwater flow processes and derive flow parameters with common measurement calculations . Based on the acquired knowledge, they can analyze concepts for preventing groundwater-related structural damage in a critical manner.
Students characterize and categorize flow-induced structural vibrations. They can apply their knowledge to application examples.

Content
In this module, the following topics are discussed in depth:

- potential theory
- groundwater flow
- structural adjustment to groundwater flow
- determination of hydrostatic and hydrodynamic flow forces
- overview of sealing mechanisms: flood sluices, weirs, gates
- flow-induced structural vibrations

Recommendations
none

Remarks
none

Literature
Erbisti, P.C.F., 2004, Design of Hydraulic Gates, Balkema Pub. , Tokyo

Naudascher; E, 1991, Hydrodynamic Forces, Balkema Pub., Rotterdam
C. Lang, Skript Interaktion Strömung - Wasserbauwerk

Workload
contact hours (1 HpW = 1 h x 15 weeks):

- Groundwater Flow around Structures lecture/exercise: 30
- Wechselwirkung Strömung - Wasserbauwerk lecture/exercise: 30 h

independent study:

- preparation and follow-up lecture/exercises Groundwater Flow around Structures: 30 h
- examination preparation Groundwater Flow around Structures (partial exam): 30 h
- preparation and follow-up lecture/exercises Wechselwirkung Strömung - Wasserbauwerk: 30 h
- examination preparation Wechselwirkung Strömung - Wasserbauwerk (partial exam): 30 h

total: 180 h

M Module: Hydro Power Engineering (bauiM2S11-WB3) [M-BGU-100103]

Responsibility: Peter Oberle

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften
Curricular Embedding: Compulsory Elective
Contained in: Study Focus / Water and Environment

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each summer term	1 term	German	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-100139	Hydro Power Engineering (S. 317)	6	Peter Oberle

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-100139 with oral examination according to § 4 Par. 2 No. 2
details about the learning control see at the 'Teilleistung'

Grade of the Module
grade of the module is grade of the exam

Prerequisites
none

Qualification Goals
Students are able to describe the different turbine types and can define selection criteria for their usage. They are able to reproduce the basic approaches in the planning and design of hydropower plants and to make own calculations to select turbines. They can select and apply the necessary tools in a methodical matter.
Students are able to discuss the current political conditions in terms of energy policy with other students and support their personal opinion on these issues with technical arguments.

Content
The course explains the technical background for planning and designing waterpower plants. Among others, it covers the constructional characteristics of river and high-pressure power plants, the operating modes and selection criteria of different types of turbines as well as electro-technical aspects of the plants' operation. In addition, ecological aspects and energy policy are considered as frame conditions. The lecture sessions are complemented by the presentation of current projects and excursions.

Recommendations
course Hydraulic Engineering and Water Management (6200511)

Remarks
none

Literature
Folienumdrucke;
Giesecke J., Mosonyi E., 2005, Wasserkraftanlagen, Planung, Bau und Betrieb, Springer Verlag, Berlin

Workload
contact hours (1 HpW = 1 h x 15 weeks):

- lecture, exercise: 60 h

independent study:

- preparation and follow-up lectures, exercises: 60 h
- examination preparation: 60 h

total: 180 h

M Module: Hydrological Measurements in Environmental Systems (bauiM2S05-HY5) [M-BGU-103763]

Responsibility:	Jan Wienhöfer
Institution:	KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften
Curricular Embedding:	Compulsory Elective
Contained in:	Study Focus / Water and Environment

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each summer term	1 term	English	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-106599	Hydrological Measurements in Environmental Systems (S. 318)	6	Jan Wienhöfer

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-106599 with examination of other type according to § 4 Par. 2 No. 3
details about the learning control see at the 'Teilleistung'

Grade of the Module
grade of the module is grade of the exam

Prerequisites
none

Qualification Goals
Students know and understand measurement principles for catchment properties, catchment states, and water fluxes. They are able to independently plan and conduct measurements on various scales (soil column, plot, hillslope, catchment) in the field and the laboratory. Students can analyze observation data with statistical methods, and are able to quantify and evaluate the related uncertainties. Students are able to present the related results in teamwork.

Content
- introduction to environmental observations (scales, uncertainties), statistical data analysis and error analysis
- seminar on hydrological measurement devices in field and laboratory: Discharge, soil moisture, infiltration, hydraulic conductivity
- lab and field work (several days) where students conduct hydrological measurements

Recommendations
knowledge in hydrology

Remarks
This module is offered newly as from summer term 2018.

The course requires a minimum number of 6 and a maximum number of 30 participants. Please register online for the course (not exam!), 6224807, via the Campus portal (in exceptional cases via e-mail to the responsible lecturer). Participants are selected according to their year of study and in the following order: students of Water Science and Engineering, students of Civil Engineering, students of Geoecology.

Literature
notes for field exercises

Workload

contact hours (1 HpW = 1 h x 15 weeks):

- laboratory and field exercise: 70 h

independent study:

- preparation and follow-up laboratory and field exercises: 10 h
- preparation of presentations and reports (exam): 100 h

total: 180 h

Module: Industrial Water Management (bauiM2S29-SW6) [M-BGU-104073]

Responsibility: Tobias Morck

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften
Curricular Embedding: Compulsory Elective
Contained in: Study Focus / Water and Environment

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each summer term	1 term	English	2

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-108448	Industrial Water Management (S. 319)	5	Tobias Morck
T-BGU-109980	Lab report 'Industrial Water Management' (S. 325)	1	Tobias Morck

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-109980 with not graded accomkplishment according to § 4 Par. 3 as examination prerequisite
- 'Teilleistung' T-BGU-108448 with oral examination according to § 4 Par. 2 No. 2
details about the learning controls see at the respective 'Teilleistung'

Grade of the Module
grade of the module is grade of the exam

Prerequisites
none

Qualification Goals
Students acquire knowledge about techniques for wastewater treatment in industrial production processes and based on it, they can explain functioning principles of the techniques.Students are able to assess wastewater constituents from industrial effluents and its emissions on the basis of legal regulations. They can analyze arising problems in the industrial wastewater treatment and select appropriate methods for emission reduction and water recycling.

Content
In this module, different types of industrial wastewater (e.g. leather, paper, metal industries) are considered and studied. Customized chemical, physico-chemical and, if necessary, biological treatment processes are presented and discussed.

Recommendations
course Sanitation and Environmental Engineering (6200603)

Remarks
none

Workload
contact hours (1 HpW = 1 h x 15 weeks):

- lecture/exercise: 60 h

independent study:

- preparation and follow-up lecture/exercises: 40 h
- report on laboratory work (examination prerequisite): 30 h
- examination preparation: 50 h

total: 180 h

Module: Infrastructure Management (bauiM3P3-STRINFRA) [M-BGU-100009]

Responsibility: Ralf Roos

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Mobility and Infrastructure

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each summer term	1 term	German	2

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-106300	Infrastructure Management (S. 321)	6	Ralf Roos

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-106300 with written examination according to § 4 Par. 2 No. 1
details about the learning control see at the respective 'Teilleistung'

Grade of the Module
grade of the module is grade of the exam

Prerequisites
none

Qualification Goals
The graduates are able to apply and develop respectively methods and techniques for different tasks related to the life cycle of a road (design, construction, operation and maintenance) and to examine these with regard to their technical suitability and economic feasibility. Further, they have the competence to be able to apply these methods to other problems and in different fields and modify them respectively.

Content
The module addresses further topics about design and construction of roads such as aspects of safety, junctions, construction materials, way of construction and drainage. In the phase of operation of a road after release for traffic logistical and technical aspects of the operation service (road control, snow and ice control, green belt care etc.) as well as the maintenance of roads (status recognition and evaluation, surface and structure properties, pavement management a.o.) come to the fore which are important for smooth and safe traffic flow. These are discussed in the classes fundamentally.

Recommendations
none

Remarks
none

Workload
contact hours (1 HpW = 1 h x 15 weeks):

- Design and Construction of Highways lectures: 30 h
- Operation and Maintenance of Highways lectures: 30 h

independent study:

- preparation and follow-up Design and Construction of Highways lectures: 30 h
- preparation and follow-up Operation and Maintenance of Highways lectures: 30 h
- examination preparation: 60 h

total: 180 h

M Module: Interaction Flow - Building Structure (bauiM2S16-SM2) [M-BGU-103897]

Responsibility: Olivier Eiff

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Water and Environment

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each winter term	1 term	German	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-106775	Interaction Flow – Hydraulic Structures (S. 322)	3	Michael Gebhardt
T-BGU-103563	Building and Environmental Aerodynamics (S. 254)	3	Christof-Bernhard Gromke

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-106775 with oral examination according to § 4 Par. 2 No. 2
- 'Teilleistung' T-BGU-103563 with oral examination according to § 4 Par. 2 No. 2
details about the learning controls see at the respective 'Teilleistung'

Grade of the Module
grade of the module is CP weighted average of grades of the partial exams

Prerequisites
The module must not be selected together with the module Hydraulic Structures [bauiM2S36-WB9].

Modeled Conditions
The following conditions must be met:

- The module [M-BGU-103389] *Hydraulic Structures* must not have been started.

Qualification Goals
The students have the competence to analyse and calculate steady and unsteady flow loading on hydro-engineering and aerodynamic structures as well as natural structures. They characterize flow induced vibrations and can categorize and pre-estimate them. With typical applications the connection between theory and practice is given.

Content
The particularities of gates (lock gates, weir gates, submerged gate leafs) in hydraulic steel engineering are presented, their construction and calculation of their loading will be discussed.
The course Building- and Environmental Aerodynamics gives an introduction to the natural wind and its interaction with the built and natural environment. In the focus are wind load on buildings and wind induced vibrations as well as flow processes in the natural environment regarding natural wind shelter, fresh air ventilation to urban areas and wind comfort.

Recommendations
course Hydromechanics (6200304),
modules Advanced Fluid Mechanics [bauiM2P9-ADVFM], Technical Hydraulics [bauiM2S17-SM3]

Remarks
none

Literature
Wickert, G., Schmaußer, G.,1971, Stahlwasserbau, Springer Verlag, Berlin
Schmaußer, G., Nölke, H., Herz, E., 2000, Stahlwasserbauten - Kommentar zur DIN 19704, Ernst und Sohn Verlag, Berlin
Naudascher, E., 1991, Hydrodynamic Forces, Balkema Pub., Rotterdam, Naudascher, E., Rockwell, D., 2005, Flow-Induced Vibrations, Dover Publ., N.Y.
Erbisti, P.C.F., 2004, Design of Hydraulic Gates, Balkema Pub., Tokyo

Lewin, J., 1995, Hydraulic Gates and Valves in free surface flow and submerged outlets, Th. Telford Pub., London
Hucho, W., 2002: "Aerodynamik der stumpfen Körper", Vieweg-Verlag, ISBN 3-528-06870-1
Holmes, J.D., 2007: "Wind Loading on Structures", Taylor & Francis, ISBN 978-0-415-40946-9
Oertel, H., Ruck, S.: 2012: "Bioströmungsmechanik", Vieweg - Teubner, ISBN: 978-3-8348-1765-5
Oertel, H. jr. (Hrsg.), 2008: "Prandtl - Führer durch die Strömungslehre", Vieweg-Teubner, ISBN 978-3-8348-0430-3

Workload

contact hours (1 HpW = 1 h x 15 weeks):

- Interaction Flow - Building Structure lecture/exercise: 30 h
- Building and Environmental Aerodynamics lecture, exercise: 30 h

independent study:

- preparation and follow-up lecture/exercises Interaction Flow - Building Structure: 30 h
- examination preparation Interaction Flow - Building Structure (partial exam): 30 h
- preparation and follow-up lectures, exercises Building and Environmental Aerodynamics: 30 h
- examination preparation Building and Environmental Aerodynamics (partial exam): 30 h

total: 180 h

M Module: Interdisciplinary Qualifications (bauiMW0-UEQUAL) [M-BGU-103927]

Responsibility: Peter Vortisch

Institution: Universität gesamt

Curricular Embedding: Compulsory

Contained in: Interdisciplinary Qualification

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each term	2 terms	German	1

Überfachliche Qualifikationen
Compulsory Elective; You must choose at least 6 credits.

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-106765	Introduction to Matlab (S. 324)	3	Uwe Ehret
T-BGU-108027	Wildcard (S. 423)	1	

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
according to elected courses, freely be chosen from the course catalogue for Interdisciplinary Qualifications of HoC and ZAK

Grade of the Module
not graded

Prerequisites
none

Qualification Goals
Learning outcomes can be divided into three main complementary categories:1. Contextual Knowledge

- Students are aware of the cultural context of their position and are in a position to consider the views and interests of others (beyond the boundaries of subject, culture, and language).
- They have enhanced their ability to participate properly and appropriately in academic or public discussions.

2. Practical Focus

- Students have gained an insight into the routines of professional life.
- They have further developed their capability to learn.
- They have improved their scope of action by extending their knowledge of foreign languages.
- They are able to relate their field of experience to basic aspects of business administration and law.

3. Basic Competences

- The students autonomously acquire new knowledge in a planned, specific, and methodologically founded manner and use it for solving tasks and problems.
- They can evaluate own work.
- They possess efficient work techniques, can set priorities, take decisions, and assume responsibility.

Content
With the key competences, the House of Competence (HoC) and the Centre for Cultural and General Studies (ZAK) offer a wide range of courses, which are bundled thematically for better orientation. The contents are explained in detail in the descriptions of the courses on the internet pages of HoC (http://www.hoc.kit.edu/lehrangebot.php) and ZAK (http://www.zak.kit.edu/english/general_studies.php).

Recommendations
none

Remarks
The mentor can recognize, if applicable in consultation with the Examination Committee, further suitable courses as interdisciplinary qualifications which are not listed in the mentioned offers of Hoc and ZAK. Language courses of the

‘Sprachenzentrum’ (SpZ) are usually recognized. Further information about the selection of Interdisciplinary Qualifications see Sect. 1.3.

Workload
see course description of HoC, and lecture descriptions of ZAK

M Module: Intermodality in Freight, Long-Distance and Air Transport (bauiM3S11-VERINTER) [M-BGU-100020]

Responsibility: Bastian Chlond

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Mobility and Infrastructure

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each term	2 terms	German	4

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-106611	Freight Transport (S. 296)	3	Bastian Chlond
T-BGU-106301	Long-Distance and Air Traffic (S. 329)	3	Bastian Chlond

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-106611 with written examination according to § 4 Par. 2 No. 1
- 'Teilleistung' T-BGU-106301 with written examination according to § 4 Par. 2 No. 1
details about the learning controls see at the respective 'Teilleistung'

Grade of the Module
grade of the module is CP weighted average of grades of the partial exams

Prerequisites
none

Qualification Goals
Knowledges about the characteristics of freight transportation, long distance travel and air travel against the background of the globalization and and EU-integration Knowledge about the challenges and the design and of intermodal transport services.

Content
- relevant factors for the demand in freight transport
- methods for demand forecasts and planning in freight transport
- measures for influencing the demand in freight transport as well as their efficiency
- particularities of the airline industry in a global market shown in case studies
- organisation of the airline industry
- particularities of Long Distance Travel
- methodology of the Federal Transport Master Plan
- evolution of Long Distance Transport Systems

Recommendations
none

Remarks
none

Literature
lecture accompanying documents

Workload
contact hours (1 HpW = 1 h x 15 weeks):

- Freight Transport lectures/exercises: 30 h
- Long-distance and Air Traffic lectures: 30 h

independent study:

- preparation and follow-up Freight Transport lectures/exercises: 30 h
- examination preparation Freight Transport (partial exam): 30 h
- preparation and follow-up Long-distance and Air Traffic lectures: 30 h
- examination preparation Long-distance and Air Traffic (partial exam): 30 h

total: 180 h

M Module: Introduction to Environmental Data Analysis and Statistical Learning (baui2S44-ENVDAT) [M-BGU-104880]

Responsibility: Uwe Ehret

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Water and Environment

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each winter term	1 term	English	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-109950	Homework 'Introduction to Environmental Data Analysis and Statistical Learning' (S. 314)	2	Uwe Ehret
T-BGU-109949	Introduction to Environmental Data Analysis and Statistical Learning (S. 323)	4	Uwe Ehret

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017

- 'Teilleistung' T-BGU-109950 with not graded accomplishment according to § 4 Par. 3 as examination prerequisite
- 'Teilleistung' T-BGU-109949 with written examination according to § 4 Par. 2 No. 1

details about the learning controls see at the respective 'Teilleistung'

Grade of the Module

grade of the module is grade of the exam

Prerequisites

none

Qualification Goals

The students can explain and apply methods for analysis and simulation of environmental data. Based on this they are capable of evaluating the suitability of available data, analysis and simulation methods for different tasks. The students are able to critically assess the results of analysis and simulation tools and to quantify and evaluate the related uncertainties.

Content

- explorative data analysis
- data storage / data bases
- probability theory (short summary)
- statistical tests (short summary)
- Bayesian methods
- information theory
- time series
- statistical learning / machine learning basics
- supervised learning
- unsupervised learning

Recommendations

preliminary knowledge in statistics, e.g. successful completion of Probability and Statistics (CC911), and Matlab programming skills, e.g. successful completion of Introduction to Matlab (CC772)

Remarks

The module is offered newly as from summer term 2019.

Literature

Daniel Wilks (2011): Statistical Methods in the Atmospheric Sciences, Volume 100, 3rd Edition, ISBN 978-0-1238-5022-5, Academic Press.

Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani (2014): An Introduction to Statistical Learning, ISBN 978-1-4614-7137-0, Springer.
Thomas M. Cover, Joy A. Thomas (2006): Elements of Information Theory, 2nd Edition, ISBN: 978-0-471-24195-9, Wiley.

Workload
contact hours (1 HpW = 1 h x 15 weeks):

- lecture/exercise: 60 h

independent study:

- preparation and follow-up lecture/exercises: 20 h
- preparation of Homework 'Introduction to Environmental Data Analysis and Statistical Learning' (exam prerequisite): 60 h
- examination preparation: 40 h

total: 180 h

M Module: Laws and Proceedings Concerning Traffic and Roads (bauiM3P5-VERFRECHT) [M-BGU-100011]

Responsibility: Ralf Roos

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Mobility and Infrastructure

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each summer term	1 term	German	2

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-106297	Laws and Proceedings concerning Traffic and Roads (S. 327)	6	Dietmar Hönig, Ralf Roos, Peter Vortisch

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-100050 with written examination according to § 4 Par. 2 No. 1
details about the learning control see at the 'Teilleistung'

Grade of the Module
grade of the module is grade of the exam

Prerequisites
none

Qualification Goals
The graduates know the legal framework concerning construction and operating of roads and can justify and question decisions. Furthermore, they understand methods concerning environmental impact analysis of infrastructure, they can technically argue and classify evaluations of variants. In addition, they are able to apply assessment and evaluation techniques for the planning of infrastructure projects, to modify them with respect to specific applications and to analyse their results.

Content
Constitutional framework, environmental impact of roads, changing topics concerning mainly procedures in highway engineering Methodologies and application of standardized assessment and decision techniques (Cost-Benefit-Analyses, Value Benefit Analyis etc.) in transport planning

Recommendations
none

Remarks
none

Workload
contact hours (1 HpW = 1 h x 15 weeks):

- Laws concerning Traffic and Roads lectures: 30 h
- Environmental Impact Assessment lectures: 15 h
- Assessment and Evaluation Techniques lectures: 15 h

independent study:

- preparation and follow-up Laws concerning Traffic and Roads lectures: 30 h
- preparation and follow-up Environmental Impact Assessment lectures: 15 h
- preparation and follow-up Assessment and Evaluation Techniques lectures: 15 h
- examination preparation: 60 h

total: 180 h

M Module: Lean Construction (bauiM4S09-) [M-BGU-100104]

Responsibility:	Shervin Haghsheno
Institution:	KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften
Curricular Embedding:	Compulsory Elective
Contained in:	Study Focus / Technology and Management in Construction

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each winter term	1 term	German	3

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-101007	Project Paper Lean Construction (S. 355)	1,5	Shervin Haghsheno
T-BGU-108000	Lean Construction (S. 328)	4,5	Shervin Haghsheno

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017

- 'Teilleistung' T-BGU-101007 with examination of other type according to § 4 Par. 2 No. 3
- 'Teilleistung' T-BGU-108000 with written examination according to § 4 Par. 2 No. 1

details about the learning controls see at the respective 'Teilleistung'

Grade of the Module

grade of the module is CP weighted average of grades of the partial exams

Prerequisites

none

Qualification Goals

see German version

Content

see German version

Recommendations

none

Remarks

none

Literature

Gehbauer, F. (2013) *Lean Management Im Bauwesen*. Skript des Instituts für Technologie und Management im Baubetrieb, Karlsruher Institut für Technologie (KIT).
Liker, J. & Meier, D. (2007) *Praxisbuch, der Toyota Weg: für jedes Unternehmen*. Finanzbuch Verlag.
Rother, M., Shook, J., & Wiegand, B. (2006). *Sehen lernen: mit Wertstromdesign die Wertschöpfung erhöhen und Verschwendung beseitigen*. Lean Management Institut.

Workload

contact hours (1 HpW = 1 h x 15 weeks):

- lecture, exercise: 60 h

independent study:

- preparation and follow-up lectures, exercises: 30 h
- preparation of project with report (partial exam): 40 h
- examination preparation (partial exam): 50 h

total: 180 h

M Module: Machinery and Process Engineering (bauiM4P6-) [M-BGU-100339]

Responsibility: Sascha Gentes

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Technology and Management in Construction

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each winter term	1 term	German	2

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-100623	Machinery and Process Engineering (S. 330)	5	Sascha Gentes
T-BGU-108012	Student Research Project 'Excavation Pit Development and Shuttering Planning' (S. 388)	1	Harald Schneider

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-108012 with not graded accomplishment according to § 4 Par. 3
- 'Teilleistung' T-BGU-100623 with written examination according to § 4 Par. 2 No. 1

details about the learning controls see at the respective 'Teilleistung'

Grade of the Module
grade of the module is grade of the exam

Prerequisites
none

Qualification Goals
The students can name the basic principles and concepts of machine technology and are able to describe the built and function of construction machinery and equipment. They can appropriately name the equipment and select the suitable machines depending on their building tasks. They understand the BGL system (list of construction equipment) and are able to rank and classify machines and equipment as needed. They will realize optimization potentials using suitable process technology and equipment alternatives. Finally, they will be able to plan and size various construction machines and transport devices with respect to static and dynamic effects and impacts.

Content
This module provides machine technology basics to better understand a broad variety of construction equipment and machinery. Further, static and dynamic effects and impacts of construction equipment application will be discussed, various construction machines introduced, their respective applications compared, and basics for their dimensioning provided. Different construction machines and their variations will be presented with the help of the BGL system. In addition, the functions, variations, effectiveness, and applications for diverse construction and productions procedures used in processing technology, earthworks, underground engineering, and hydraulic engineering will be presented and discussed. The curriculum also includes the necessary technical basics for drive systems, power transmission components (mechanic and hydraulic), undercarriages, as well as steering controls, and safety facilities.
In addition to a building site visit for practical insight, a practical course on the institute's own test site will be offered to try out construction machinery. Finally, students need to develop two exercises within the scope of their seminar paper as part of this module.

Recommendations
none

Remarks
none

Literature
1) Baugeräteliste, aktuelle Fassung

2) Hüster, Felix, Leistungsberechnung der Baumaschinen, Shaker, 5. Aufl., Aachen, 2005.
3) Girmscheid, Gerhard: Leistungsermittlungshandbuch für Baumaschinen und Bauprozesse, Springer Berlin Heidelberg, 2010.
4) Drees, Gerhard; Krauß, Siri: Baumaschinen und Bauverfahren - Einsatzgebiete und Einsatzplanung, expert-Verlag, 3., völlig neu bearb. Aufl., Renningen, 2002.

Workload

contact hours (1 HpW = 1 h x 15 weeks):

- Construction Equipment lecture: 30 h
- Process Engineering lecture: 30 h

independent study:

- preparation and follow-up lectures Construction Equipment: 20 h
- preparation and follow-up lectures Process Engineering: 20 h
- preparation of student research project: 30 h
- examination preparation: 50 h

total: 180 h

M Module: Management of Water Resources and River Basins (bauiM2S01-HY1) [M-BGU-103364]

Responsibility:	Uwe Ehret
Institution:	KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften
Curricular Embedding:	Compulsory Elective
Contained in:	Study Focus / Water and Environment

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each summer term	1 term	English	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-106597	Management of Water Resources and River Basins (S. 331)	6	Uwe Ehret

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-106597 with examination of other type according to § 4 Par. 2 No. 3
details about the learning control see at the 'Teilleistung'

Grade of the Module
grade of the module is grade of the exam

Prerequisites
none

Qualification Goals
Students are able to identify the components of tasks related to Water Management. They are able to formulate solutions for these tasks based on the principles of Integrated Water Resources Management (IWRM).
Students are familiar with the principles, methods and limitations of environmental systems modeling and are able to set up and apply water balance models for given tasks of Water Resources Management. They are able to interpret the results and quantify and evaluate the related uncertainties.
Students are able to solve problems and to present the related results in teamwork.

Content
- definition, scope and examples of Integrated River Basin Management
- methods for Multi-Objective Decision Making (Utility Matrix)
- hydrological Modeling: Environmental Systems Theory, Calibration and Validation, Sensitivity and Uncertainty Analysis
- methods of Engineering Hydrology
- computer-based application of hydrological models (HBV,Larsim): manual and automated calibration, Monte-Carlo based uncertainty estimation, identification of design storm hydrographs

Preparation of assignments and presentation in small groups.

Recommendations
courses Hydrology (6200513), Water Resources Management and Engineering Hydrology (6200617)

Remarks
none

Workload

contact hours (1 HpW = 1 h x 15 weeks):

- lecture/exercise: 60 h

independent study:

- preparation and follow-up lecture/exercises: 20 h
- preparation of course associated assignments (parts of the exam): 60 h
- preparation of final take home exam (part of the exam): 40 h

total: 180 h

M Module: Material Models in Solid Mechanics (bauiM1S22-MATTHEO) [M-BGU-100054]

Responsibility:	Thomas Seelig
Institution:	KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften
Curricular Embedding:	Compulsory Elective
Contained in:	Study Focus / Structural Engineering

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each summer term	1 term	German	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-100044	Material Models in Solid Mechanics (S. 333)	6	Thomas Seelig

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-100044 with oral examination according to § 4 Par. 2 No. 2
details about the learning control see at the 'Teilleistung'

Grade of the Module
grade of the module is grade of the exam

Prerequisites
none

Qualification Goals
The students know the phenomena of inelastic material behavior as well as the continuum mechanical methods for their theoretical description and they can explain them.

Content

- general purpose of material theories and constitutive laws
- elasticity (isotropic / anisotropic material models)
- phenomenology of inelastic material behavior (residual deformation, rate-dependence / creep, plastic incompressibility / dilatancy, pressure-dependence / independence, damage)
- concepts of constitutive modeling (internal variables, yield condition, flow rule, hardening laws, incremental constitutive equations)
- material theories: viscoelasticity, plasticity, viscoplasticity
- applications (metals, geomaterials, concrete, thermoplastic polymers, wood)

Recommendations
course Introduction to Continuum Mechanics (6200607)

Remarks
none

Literature

[1] Chen, W.F., Hahn, D.J.: Plasticity for Structural Engineers. Springer, 1988
[2] de Souza Neto, E.A., Peric, D., Owen, D.R.J.: Computational Methods for Plasticity. Wiley, 2008
[3] Doghri, I.: Mechanics of Deformable Solids. Springer, 2000
[4] Khan, A.S., Huang, S.: Continuum Theory of Plasticity. Wiley,1995
[5] Lemaitre, J., Chaboche, J.L.: Mechanics of Solid Materials. Cambridge University Press, 1990
[6] Lubliner, J.: Plasticity Theory. Macmillan, 1990; Dover, 2008
[7] Seelig, Th.: Anwendungsorientierte Materialtheorien. Lecture notes

Workload

contact hours (1 HpW = 1 h x 15 weeks):

- lecture, exercise: 60 h

independent study:

- preparation and follow-up lectures, exercises: 60 h
- examination preparation: 60 h

total: 180 h

M Module: Material Science, Welding and Fatigue (bauiM1S06-SCHWEISSEN) [M-BGU-100039]

Responsibility: Peter Knödel

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Structural Engineering

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each summer term	1 term	German	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-100023	Material Science, Welding and Fatigue (S. 334)	6	Peter Knödel

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-100023 with written examination according to § 4 Par. 2 No. 1
details about the learning control see at the 'Teilleistung'

Grade of the Module
grade of the module is grade of the exam

Prerequisites
none

Qualification Goals
The students can

- assess the usability of different steel materials for different requirements,
- design constructionally weld joints and define requirements for their production and quality assurance,
- differentiate the usability of different welding techniques,
- design and construct steel components stressed by fatigue,
- evaluate failures of steel components.

Content
- materials: denotation of steels, physical and technological properties
- fatigue: influencing parameters, calculation concepts
- welding technology: welding techniques, welding instructions
- quality management: building law, implementation categories, competences
- fracture toughness: linear fracture mechanics
- designing of welded constructions: internal stresses, welding distortion
- material testing: non-destructive testing, material and weld joint failures

Recommendations
courses Theory of Building Materials (6200206), Basics in Steel Structures (6200504)

Remarks
none

Literature
lecture accompanying documents
DIN EN 1993-1-9: Bemessung und Konstruktion von Stahlbauten - Teil 1-9: Ermüdung
DIN EN 1993-1-10: Bemessung und Konstruktion von Stahlbauten - Teil 1-10: Stahlsortenauswahl im Hinblick auf Bruchzähigkeit und Eigenschaften in Dickenrichtung
DIN EN 1090: Ausführung von Stahltragwerken und Aluminiumtragwerken

Workload
contact hours (1 HpW = 1 h x 15 weeks):

- lecture/exercise: 60 h

independent study:

- preparation and follow-up lecture/exercises: 60 h
- examination preparation: 60 h

total: 180 h

M Module: Materials Testing and Measuring Techniques (bauiM1S29-MATPRÜF) [M-BGU-100061]

Responsibility: Nico Herrmann

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Structural Engineering

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each winter term	1 term	German	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-100043	Materials Testing and Measuring Techniques (S. 335)	6	Nico Herrmann

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-100043 with oral examination according to § 4 Par. 2 No. 2
details about the learning control see at the 'Teilleistung'

Grade of the Module
grade of the module is grade of the exam

Prerequisites
none

Qualification Goals
The students can explain the basic knowledge of materials testing in the field of construction materials and concrete structures connected with the application in engineering constructions (e.g. bridges, power plants, etc.). They can name the basics of measuring techniques and are able to record the relevant measuring parameters for high-level material testing. The students develop self-reliantly a measurement concept, which they apply and evaluate.

Content

- introduction to different measurement techniques and their principles
- material testing of construction materials and elements
- basics in testing techniques and concepts
- examples from current research projects

Recommendations
none

Remarks
maximum number of participants: 12

Workload
contact hours (1 HpW = 1 h x 15 weeks):

- Measuring Techniques in Civil Engineering lecture, exercise: 30 h
- Materials Testing in the Field of Concrete lecture: 30 h

independent study:

- preparation and follow-up lectures, exercises Measuring Techniques in Civil Engineering: 30 h
- preparation and follow-up lectures Materials Testing in the Field of Concrete: 30 h
- examination preparation: 60 h

total: 180 h

M Module: Modeling in Solid Mechanics (bauiM1S40-MODFEST) [M-BGU-101673]

Responsibility: Peter Betsch

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften
Curricular Embedding: Compulsory Elective
Contained in: Study Focus / Structural Engineering

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each summer term	1 term	German	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-103223	Modeling Techniques in Solid Mechanics (S. 337)	6	Alexander Konyukhov

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-103223 with oral examination according to § 4 Par. 2 No. 2
details about the learning control see at the 'Teilleistung'

Grade of the Module
grade of the module is grade of the exam

Prerequisites
none

Qualification Goals
The students can explain and classify various numerical analysis of engineering structures based on geometrical models of different dimensionality bars, beams, shells and solids. They know the derivation of finite element models from the geometrical point of view together with corresponding hypothesis of deformation. They know, that this procedure is a model reduction and a continuous transformation from 3D continuum to the shell, beams and bar models. They can assign and use different computational methods and the corresponding set of finite elements for practical engineering problems.

Content
One- and multidimensional bodies are presented by differential geometry: provision of line and surface descriptions on the one hand and of selected curvilinear coordinate system for the description of three-dimensional solid bodies on the other hand. The kinematics of deformation is imparted in all cases with the associated forces on the one hand and the appropriate Dirichlet and Neumann boundary conditions on the other hand.
Available computational methods are explained: static methods with a-posteriori error estimation and mesh refinement; eigen value analyses and modal methods as well as their applications, e.g. with respect to stability problems; dynamic computations in implicit and explicit formulations; harmonic methods with application of resonance phenomena.
All models are illustrated with FEM software, including practical programming in ANSYS APDL.

Recommendations
course Introduction to Continuum Mechanics (6200607);
module Basics of Finite Elements [bauiM1S20-GRUNDFE]

Remarks
none

Literature
1. P. Wriggers, Nichtlineare Finite-Element-Methoden, Springer, 508 p., 2008.
2. P. Wriggers, Nonlinear Finite Element Methods, Springer, 560 p., 2008.
3. O. C. Zienkiewicz, R. L. Taylor, J. Z. Zhu, The Finite Element Method. Its Basis and Fundamentals, ITS Basisand Fundamentals, Elsevier Ltd, Oxford; Auflage: 6th ed. 752 p., 2005.
4. Thomas J. R. Hughes, The Finite Element Method: Linear Static and Dynamic Finite Element Analysis, Dover Civil and Mechanical Engineering publication, 672 p., 2000.

5. T. Belytschko, W.K. Liu, B. Moran, Nonlinear Finite Elements for Continua and Structures, Wiley, 300 p., 2000.
6. http://www.ansys.com/Support/Documentation
7. http://www.lstc.com/download/manuals

Workload

contact hours (1 HpW = 1 h x 15 weeks):

- lecture, exercise: 60 h

independent study:

- preparation and follow-up lectures, exercises: 45 h
- examination preparation: 75 h

total: 180 h

M Module: Models and Methods in Traffic Engineering and Transportation Planning (bauiM3P2-VERMODELL) [M-BGU-100008]

Responsibility: Peter Vortisch

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Mobility and Infrastructure

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each winter term	1 term	German	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-100012	Models and Methods in Traffic Engineering and Transportation Planning (S. 338)	6	Peter Vortisch

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-100012 with oral examination according to § 4 Par. 2 No. 2
details about the learning control see at the 'Teilleistung'

Grade of the Module
grade of the module is grade of the exam

Prerequisites
none

Qualification Goals
see German version

Content
Methods and models in transport planning as well as the relevant tools and methods for the traffic engineer. Transport Planning:
- four-Step-Algorithm
- aggregate versus individual models
- choice modeling

Traffic Engineering:
- measuring traffic flow data
- description of traffic conditions / fundamental diagram
- capacity of roads and intersections with and without traffic signals

Recommendations
none

Remarks
none

Literature
lecture notes with additional references / exercises

Workload
contact hours (1 HpW = 1 h x 15 weeks):
- Methods and Models in Transportation Planning lectures/exercises: 30 h
- Traffic Engineering lectures/exercises: 30 h

independent study:
- preparation and follow-up Methods and Models in Transportation Planning lectures/exercises: 30 h
- preparation and follow-up Traffic Engineering lectures/exercises: 30 h
- examination preparation: 60 h

total: 180 h

M Module: Module Master Thesis (bauiMSC-THESIS) [M-BGU-103953]

Responsibility: Peter Vortisch

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory

Contained in: Master Thesis

Credit Points	Recurrence Frequency	Duration	Language	Version
30	Each term	1 term	German/English	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-108097	Master Thesis (S. 332)	30	Peter Vortisch

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
thesis and final presentation according to § 14 ER/SPO

Grade of the Module
The grade of the module results from the evaluation of the Master Thesis and the final presentation.

Prerequisites
Modules in extent of minimum 42 CP has to be passed in order to be admitted to the Master Thesis according to ER/SPO § 14 Par. 1. Results obtained in the module Key Competences [bauiMW0-UEQUAL] cannot be counted for this purpose.

Qualification Goals
The student is able to investigate independently a complex problem within a particular research field of his choice in limited time, following scientific methods. He can search autonomously for literature, can find own approaches, can evaluate his results and can classify them according to the state of the art. He is further able to present clearly the essential matter and results in his master thesis and in a comprehensive presentation.

Content
The Master Thesis is an independent written report and comprises the theoretical or experimental work on a complex problem within a particular field of civil engineering with scientific methods. The topic of the master thesis derives from the students choice of a particular field. The student and can make proposals for the topic.

Recommendations
All technical skills and soft skills required for working on the selected topic and the preparation of the thesis should be attained.

Remarks
Information about the procedure regarding admission and registration of the Master Thesis see chap. 1.8.

Workload

- working on thesis project: 720 h
- thesis writing: 150 h.
- preparation of presentation: 30 h

total: 900 h

M Module: Non-linear Analysis of Beam Structures (bauiM1S14-NILI-STAB) [M-BGU-100046]

Responsibility: Werner Wagner

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Structural Engineering

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each winter term	1 term	German	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-100030	Non-linear Analysis of Beam Structures (S. 339)	6	Ingo Münch, Werner Wagner

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017

- 'Teilleistung' T-BGU-100030 with written examination according to § 4 Par. 2 No. 1
details about the learning control see at the 'Teilleistung'

Grade of the Module

grade of the module is grade of the exam

Prerequisites

none

Qualification Goals

The students can formulate and apply the main essential principles of the nonlinear analysis of beam structures (ultimate load design, II. Order theory, extensions and error analysis) as the basis for design and construction. They are able to compare and combine different methods.

Content

- material nonlinearity: basics of ultimate load design, plastic hinge 1st order theory
- incremental and direct calculation of the ultimate load, limit value theorems
- geometrical nonlinearity: equilibrium of 2nd order theory
- displacement methods
- predeformation
- iteration procedures
- stability problems
- combination of geometrical and material nonlinearity

Recommendations

courses Structural Analysis I+II (6200401, 6200501)

Remarks

none

Literature

lecture notes 'Nichtlineare Modellierung von Stabtragwerken'

Workload

contact hours (1 HpW = 1 h x 15 weeks):

- lecture, exercise: 60 h

independent study:

- preparation and follow-up lectures, exercises: 45 h
- examination preparation: 75 h

total: 180 h

M Module: Non-linear Analysis of Surface Structures (bauiM1S19-NILI-FTW) [M-BGU-100051]

Responsibility: Werner Wagner

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Structural Engineering

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each winter term	1 term	German	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-100035	Non-linear Analysis of Surface Structures (S. 340)	6	Werner Wagner

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017

- 'Teilleistung' T-BGU-100035 with oral examination according to § 4 Par. 2 No. 2
details about the learning control see at the 'Teilleistung'

Grade of the Module

grade of the module is grade of the exam

Prerequisites

none

Qualification Goals

The students can classify and apply the essential principles of nonlinear analysis of surface structures. Hence, they are able to conduct even difficult static computations and use the required tools therefore methodically in an appropriate manner.

Content

- geometric nonlinear models of surface structures
- nonlinear material models for thin structures
- analytical and numerical surface structure analysis
- introduction to the modeling of shell structures
- application of stability and dynamic problems
- modeling of laminated structures
- practical examples

Recommendations

course Surface Structures (6214701),module Computational Analysis of Structures [bauiM1S15-CTWM]

Remarks

none

Literature

lecture notes

Workload

contact hours (1 HpW = 1 h x 15 weeks):

- lecture, exercise: 60 h

independent study:

- preparation and follow-up lectures, exercises: 60 h
- examination preparation: 60 h

total: 180 h

M Module: Numerical Flow Modeling in Hydraulic Engineering (bauiM2S34-WB7) [M-BGU-103390]

Responsibility: Peter Oberle

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Water and Environment

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each winter term	1 term	German	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-106776	Numerical Flow Modeling in Hydraulic Engineering (S. 341)	6	Peter Oberle

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017

- 'Teilleistung' T-BGU-106776 with oral examination according to § 4 Par. 2 No. 2

details about the learning control see at the 'Teilleistung'

Grade of the Module

grade of the module is grade of the exam

Prerequisites

none

Qualification Goals

see German version

Content

see German version

Recommendations

basic knowledge of hydrology, hydraulic engineering and water management as well as open channel hydraulics

Remarks

none

Literature

lecture notes

Workload

contact hours (1 HpW = 1 h x 15 weeks):

- lecture, exercise: 60 h

independent study:

- preparation and follow-up lectures, exercises: 60 h
- examination preparation: 60 h

total: 180 h

M Module: Numerical Fluid Mechanics (bauiM2P5-NUMFLMECH) [M-BGU-103375]

Responsibility: Markus Uhlmann

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Water and Environment

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each winter term	1 term	English	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-106758	Numerical Fluid Mechanics (S. 342)	6	Markus Uhlmann

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-106758 with written examination according to § 4 Par. 2 No. 1
details about the learning control see at the 'Teilleistung'

Grade of the Module
grade of the module is grade of the exam

Prerequisites
none

Qualification Goals
Students are enabled to describe the fundamental approaches of numerical solution of flow problems. They are capable of evaluating the advantages and disadvantages of these approaches in the various areas of application, enabling them to make an appropriate choice. Participants are able to apply the numerical methods to simple flow problems; this involves the generation and application of basic computer programs. They are able to analyze the results with respect to precision, stability and efficiency.

Content
This module constitutes a general introduction to the numerical solution of flow-related problems. The mathematical properties of the conservation equations are analyzed. The principles of numerical discretization are studied with the aid of the finite-difference and the finite-volume method. The concept of numerical stability is introduced, and various techniques of error analysis are presented theoretically and by way of examples

Recommendations
modules Hydromechanics [bauiBGP04-HYDRO] (understanding of physical processes of advektion and diffusion, handling of Navier-Stokes equations) and Advanced Mathematics [bauiBGP05-HM1, bauiBGP06-HM2, bauiBGP08-HM3, bauiBFW1-PDGL] (analysis - partial differential equations, Fourier analysis, series expansion, complex numbers; linear algebra - matrices, determinants, eigenvalue analysis, numerics - discrete number representation, round-off, floating point operations, numerical treatment of partial differential equations)

Remarks
none

Workload
contact hours (1 HpW = 1 h x 15 weeks):
- lecture, exercise: 60 h

independent study:
- preparation and follow-up lectures, exercises: 60 h
- examination preparation: 60 h

total: 180 h

M Module: Numerical Methods in Structural Analysis (bauiM1S18-FEM-BS) [M-BGU-100050]

Responsibility: Werner Wagner

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Structural Engineering

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each winter term	1 term	German	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-100034	Numerical Methods in Structural Analysis (S. 345)	6	Ingo Münch, Werner Wagner

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-100034 with oral examination according to § 4 Par. 2 No. 2
details about the learning control see at the 'Teilleistung'

Grade of the Module
grade of the module is grade of the exam

Prerequisites
none

Qualification Goals
The students will can develop finite element programs for beam and surface structures on the basis of methods from structural analysis and can integrate the numerical methods.

Content
- development of a program for truss structures with VBA
- input and output of data
- element stiffness matrices, transformation, solving of equations
- calculation of stress resultants
- programming force density method for cable structures
- iterative procedures for designing
- visualization of results
- FEM for surface structures
- numerical integration for surface structures
- discussion of FEM with approximation with low order interpolation functions
- elimination of numerical stiffness effects using specific integration and interpolation techniques

Recommendations
module Computational Analysis of Structures [bauiM1S15-CTWM]

Remarks
none

Literature
lecture notes Computational Analysis of Structures

Workload

contact hours (1 HpW = 1 h x 15 weeks):

- lecture, exercise: 60 h

independent study:

- preparation and follow-up lectures, exercises: 60 h
- examination preparation: 60 h

total: 180 h

M Module: Numerical Modelling in Geotechnics (bauiM5S06-NUMMOD) [M-BGU-100075]

Responsibility: Theodoros Triantafyllidis

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Geotechnical Engineering

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each summer term	1 term	German	2

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-100107	Numerical Modelling in Geotechnics (S. 346)	6	Andrzej Niemunis

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-100107 with oral examination according to § 4 Par. 2 No. 2
details about the learning control see at the 'Teilleistung'

Grade of the Module
grade of the module is grade of the exam

Prerequisites
none

Qualification Goals
The students can develop numerical solutions for typical geotechnical boundary value problems by themself and implement them by programming with FORTRAN95. They got to know FE applications in several fields of geotechnics (foundation, rock and tunnel construction, dam construction), got practical experience with the FE code ABAQUS (TM) and applied this for the modeling of example problems. They are able to interpret and evaluate critically results of numerical simulations.

Content
- beam on elastic half-space
- slope stability with layer procedure according to Bishop
- 2D and 3D pile rafts with lateral bedding
- FE-modeling of spatially correlated fluctuations of soil parameters
- FE settlement prediction with nonlinearity for small strains
- introduction to the FE-program ABAQUS: definition of joints and elements, assignment of material laws, definition of initial and boundary conditions
- examples of FE-applications in tunnel engineering
- numerical FE-modeling of a deep pit excavation under consideration of the construction sequence
- numerical FE-modeling of seepage through a zoned dam with partial saturation (different load cases)
- linear dynamics using ABAQUS

Recommendations
module Basics of Numeric Modelling [bauiM5P4-NUMGRUND]

Remarks
none

Literature
[1] Smith, I.M.; Griffith, D.V. (2004): Programming the Finite Element Method. JWS
[2] Hibbit, Karlsson, Sorensen: ABAQUS for geotechnical problems
[3] Helwany, S. (2007) Applied Soil Mechanics with ABAQUS Applications, Wiley

[4] Hibbit, Karlsson, Sorensen (1997): Contact in ABAQUS/Standard
[5] FORTRAN 95 HP Manual

Workload
contact hours (1 HpW = 1 h x 15 weeks):

- Exercises in Numerical Modelling: 30 h
- FEM Applications in Geotechnical Modelling lecture: 30 h

independent study:

- preparation and follow-up Exercises in Numerical Modelling: 15 h
- preparation and follow-up lectures FEM Applications in Geotechnical Modelling: 15 h
- exercises with available software: 30 h
- examination preparation: 60 h

total: 180 h

M Module: Numerical Structural Dynamics (bauiM1S38-NUMSTRDYN) [M-BGU-100579]

Responsibility: Peter Betsch

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Structural Engineering

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each summer term	1 term	German	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-100999	Computational Structural Dynamics (S. 262)	6	Peter Betsch

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-100999 with oral examination according to § 4 Par. 2 No. 2
details about the learning control see at the 'Teilleistung'

Grade of the Module
grade of the module is grade of the exam

Prerequisites
none

Qualification Goals
see German version

Content
see German version

Recommendations
module Basics in Finite Elements [bauiM1S20-GRUNDFE]

Remarks
none

Workload
contact hours (1 HpW = 1 h x 15 weeks):

- lectures, exercises: 60 h

independent study:

- preparation and follow-up: 45 h
- working on programming exercises: 30 h
- examination preparation and examination: 45 h

total: 180 h

M Module: Planning of Transportation Systems (bauiM3S04-VERPLAN) [M-BGU-100016]

Responsibility: Peter Vortisch

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Mobility and Infrastructure

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each term	1 term	German	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-100013	Planning of Transportation Systems (S. 349)	6	Peter Vortisch

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-100013 with oral examination according to § 4 Par. 2 No. 2
details about the learning control see at the 'Teilleistung'

Grade of the Module
grade of the module is grade of the exam

Prerequisites
none

Qualification Goals
The students know all common means of transport and their properties. They can assess advantages and disadvantages of the means of transport from the perspective of users, operators and the environment, and they can make decisions about the system adapted to the situation. They understand the systemic interrelation of means of transport, infrastructure and mobility behaviour. The students know the methods of transportation planning common in practice and can these critically evaluate and develop further.

Content

- means of transport and their properties: capacity, velocity and energy consumption;
- environmental impacts: pollutant emission, noise and traffic safety;
- origin and evolution of traffic demand;
- examples of transport systems: bicycle traffic as system, planning procedures in public transport,
- boundary conditions of strategic planning: target systems, civic participation, policy influence;
- application of models;
- activity development;
- impact investigation and evaluation;
- examples: federal road plan, international master plans;
- transport development plans

Recommendations
course Transportation (6200406)

Remarks
none

Literature
lecture notes and materials are available for downloading

Workload

contact hours (1 HpW = 1 h x 15 weeks):

- Characteristics of Transportation Systems lectures: 30 h
- Strategic Transport Planning lectures: 30 h

independent study:

- preparation and follow-up Characteristics of Transportation Systems lectures: 30 h
- preparation and follow-up Strategic Transport Planning lectures: 30 h
- examination preparation: 60 h

total: 180 h

M Module: Process Engineering in Wastewater Treatment (bauiM2S43-SW10) [M-BGU-103399]

Responsibility: Tobias Morck

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Water and Environment

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each winter term	1 term	English	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-106787	Process Engineering in Wastewater Treatment (S. 352)	6	Tobias Morck

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-106787 with written examination according to § 4 Par. 2 No. 1
details about the learning control see at the 'Teilleistung'

Grade of the Module
grade of the module is grade of the exam

Prerequisites
none

Qualification Goals
Students acquire knowledge about typical techniques in wastewater treatment at local and international level. They are able to perform a technical evaluation and describe dimensioning approaches taking into consideration legal boundary conditions. Students analyze, evaluate and optimize operation of plant technologies. They focus on energy-efficient plant designs considering the most relevant factors affecting the total costs.Students can analyze the situation in emerging and developing countries making a comparison with that in industrialized countries. Based on that, they are able to develop water-related management strategies.

Content
Municipal Wastewater Treatment:Students gain deep knowledge about design and operation of typical process technologies in municipal wastewater treatment in Germany. Following processes are covered:

- different activated sludge processes
- anaerobic technologies and energy-recovery systems
- filtration technologies
- wastewater disinfection and pathogen removal
- chemical and biological phosphorus removal
- micro-pollutants removal
- resource management and energy efficiency

International Sanitary Engineering:Students get acquainted with the design and operation used for wastewater treatment at international level. They analyze, evaluate and take decisions when new and more holistic oriented met hods can be implemented. Following topics are covered:

- activated sludge processes
- trickling filters and rotating biological contactors
- treatment ponds
- retention soil filter / Wetlands
- UASB/EGSB/Anaerobic filter
- decentralized versus centralized systems
- material flow separation

- energy-recovery from wastewater
- drinking water purification
- waste management

Recommendations
module Urban Water Infrastructure and Management [bauiM2S43-SW10]

Remarks
IMPORTANT:

The module will not be offered anymore as from summer term 2019. It will be replaced by the module Wastewater Treatment Technologies.

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group presentation and written report is internal examination prerequisite.

Literature
Imhoff, K. u. K.R. (1999) Taschenbuch der Stadtentwässerung, 29. Aufl., Oldenbourg Verlag, München, WienATV-DVWK (1997) Handbuch der Abwassertechnik: Biologische und weitergehende Abwasserreinigung, Band 5, Verlag Ernst & Sohn, BerlinATV-DVWK(1997) Handbuch der Abwassertechnik: Mechanische Abwasserreinigung, Band 6, Verlag Ernst & Sohn , BerlinSperling, M.; Chernicaro, C.A.L. (2005) Biological wastewater treatment in warm climate regions, IWA publishing, LondonWilderer, P.A., Schroeder, E.D. and Kopp, H. (2004) Global Sustainability - The Impact of Local Cultures. A New Perspective for Science and Engineering, Economics and Politics WILEY-VCH

Workload
contact hours (1 HpW = 1 h x 15 weeks):

- Municipal Wastewater Treatment lecture/exercise: 30 h
- International Sanitary Engineering lecture/exercise: 30 h

independent study:

- preparation and follow-up lecture/exercises Municipal Wastewater Treatment: 30 h
- preparation and follow-up lecture/exercises International Sanitary Engineering: 30 h
- examination preparation: 60 h

total: 180 h

M Module: Project Integrated Planning (bauiM3S09-PROJEKTIP) [M-BGU-100018]

Responsibility: Ralf Roos

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Mobility and Infrastructure

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each winter term	1 term	German	2

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-109916	Group exercise Project Integrated Planning (S. 307)	5	Ralf Roos
T-BGU-100061	Project Integrated Planning (S. 353)	1	Ralf Roos

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-109916 with not graded accomplishment according to § 4 Par. 3 as examination prerequisite
- 'Teilleistung' T-BGU-100061 with oral examination according to § 4 Par. 2 No. 2

details about the learning controls see at the respective 'Teilleistung'

Grade of the Module
grade of the module is grade of the exam

Prerequisites
none

Qualification Goals
The graduates are able to analyze the planning requirements of the different subject areas in the field mobility and infrastructure and to apply them to a specific example. They identify the weak points, develop realizable solutions and discuss them in the framework of a multi-disciplinary weighing process. Furthermore, they can work self-organized and have organisational and didactic competences with respect to team work and presentation.

Content
A typical practical task in the field of spatial and infrastructure planning has to be elaborated (e.g. ideas contest in town planning). The students have to take charge of certain planning tasks from the fields town planning, transport studies, highway engineering and track guided transport systems and develop different solution concepts based on a conflict and deficiency analysis. In order to obtain an integrated planning concept the requirements of the involved subject areas have to be considered. Subsequent to a weighing process, they select well-founded a acceptable and sustainable concept which they develop further and present in 3 phases to a realizable solution on different levels of detail.

Recommendations
preliminary attendance of at least 2 compulsory modules in the selected Profile

Remarks
none

Workload
contact hours (1 HpW = 1 h x 15 weeks):

- on-site meeting, technical group meetings, presentations: 15 h

independent study:

- preparation and follow-up: 15 h
- team exercise (examination prerequisite, part per person): 135 h
- examination preparation and examination: 15 h

total: 180 h

M Module: Project Management in Construction and Real Estate Industry (bauiM4P5-) [M-BGU-100338]

Responsibility: Shervin Haghsheno

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Technology and Management in Construction

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each winter term	1 term	German	3

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-101006	Group Exercise Project Management in Construction and Real Estate Industry (S. 308)	1	Shervin Haghsheno
T-BGU-100622	Project Management in Construction and Real Estate Industry (S. 354)	4	Shervin Haghsheno
T-BGU-108011	Student Research Project 'Scheduling and Building Site Facilities' (S. 392)	1	Harald Schneider

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017

- 'Teilleistung' T-BGU-108011 with not graded accomplishment according to § 4 Par. 3
- 'Teilleistung' T-BGU-101006 with not graded accomplishment according to § 4 Par. 3
- 'Teilleistung' T-BGU-100622 with written examination according to § 4 Par. 2 No. 1

details about the learning controls see at the respective 'Teilleistung'

Grade of the Module

grade of the module is grade of the exam

Prerequisites

none

Qualification Goals

Students have advanced knowledge in the area of project management, particularly in the planning and management of the construction and real estate projects. They are able to name and analyze the different project parties, structures and types of contracts. Furthermore, they are able to apply methods and tools in construction projects.

Content

In the area of project management the topics project organization, awards and types of contracts, quality management, production planning and construction logistics, schedule management, cost management and conflict management are discussed.

In addition, skills for technical project development will be imparted. Complex issues are clarified using practical examples. In case of process planning, basic principles (terms, definitions, basic variables, current trends), methods of process comparison, methods of construction scheduling (classification and structuring of projects, structure, time and cost analyzes), optimization techniques, and basic knowledge of site facilities and formwork are explained. In addition, accident prevention regulations, active and passive protection measures as well as the organization of the labor protection during operation and on site are discussed.

In addition, students need to develop two exercises within the scope of their seminar paper as part of this module.

Recommendations

none

Remarks

none

Literature

DIETHELM, G.: Projektmanagement, Band 1: Grundlagen, Verlag Neue Wirtschafts-Briefe, Herne, 2000
DIETHELM, G.: Projektmanagement, Band 2: Sonderfragen, Verlag Neue Wirtschafts-Briefe, Herne, 2001
ESCHENBRUCH, K.: Recht der Projektsteuerung, Werner Verlag, München, 2003
HAHN, R.: Projektmanagement für Ingenieure, Wiley-VCH Verlag, Weinheim, 2002
KERZNER, H.: Project Management - A Systems Approach to Planning, Scheduling and Controlling, Wiley & Sons, 2006
KOCHENDÖRFER, B., LIEBCHEN, J.: Bau-Projekt-Management, Verlag B. G. Teubner, Stuttgart, 2001
Project Management Institute: A Guide to the Project Management Body of Knowledge: PMBOK Guide, 2008
ROSENAU, M:, W.: Succesful Project Management, Van Norstrand Reinhold, New York, 1992
VOLKMANN, W.: Projektabwicklung, Verlag für Wirtschaft und Verwaltung Hubert Wingen, Essen, 2002

Workload

contact hours (1 HpW = 1 h x 15 weeks):

- lecture, exercise: 60 h

independent study:

- preparation and follow-up lectures, exercises: 20 h
- group exercise (not graded accomplishment as exam prerequisite): 30 h
- preparation of student research project (not graded accomplishment): 30 h
- examination preparation: 40 h

total: 180 h

M Module: Project Studies in Water Resources Management (bauiM2S33-WB6) [M-BGU-103394]

Responsibility:	Frank Seidel
Institution:	KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften
Curricular Embedding:	Compulsory Elective
Contained in:	Study Focus / Water and Environment

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each winter term	1 term	German	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-106783	Project Studies in Water Resources Management (S. 357)	6	Franz Nestmann, Frank Seidel

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-106783 with examination of other type according to § 4 Par. 2 No. 3
details about the learning control see at the 'Teilleistung'

Grade of the Module
grade of the module is grade of the exam

Prerequisites
none

Qualification Goals
see German version

Content
see German version

Recommendations
module Flow and Sediment Dynamics in Rivers [bauiM2S35-WB8]

Remarks
none

Workload
contact hours (1 HpW = 1 h x 15 weeks):

- lecture, exercise: 30 h

independent study:

- preparation and follow-up lectures, exercises: 30 h
- preparation of term paper (exam): 120 h

total: 180 h

M Module: Real Estate Management (bauiM4S08-) [M-BGU-100346]

Responsibility: Kunibert Lennerts

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften
Curricular Embedding: Compulsory Elective
Contained in: Study Focus / Technology and Management in Construction

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each winter term	1 term	German	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-100629	Real Estate Management (S. 358)	6	Kunibert Lennerts

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-100629 with oral examination according to § 4 Par. 2 No. 2
details about the learning control see at the 'Teilleistung'

Grade of the Module
grade of the module is grade of the exam

Prerequisites
none

Qualification Goals
see German version

Content
see German version

Recommendations
none

Remarks
none

Workload
contact hours (1 HpW = 1 h x 15 weeks):

- Controlling in Real Estate Management lecture: 15 h
- Public Real Estate Management and Public Private Partnership lecture: 15 h
- Project Development lecture: 15 h
- Corporate Real Estate Management and Human Resources in Real Estate lecture: 15 h

independent study:

- preparation and follow-up lectures Controlling in Real Estate Management: 15 h
- preparation and follow-up lectures Public Real Estate Management and Public Private Partnership: 15 h
- preparation and follow-up lectures Project Development: 15 h
- preparation and follow-up lectures Corporate Real Estate Management and Human Resources in Real Estate: 15 h
- examination preparation: 60 h

total: 180 h

M Module: Research Seminar Construction Management (bauiM4S17-) [M-BGU-103917]

Responsibility: Shervin Haghsheno

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Technology and Management in Construction

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each term	2 terms	German	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-108008	Research Seminar Construction Management (S. 359)	6	Shervin Haghsheno

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-108008 with examination of other type according to § 4 Par. 2 No. 3
details about the learning control see at the 'Teilleistung'

Grade of the Module
grade of the module is grade of the exam

Prerequisites
none

Qualification Goals
The students can name the principles of the theory of science and different research methods and can apply them self-reliantly to scientific problems in the context of construction management. They are able to prepare self-reliantly scientific papers.

Content
- theory of science
- research methods in context of research questions in construction management
- basics for scientific working
- structure, form and style of scientific papers
- application at example of specific and current research questions in the field of construction management
- intermediate and final presentations of current research with discussion
- semester accomanying seminar paper

Recommendations
none

Remarks
The module can be started with in the summer and in the winter semester as well. The courses of the module do not depend on each other and can be taken in arbitrary order.

Workload
contact hours (1 HpW = 1 h x 15 weeks):

- Research Seminar Construction Management I: 30 h
- Research Seminar Construction Management II: 30 h

independent study:

- preparation and follow-up Research Seminar Construction Management I: 30 h
- preparation and follow-up Research Seminar Construction Management II: 30 h
- project work, preparation of report and colloquium (exam): 60 h

total: 180 h

M Module: River Basin Modeling (bauiM2S42-SW9) [M-BGU-103373]

Responsibility: Stephan Fuchs

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Water and Environment

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each summer term	2 terms	English	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-106603	River Basin Modelling (S. 360)	6	Stephan Fuchs

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-106603 with examination of other type according to § 4 Par. 2 No. 3
details about the learning control see at the 'Teilleistung'

Grade of the Module
grade of the module is grade of the exam

Prerequisites
none

Qualification Goals
Students are able to explain the basic relationships between water-driven material cycles in river basins and their budget in aquatic ecosystems. They are able to analyze the impact of anthropogenic activities on water condition and quality. Students gain knowledge regarding transport pathways of substances and biochemical and physical interactions in water bodies in order to formulate mathematical model approaches. Using simulation models, they are able to quantify substance emissions; to predict the impact from external influences on the water quality relevant processes and; to perform different scenario analysis. Students are capable of evaluating model results in terms of their plausibility and uncertainty.

Content
This module provides students with a broad-based understanding of the fundamentals of materials flows (N, P, pollutants) and their relevant transport pathways in river basins. Different modeling approaches for a quantitative description of the processes will be presented. Students receive a single-user version of the simulation tool MoRE (Modeling of Regionalized Emissions). They have to develop and implement their own model in small groups and interpret simulation results.

Recommendations
modules Urban Water Infrastructure and Management [bauiM2P10-URBIM], Water Ecology [bauiM2S41-SW8]

Remarks
none

Literature
Schwoerbel, J. (1993): Einführung in die Limnologie, 7. Aufl., Fischer Verlag, Stuttgart
Kummert, R. (1989): Gewässer als Ökosysteme: Grundlagen des Gewässerschutzes, 2. Aufl., Teubner Verlag, Stuttgart
Stumm, W.; Morgan, J.J. (1996): Aquatic Chemistry – Chemical equilibria and rates in natural waters, Wiley Interscience, NY

Workload
contact hours (1 HpW = 1 h x 15 weeks):

- Mass Fluxes in River Basins lecture: 30 h
- Modeling Mass Fluxes in River Basins exercise: 30 h

independent study:

- preparation and follow-up lectures Mass Fluxes in River Basins: 60 h
- project work on River Basin Modeling (exam): 60 h

total: 180 h

M Module: Road Construction (bauiM3S06-STRBAUT) [M-BGU-100006]

Responsibility: Ralf Roos

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Mobility and Infrastructure

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each winter term	1 term	German	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-100058	Road Construction (S. 361)	6	Ralf Roos

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-100058 with oral examination according to § 4 Par. 2 No. 2
details about the learning control see at the 'Teilleistung'

Grade of the Module
grade of the module is grade of the exam

Prerequisites
none

Qualification Goals
The graduates are able to dimension and to test roadway constructions build of asphalt and concrete empirically and by calculation and to assess the impact of internal and external influencing factors on roadway constructions. Furthermore, they are able to explain mechanisms of failure, to question and to evaluate failures as well as to test material parameters by experimental techniques in the lab.

Content
In this module material models, influencing factors on roadway constructions as well as basics and parameters for an empirical and calculatory dimensioning of transportation routes are addressed deeply. Furthermore, deficiencies and failures of roadway constructions are presented and failure mechanisms are explained. In the practical training experiments on the determination of material parameters of unconsolidated materials, bitumen and asphalt are conducted, analysed and evaluated as well as the application of dimensioning methods are examined at real-world examples.

Recommendations
preliminary attendance of compulsory module Infrastructure Management [mobiM301-STRINFRA]

Remarks
none

Workload
contact hours (1 HpW = 1 h x 15 weeks):

- Practical Laboratory Training in Road Construction lectures/exercises: 30 h
- Pavement Structural Design and Failure Analysis lectures: 30 h

independent study:

- preparation and follow-up Practical Laboratory Training in Road Construction lectures/exercises: 30 h
- preparation and follow-up Pavement Structural Design and Failure Analysis lectures: 30 h
- examination preparation: 60 h

total: 180 h

M Module: Road Safety (bauiM3S12-STRVSICH) [M-BGU-100021]

Responsibility: Matthias Zimmermann

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Mobility and Infrastructure

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each winter term	1 term	German	2

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-109915	Seminar paper Road Safety (S. 370)	3	Matthias Zimmermann
T-BGU-100062	Road Safety (S. 362)	3	Matthias Zimmermann

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-109912 with not graded accomplishment according to § 4 Par. 3 as examination prerequisite
- 'Teilleistung' T-BGU-100062 with oral examination according to § 4 Par. 2 No. 2
details about the learning controls see at the respective 'Teilleistung'

Grade of the Module
grade of the module is grade of the exam

Prerequisites
none

Qualification Goals
The graduates are able to apply methods and techniques for the improvement of road safety, to evaluate the safety of road networks, road sections and junctions, to identify accident black spots, to analyse accidents and their causes as well as to develop measures to improve road safety and evaluate them in their effect. Furthermore, they are able to self-organized and have organisational and didactic competences available related to team work and presentations.

Content
In this course the theoretical basics of road safety are repeated and fundamental improvements are discussed.
During the following seminar in highway engineering changing regional accident black spots are analysed and improvements for the road authorities are worked out and will be presented.

Recommendations
none

Remarks
none

Workload
contact hours (1 HpW = 1 h x 15 weeks):

- Safety Management in Highway Engineering lectures/exercises: 30 h
- Seminar in Highway Engineering: 30 h

independent study:

- preparation and follow-up Safety Management in Highway Engineering lectures/exercises: 30 h
- preparation of seminar paper (examination prerequisite): 60 h
- examination preparation: 60 h

total: 180 h

M Module: Rock Engineering and Underground Construction (bauiM5S05-FELSHOHL) [M-BGU-100074]

Responsibility: Theodoros Triantafyllidis

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Geotechnical Engineering

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each winter term	1 term	German	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-100074	Rock Engineering and Underground Construction (S. 364)	6	Peter Kudella

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-100074 with written examination according to § 4 Par. 2 No. 1
details about the learning control see at the 'Teilleistung'

Grade of the Module
grade of the module is grade of the exam

Prerequisites
none

Qualification Goals
The students are familiar with planning, construction and design of safety systems for embankments and hillsides in bedrock. They can identify critical failure mechanisms, conduct respective stability analyses and design anchoring. They know setup and function of tunnel boring machines and tunneling techniques by own perception and can select appropriate tunnel boring technologies. They can transfer deepened knowledge about strength and deformation properties of bedrock and the precursory and accompanied exploration to the rehabilitation of existing tunnels.

Content
see German version

Recommendations
module Rock Engineering and Tunneling [bauiM5P3-FMTUB]

Remarks
none

Literature
[1] Brady, B. H. G. and Brown, E. T., (2004): Rock Mechanics for Underground Mining, 3rd. Edition, Kluwer Academic Publishers.
[2] Maidl B., Herrenknecht M., Maidl U., Wehrmeyer G. Maschineller Tunnelbau im Schildvortrieb, 2. Auflage 2011, Ernst & Sohn
[3] Kolymbas, D. (1998), Geotechnik - Tunnelbau und Tunnelmechanik, Springer.

Workload
contact hours (1 HpW = 1 h x 15 weeks):

- Aboveground Rock Engineering lecture/exercise: 30 h
- Tunnel Construction in Soils and in Existence lecture/exercise: 30 h
- field trips: 10 h

independent study:

- preparation and follow-up lecture/exercises Aboveground Rock Engineering: 25 h
- preparation and follow-up lecture/exercises Tunnel Construction in Soils and in Existence: 25 h
- examination preparation: 60 h

total: 180 h

M Module: Rock Mechanics and Tunneling (bauiM5P3-FMTUB) [M-BGU-100069]

Responsibility: Theodoros Triantafyllidis

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Geotechnical Engineering

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each summer term	1 term	German	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-100069	Rock Mechanics and Tunneling (S. 366)	5	Carlos Grandas Tavera, Theodoros Triantafyllidis
T-BGU-100179	Student Research Project 'Rock Mechanics and Tunneling' (S. 390)	1	Carlos Grandas Tavera, Theodoros Triantafyllidis

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-100179 with not graded accomplishment according to § 4 Par. 3
- 'Teilleistung' T-BGU-100069 with written examination according to § 4 Par. 2 No. 1

details about the learning controls see at the respective 'Teilleistung'

Grade of the Module
grade of the module is grade of the exam

Prerequisites
none

Qualification Goals
The students understand the essential strength and deformation properties of rock and master the basic analytical methods to solve boundary value problems of surface and underground rock excavation. They can select basic construction methods and constructions in underground tunnel construction and apply self-reliantly the methods of rock mechanics and static calculation and safety assessments. With regard to the assessment of variants, costs, construction operation and safety aspects they gained geotechnical competence in solving problems for all kind of constructions in and with solid rocks.

Content
see German version

Recommendations
basic knowledge of Engineering Geology;
compilation and submission of student research project as examination preparation until examination date

Remarks
none

Literature
[1] Brady, B. H. G. and Brown, E. T., (2004): Rock Mechanics for Underground Mining, 3rd. Edition, Kluwer Academic Publishers.
[2] Kolymbas, D. (1998), Geotechnik - Tunnelbau und Tunnelmechanik, Springer.
[3] Goodmann, R.E., (1989): Introduction to Rock Mechanics, John Wiley & Sons.
[4] Hoek, E., 2007: Practical Rock Engineering, free download from
http://www.rocscience.com/hoek/PracticalRockEngineering.asp.
[5] Jäger, J.C., Cook, N.G.W. and Zimmerman, R.W., 2007: Fundamentals of Rock Mechanics, Blackwell Publishing.
[6] Wittke, W., 1982: Felsmechanik, Springer-Verlag.
[7] Maidl, B. 1997: Tunnelbau im Sprengvortrieb
[8] Müller, L. 1978: Der Felsbau, Bd. 3 Tunnelbau

Workload
contact hours (1 HpW = 1 h x 15 weeks):

- Basics in Rock Mechanics lecture/exercise: 30 h
- Basics in Tunnel Construction lecture/exercise: 30 h

independent study:

- preparation and follow-up lecture/exercises Basics in Rock Mechanics: 20 h
- preparation and follow-up lecture/exercises Basics in Tunnel Construction: 20 h
- preparation of student research project: 20 h
- examination preparation: 60 h

total: 180 h

M Module: Shell Structures and Stability of Structures (bauiM1S17-STABISHELL) [M-BGU-100049]

Responsibility: Werner Wagner

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Structural Engineering

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each summer term	1 term	German	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-100254	Student Research Project 'Shell Structures and Stability of Structures' (S. 393)	2	Ingo Münch, Werner Wagner
T-BGU-100033	Shell Structures and Stability of Structures (S. 372)	4	Ingo Münch, Werner Wagner

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017

- ‘Teilleistung’ T-BGU-100254 with not graded accomplishment according to § 4 Par. 3 as examination prerequisite
- ‘Teilleistung’ T-BGU-100033 with oral examination according to § 4 Par. 2 No. 2
details about the learning controls see at the respective ‘Teilleistung’

Grade of the Module

grade of the module is grade of the exam

Prerequisites

none

Qualification Goals

The students can formulate and apply analytical and computational modeling of shell structures and of stability problems.

Content

- shell structures in nature and technique
- membrane and bending theory of rotational shells
- analytical solutions for rotational shells
- force value method for rotational shells,
- FE-modeling of shell structures
- basics of stability theory for structures
- analytical solutions for stability endangered structures
- sensitivity and imperfections for beam and surface structures
- numerical models for path following
- bifurcation
- buckling of shells
- practical examples

Recommendations

course Surface Structures (6214701)

Remarks

none

Literature

lecture notes Schalentragwerke
lecture notes Stabilität der Tragwerke

Workload

contact hours (1 HpW = 1 h x 15 weeks):

- Shell Structures lecture, exercise: 30 h
- Stability of Structures lecture, exercise: 30 h

independent study:

- preparation and follow-up lectures, exercises Shell Structures: 15 h
- preparation and follow-up lectures, exercises Stability of Structures: 15 h
- preparation of student research project (exam prerequisite): 50 h
- examination preparation: 40 h

total: 180 h

M Module: Solid Construction Bridges (bauiM1S03-MASSBRUE) [M-BGU-100037]

Responsibility: Lothar Stempniewski

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Structural Engineering

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each winter term	1 term	German	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-100020	Solid Construction Bridges (S. 374)	6	Lothar Stempniewski

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-100020 with written examination according to § 4 Par. 2 No. 1
details about the learning control see at the 'Teilleistung'

Grade of the Module
grade of the module is grade of the exam

Prerequisites
none

Qualification Goals
Based on the module 'Basics of Prestressed Concrete' the students can explain the peculiarity of bridge constructions. In addition, they can describe the principle procedure of the design of solid construction bridges and can conduct these. Hence, the students can describe the differences to classical structural engineering and the introduction to current standards.

Content

- construction methods, production and impacts
- proof in ultimate limit state and in serviceability limit state
- types of supports

Recommendations
module Basics of Prestressed Concrete [bauiM1S02-GDLSPANNB]

Remarks
none

Literature
lecture notes

Workload
contact hours (1 HpW = 1 h x 15 weeks):

- lecture, exercise: 60 h

independent study:

- preparation and follow-up lectures, exercises: 45 h
- examination preparation: 75 h

total: 180 h

M Module: Space and Infrastructure (bauiM3S02-PLRAUMINF) [M-BGU-100014]

Responsibility: Martin Kagerbauer

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Mobility and Infrastructure

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each term	1 term	German	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-100056	Space and Infrastructure (S. 375)	6	Martin Kagerbauer, Sina Keller

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-100056 with oral examination according to § 4 Par. 2 No. 2
details about the learning control see at the 'Teilleistung'

Grade of the Module
grade of the module is grade of the exam

Prerequisites
none

Qualification Goals
Transport infrastructure, water and energy, and telecommunications are fundamental prerequisites for the development of an area. However, the conditions of the area, its topography, resources, environment, population and characteristics have to be considered in order to design not only an effective, but also a sustainable plan. This relationship between spatial planning and infrastructure development are mediated. This content will be supplemented by learning the skills to analyse and display spatial data. The aim is to show the importance of coupling between planning task and use of computer-based tools in spatial planning. A link between theoretical background and reality on the one hand and instruments on the other is necessary.

Content
Logistics, Supply and Disposal:
After a introduction to the terms infrastructure and development the lecture examines the most important infrastructures in detail:

- traffic systems
- railway planning
- air traffic
- watercourses
- water supply and drainage
- power supply
- telecommunications
- recycling and waste management systems
- calculation and distribution of development costs

Fundamentals of Geographic Information Systems for Modelling and Planning:

- foundations of information and communication theory
- spatial information on the Internet
- project presentation
- planning information systems
- technical information systems
- cartographic principles

Recommendations
none

Remarks
none

Literature
list of literature to module

Workload
contact hours (1 HpW = 1 h x 15 weeks):

- Logistics, Supply and Disposal lectures/exercises: 30 h
- Fundamentals of Geographic Information Systems for Modelling and Planning lectures/exercises: 60 h

independent study:

- preparation and follow-up Logistics, Supply and Disposal lectures/exercises: 30 h
- preparation and follow-up Fundamentals of Geographic Information Systems for Modelling and Planning lectures/exercises: 15 h
- examination preparation: 45 h

total: 180 h

M Module: Special Issues of Public Transport (bauiM3S22-VERSPEZOEV) [M-BGU-103357]

Responsibility: Peter Vortisch

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Mobility and Infrastructure

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each summer term	1 term	German	1

Wahlpflicht
Compulsory Elective; You must choose 2 courses and 6 credits.

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-101005	Tendering, Planning and Financing in Public Transport (S. 401)	3	Peter Vortisch
T-BGU-100014	Seminar in Transportation (S. 368)	3	Bastian Chlond, Peter Vortisch
T-BGU-106608	Information Management for Public Mobility Services (S. 320)	3	Peter Vortisch

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
two learning controls have to be selected:
- 'Teilleistung' T-BGU-101005 with oral examination according to § 4 Par. 2 No. 2
- 'Teilleistung' T-BGU-100014 with examination of other type according to § 4 Par. 2 No. 3
- 'Teilleistung' T-BGU-106608 with examination of other type according to § 4 Par. 2 No. 3

details about the learning controls see at the respective 'Teilleistung'

Grade of the Module
grade of the module is CP weighted average of grades of the partial exams

Prerequisites
none

Qualification Goals
see German version

Content
see German version

Recommendations
course Transportation (6200406)

Remarks
none

Workload

contact hours (1 HpW = 1 h x 15 weeks):

- Tendering, Planning and Financing in Public Transport lectures: 30 h
- Seminar in Transportation: 30 h
- Regional Planning lectures: 30 h
- Information Management for public Mobility Services lectures/exercises: 30 h

independent study, as selected courses:

- preparation and follow-up Tendering, Planning and Financing in Public Transport lectures: 30 h
- examination preparation Tendering, Planning and Financing in Public Transport (selectable partial exam): 30 h
- preparation of term paper and presentation (selectable partial exam): 60 h
- preparation and follow-up Information Management for public Mobility Services lectures/exercises: 30 h
- preparation accompanying exercises Information Management for public Mobility Services (selectable partial exam): 30 h

total: 180 h

M Module: Special Issues of Soil Mechanics (bauiM5S01-SPEZBM) [M-BGU-100005]

Responsibility: Theodoros Triantafyllidis

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Geotechnical Engineering

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each winter term	1 term	German	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-100071	Special Issues of Soil Mechanics (S. 376)	6	Theodoros Triantafyllidis

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-100071 with oral examination according to § 4 Par. 2 No. 2
details about the learning control see at the 'Teilleistung'

Grade of the Module
grade of the module is grade of the exams

Prerequisites
none

Qualification Goals
The students master a wide range of mechanical, hydraulic and numerical tools for the processing of specific soil mechanical problems. They can comprehend the cross-linking of hydraulic, mechanical and chemical processes under partial saturation. They can use the dynamic and cyclic laboratory techniques and apply material laws operationally for the calculation and calibration of experiments. They can describe and evaluate constructionally vibrations and waves in elastic continua and real soils in the range of strains from small shakes up to earthquakes.

Content
see German version

Recommendations
module Theoretical Soil Mechanics [bauiM5P1-THEOBM]

Remarks
none

Workload
contact hours (1 HpW = 1 h x 15 weeks):

- Unsaturated, Viscous and Cyclic Soil Behaviour - Theory and Element Tests lecture/exercise: 30 h
- Soil Dynamics lecture/exercise: 30 h

independent study:

- preparation and follow-up lecture/exercises Unsaturated, Viscous and Cyclic Soil Behaviour - Theory and Element Tests: 15 h
- preparation and follow-up lecture/exercises Soil Dynamics: 15 h
- exercises with available software: 30 h
- examination preparation: 60 h

total: 180 h

M Module: Special Topics in Highway Engineering (bauiM3S13-STRSPEZ) [M-BGU-100022]

Responsibility: Ralf Roos

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Mobility and Infrastructure

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each summer term	1 term	German	2

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-106734	Special Topics in Highway Engineering (S. 378)	6	Rainer Hess, Ralf Roos

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-106734 with oral examination according to § 4 Par. 2 No. 2
details about the learning control see at the 'Teilleistung'

Grade of the Module
grade of the module is grade of the exam

Prerequisites
none

Qualification Goals
Learning the methodology of organisation and carrying out the road operation and maintenance.
The graduates are able to apply methods and techniques for specific aspects in the life cycle of a road, to modify them for the application case and to analyse the obtained knowledge. They are able to investigate the organisation and implementation of the operation and maintenance of a road, for instance, to reveal the weak points and to develop improvement possibilities.

Content
In this module the duties of the management of existing roads are acquired and the technical and commercial control from the point of view of the road authorities are explained. Further, different methods for the simulation, analysis and evaluation of additional problems and special aspects in highway engineering are presented and discussed by means of varying topics of design, construction, operation and maintenance of roads (e.g. statistical analysis of large data sets, simulation of traffic flow under particular boundary conditions, construction material analysis in lab experiments, innovative contractual forms for construction and operation of roads, econ. privatization).

Recommendations
preliminary attendance of compulsory module Infrastructure Management [bauiM3P3-STRINFRA]

Remarks
none

Workload

contact hours (1 HpW = 1 h x 15 weeks):

- Technical and Economic Management Tools in Highway Engineering lectures: 30 h
- Simulations and Analysis Methods in Highway Engineering lectures: 15 h
- Special Topics in Highway Engineering lectures: 15 h

independent study:

- preparation and follow-up Technical and Economic Management Tools in Highway Engineering lectures: 30 h
- preparation and follow-up Simulations and Analysis Methods in Highway Engineering lectures: 15 h
- preparation and follow-up Special Topics in Highway Engineering lectures: 15 h
- examination preparation: 60 h

total: 180 h

M Module: Special Underground Engineering (bauiM5S08-SPEZTIEF) [M-BGU-100078]

Responsibility: Theodoros Triantafyllidis

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Geotechnical Engineering

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each summer term	1 term	German	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-100080	Ground Improvement, Grouting and Soil Freezing (S. 301)	3	Wolfgang Orth
T-BGU-100079	Anchoring, Piling and Slurry Wall Technology (S. 243)	3	Theodoros Triantafyllidis

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-100080 with oral examination according to § 4 Par. 2 No. 2
- 'Teilleistung' T-BGU-100079 with oral examination according to § 4 Par. 2 No. 2
details about the learning controls see at the respective 'Teilleistung'

Grade of the Module
grade of the module is CP weighted average of grades of the partial exams

Prerequisites
none

Qualification Goals
The students can name performance, ranges of application, necessary preliminary investigations and accompanying controls (monitoring) for special underground engineering technologies. They can select self-reliantly appropriate technologies for certain construction problems, describe and dimensioning the steps of the procedure, motivate required preinvestigations, specify parameters for the realization and define the type of controls of execution. They can describe the principles of the observation method and the construction measurement technology and the controls for quality assurance.

Content
The module goes into specific construction techniques of special underground engineering and discusses questions of application limitation, of designing and proofs of safety, requirements for equipement, execution controls and advices for avoiding errors and minmizing risks:

- soil freezing techniques
- injection techniques
- soil improvement techniques
- implementation of slurry and seal walls
- drilling and anchor techniques for grouted anchors
- execution of piles

Recommendations
none

Remarks
none

Literature
[1] Triantafyllidis, Th. (1990), Planung und Bauausführung im Spezialtiefbau, Teil 1, Ernst & S.
[2] Seitz, J. & Schmidt, H.-G. (2000), Bohrpfähle Ernst & S.

[3] Witt, J. (Hrsg.), Grundbau-Taschenbuch Teil 1-3, 7. Aufl. (2009), Ernst & Sohn
[4] Kutzner, Ch. (1991), Injektionen im Baugrund, F.Enke

Workload
contact hours (1 HpW = 1 h x 15 weeks):

- Ground Improvement, Grouting and Soil Freezing lecture/exercise: 30 h
- Anchoring, Piling and Slurry Wall Technology lecture/exercise: 30 h
- field trips: 10 h

independent study:

- preparation and follow-up lecture/exercises Ground Improvement, Grouting and Soil Freezing: 25 h
- examination preparation Ground Improvement, Grouting and Soil Freezing (partial exam): 30 h
- preparation and follow-up lecture/exercises Anchoring, Piling and Slurry Wall Technology: 25 h
- examination preparation Anchoring, Piling and Slurry Wall Technology (partial exam): 30 h

total: 180 h

M Module: Steel and Composite Structures (bauiM1P2-STAHLBAU) [M-BGU-100034]

Responsibility: Thomas Ummenhofer

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Structural Engineering

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each summer term	1 term	German	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-100171	Student Research Project 'Steel Structures' (S. 394)	1	Thomas Ummenhofer
T-BGU-100016	Steel and Composite Structures (S. 379)	5	Thomas Ummenhofer

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- ‘Teilleistung’ T-BGU-100171 with not graded accomplishment according to § 4 Par. 3
- ‘Teilleistung’ T-BGU-100016 with written examination according to § 4 Par. 2 No. 1
details about the learning controls see at the respective ‘Teilleistung’

Grade of the Module
grade of the module is grade of the exam

Prerequisites
none

Qualification Goals
The students can design and construct structures in steel and steel composite construction method. Further, they can calculate structures and building components made of thin-walled, cold formed steelwork components. They are able to proof fire protection in steel constructions and to design torsion-loaded components of any cross section.

Content
- basics of steel composite structures
- light-weight steel construction
- fire protection in steel constructions
- the theory of torsion

Recommendations
lecture Basics in Steel Structures (6200504)

Remarks
none

Literature
DIN EN 1993-1-1, Dezember 2010: Eurocode 3: Bemessung und Konstruktion von Stahlbauten - Teil 1-1: Allgemeine Bemessungsregeln und Regeln für den Hochbau: Beuth Verlag GmbH, Berlin.
DIN EN 1993-1-2, Dezember 2010: Eurocode 3: Bemessung und Konstruktion von Stahlbauten - Teil 1-2: Allgemeine Regeln - Tragwerksbemessung für den Brandfall: Beuth Verlag GmbH, Berlin.
DIN EN 1993-1-3, Dezember 2010: Eurocode 3: Bemessung und Konstruktion von Stahlbauten - Teil 1-3: Allgemeine Regeln - Ergänzende Regeln für kaltgeformte Bauteile und Bleche: Beuth Verlag GmbH, Berlin.
DIN EN 1994-1-1, Dezember 2010: Eurocode 4: Bemessung und Konstruktion von Verbundtragwerken aus Stahl und Beton - Teil 1-1: Allgemeine Bemessungsregeln und Anwendungsregeln für den Hochbau: Beuth Verlag GmbH, Berlin.

Workload

contact hours (1 HpW = 1 h x 15 weeks):

- lecture, exercise: 60 h

independent study:

- preparation and follow-up lectures, exercises: 25 h
- preparation of student research project: 45 h
- examination preparation: 50 h

total: 180 h

M Module: Structures in Steel and Timber (bauiM1S10-BAUING-TSH) [M-BGU-100042]

Responsibility: Thomas Ummenhofer

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Structural Engineering

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each winter term	1 term	German	2

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-106798	Structures in Steel (S. 380)	3	Thomas Ummenhofer
T-BGU-106799	Structures in Timber (S. 381)	3	Matthias Frese

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-106798 with examination of other type according to § 4 Par. 2 No. 3
- 'Teilleistung' T-BGU-106799 with oral examination according to § 4 Par. 2 No. 2
details about the learning controls see at the respective 'Teilleistung'

Grade of the Module
grade of the module is CP weighted average of grades of the partial exams

Prerequisites
none

Qualification Goals
The students can name typical supporting structures for building construction (for steel and timber) and the construction and connecting elements required for production. They can describe, model correctly and outline analytically the supporting effect of constructions and their single elements. They can identify assets and drawbacks of constructions, and they are able to develop design options under given conditions, to assess these and based on this to opt for reasonable design and construction solutions. The students can describe the most important damages and their reasons. They are able to prevent damages during constructing and designing supporting structures by creativity, accuracy and complex cross-linked thinking. By that they are able to design reliable and permanent constructions.

Content

- structure design and constructive detail design in structural and bridge engineering
- classification of damages independent of building materials
- definitions of the sphere, in which damages and failures occur
- damages and failures that are typical for timber structures

Recommendations
course Basics in Steel Structures (6200504),modules Steel and Composite Structures [bauiM1P2-STAHLBAU], Timber Structures [bauiM1S12-HB]

Remarks
none

Literature
lecture accompanying documents

Workload

contact hours (1 HpW = 1 h x 15 weeks):

- Structures in Steel lectures, exercises and discussions: 15 h
- Structures in Timber lecture/exercise: 30 h

independent study:

- preparation of design project Structures in Steel, preparation of final presentation (partial exam): 80 h
- preparation and follow-up lecture/exercises Structures in Timber: 45 h
- examination preparation Structures in Timber (partial exam): 15 h

total: 185 h

M Module: Subsurface Flow and Contaminant Transport (bauiM2S03-HY3) [M-BGU-103872]

Responsibility: Erwin Zehe

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Water and Environment

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each summer term	1 term	English	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-106598	Transport and Transformation of Contaminants in Hydrological Systems (S. 410)	6	Erwin Zehe

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-106598 with oral examination according to § 4 Par. 2 No. 2
details about the learning control see at the 'Teilleistung'

Grade of the Module
grade of the module is grade of the exam

Prerequisites
none

Qualification Goals
Students are able to explain processes of transport and decomposition related to nutrients and pollutants in surface runoff and in the unsaturated zone of rural catchments.
Students are able to independently apply analytical and process-based models: estimation of model parameters from field investigations, estimation of water and substance fluxes and balance in the critical zone, statements on the risks related to contaminant mobilization in natural soils.
Students are able to evaluate the limits of applicability of modeling approaches in natural, heterogeneous soils.

Content
Transport processes in the unsaturated zone related to infiltration, surface runoff, and movement of soil water:

- advective-dispersive transport in homogeneous and heterogeneous soils
- particulate transport by erosion
- adsorption
- chemical and microbial processes of reaction and decay in soils
- modeling contaminant transport (e.g. pesticides) in soils using analytical models
- risk assessment for pesticides in soils (transport, residence times, adsorption, decay)
- estimation of model parameters from field exploration
- parameterization of adsorption isotherms
- breakthrough curve

Computer exercise:

- simulation of water and substance transport with process-based models
- independently conducted risk-assessments for pesticides using simple simulation techniques

Recommendations
modules Water and Energy Cycles [bauiM2P8-WATENCYC] and Hydrological Measurements in Environmental Systems [bauiM2S05-HY5]
knowledge of programming with Matlab; otherwise, it is strongly recommended to attend the course 'Introduction to Matlab' (6224907)

Remarks
This module is offered newly as from summer term 2018.

Literature
Jury, W. and Horton, R. (2004): Soil physics. John Wiley
Hillel, D. (1995): Environmental Soil Physics. Academic Press
Fritsche, W. (1998) Umweltmikrobiologie, Grundlagen und Anwendungen. Gustav Fischer Verlag, 248pp.

Workload
contact hours (1 HpW = 1 h x 15 weeks):

- lecture/exercise: 60 h

independent study:

- preparation and follow-up lecture/exercises: 60 h
- examination preparation: 60 h

total: 270 h

M Module: Surface Structures and Dynamics of Structures (bauiM1P3-FTW-BD) [M-BGU-100035]

Responsibility: Werner Wagner

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Structural Engineering

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each winter term	1 term	German	2

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-107818	Student Research Project 'Surface Structures' (S. 395)	1	Werner Wagner
T-BGU-107819	Student Research Project 'Dynamics of Structures' (S. 385)	1	Peter Betsch
T-BGU-100017	Surface Structures (S. 397)	2	Werner Wagner
T-BGU-100077	Dynamics of Structures (S. 275)	2	Peter Betsch

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-107818 with not graded accomplishment according to § 4 Par. 3
- 'Teilleistung' T-BGU-107819 with not graded accomplishment according to § 4 Par. 3
- 'Teilleistung' T-BGU-100017 with written examination according to § 4 Par. 2 No. 1
- 'Teilleistung' T-BGU-100077 with written examination according to § 4 Par. 2 No. 1

details about the learning controls see at the respective 'Teilleistung'

Grade of the Module
grade of the module is CP weighted average of grades of the partial exams

Prerequisites
none

Qualification Goals
The students gain the ability to write up and apply the essential principles for surface structures (theory, models, analytical and numerical solution procedures and error analysis) as basis for design and construction. They are further able to analyze the vibration behavior of structures in the context of mechanical modeling. The students can apply concepts for the avoidance of vibrations and the reduction of vibrations to a tolerable extent and can describe fundamental vibration phenomena by means of small scale building models.

Content
Surface Structures:

- panel structures models and basic equations
- PDE and BCs for panel structures and analytical solutions
- FEM for panel structures (general/rot. symmetry)
- practical related solutions for panel structures with truss models
- plate structures models and basic equations
- PDE and simplifications for plate structures
- analytical solutions for plate structures, incl. serial solutions
- FEM for plate structures (general/rot. symmetry)
- practical related solutions for plate structures
- elastic foundation, temperature load and influence surfaces
- introduction to shell structures

Dynamics of Structures:

Vibratory structural-mechanical constructions with finite degrees of freedom are considered. The vibration analysis is based on linearized equations of motion and their solutions. Non-damped and damped free oscillations caused by different kinds of excitations are discussed. This includes measures avoiding and reducing vibrations of structures.

Recommendations
lectures in Structural Analysis I+II (6200401, 6200501);
laboratory course Dynamics of Structures (6215905) in addition to the lecture Dynamics of Structures (6215701)

Remarks
none

Literature
Surface Structures:
lecture notes Flächentragwerke
Hake, E. , Meskouris, K. (2001): Statik der Flächentragwerke, Springer.
Altenbach, H., Altenbach, J., Naumenko, K. (1998): Ebene Flächentragwerke, Grundlagen der Modellierung und Berechnung von Scheiben und Platten, Springer.
Dynamics of Structures:
lecture notes: P. Vielsack: Grundlagen der Baudynamik

Workload
contact hours (1 HpW = 1 h x 15 weeks):

- Surface Structures lecture: 30 h
- Dynamics of Structures lecture: 30 h

independent study:

- preparation and follow-up lectures Surface Structures: 15 h
- preparation of student research project 'Surface Structures' (not graded accomplishment): 20 h
- examination preparation Surface Structures (partial exam): 25 h
- preparation and follow-up lectures Dynamics of Structures: 15 h
- preparation of student research project 'Dynamics of Structures' (not graded accomplishment): 20 h
- examination preparation Dynamics of Structures (partial exam): 25 h

total: 180 h

M Module: Sustainability in Real Estate Management (bauiM4P4-) [M-BGU-100112]

Responsibility:	Kunibert Lennerts
Institution:	KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften
Curricular Embedding:	Compulsory Elective
Contained in:	Study Focus / Technology and Management in Construction

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each summer term	1 term	German	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-100149	Sustainability in Real Estate Management (S. 398)	6	Kunibert Lennerts

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-100148 with written examination according to § 4 Par. 2 No. 1
details about the learning control see at the 'Teilleistung'

Grade of the Module
grade of the module is grade of the exam

Prerequisites
none

Qualification Goals
Students understand issues an economic-ecological evaluation of the entire life cycle of buildings and can independently carry out life cycle analyzes and assess the sustainability of buildings.
Students can present the essential relationships within the sustainable construction.They can explain the focal points of international certification process and the evaluation process can DGNB apply. Students can describe technical and economic concepts and know their areas of application.
In addition, students know the procedure of procurement procedures and can discuss them in connection with the procurement law. You can explain and understand the Infrastructural FM and the FM Technical the essential contents of the procurement law for the FM and their effects.

Content
- energy concepts and ecologic balancing
- methods of calculating life-cycle costs
- comparison of international certification systems
- life cycle assessment
- outsourcing and procurement procedures / procurement law in facility management
- data collection / CAFM

Recommendations
courses Facility und Real Estate Management I (6200414), Life Cycle Management (6200615)

Remarks
none

Workload

contact hours (1 HpW = 1 h x 15 weeks):

- Sustainability in Real Estate Management lecture/exercise: 30 h
- Real Estate Life Cycle Management lecture: 30 h
- Facility and Real Estate Management II lecture: 30 h

independent study:

- preparation and follow-up lecture/exercises Sustainability in Real Estate Management: 30 h
- preparation and follow-up lectures Real Estate Life Cycle Management: 15 h
- preparation and follow-up lectures Facility and Real Estate Management II: 15 h
- examination preparation: 60 h

total: 180 h

M Module: Tank Construction (bauiM1S39-BEHBAU) [M-BGU-100580]

Responsibility: Peter Knödel

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften
Curricular Embedding: Compulsory Elective
Contained in: Study Focus / Structural Engineering

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each winter term	1 term	German	2

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-101001	Term Paper Tank Construction (S. 403)	3	Peter Knödel
T-BGU-101000	Tank Construction (S. 399)	3	Peter Knödel

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-101001 with examination of other type according to § 4 Par. 2 No. 3
- 'Teilleistung' T-BGU-101000 with oral examination according to § 4 Par. 2 No. 2
details about the learning controls see at the respective 'Teilleistung'

Grade of the Module
grade of the module is CP weighted average of grades of the partial exams

Prerequisites
none

Qualification Goals
The students can design and construct tank and silo structures and they can assess the influences on the structural behavior of shell structures:

- They can apply scientific methods for the system analysis of tanks.
- They can develop problem solutions beyond the application of the regulations for tank constructions.
- They have the ability to work intterdisciplinarily at the interface to plant engineering and construction.
- They can compile complex technical facts and impart them to a plenary assembly.

Content

- classification of tank and silo types
- application related material selection
- actions on storage structures: characteristics of wind loads (e.g. flow around cylinders), filling, internal pressure, earthquakes and explosions
- structural behavior of shell structure
- strength and stability check by linear and non-linear calculations under comparison of handouts with FE models
- design and construction
- specific problems

Recommendations
The contents of the lecture Basics in Steel Structures (6200504) are required. Contens of the modules Surface Structures and Dynamics of Structures [bauiM1P3-FTW-BD] as well as Steel and Composite Structures [bauiM1P2-STABISTB] are recommended.

Remarks
none

Literature
lecture notes
DIN EN 1993-1-6: Bemessung und Konstruktion von Stahlbauten - Teil 1-6: Festigkeit und Stabilität von Schalen.

DIN EN 1993-4-1: Bemessung und Konstruktion von Stahlbauten - Teil 4-1: Silos.
DIN EN 1993-4-2: Bemessung und Konstruktion von Stahlbauten - Teil 4-2: Tankbauwerke.
Knödel, P.; Heß, A.; Ummenhofer, T.: Stählerne Tankbauwerke nach DIN EN 1993-4-2. In: Stahlbau-Kalender 2013, S. 523-563.
Radlbeck, C.; Knödel, P.; et al.: Bemessung und Konstruktion von Aluminiumtragwerken. In: Stahlbau Kalender 2016, S. 175-309.
Knödel, P.; Ummenhofer, T.; Ruckenbrod, C.: Silos und Tanks. In: Stahlbau Kalender 2017, S. 595-692.
Knödel, P.; Ummenhofer, T.: Regeln für die Berechnung von Behältern mit der FEM. Stahlbau 86 (2017), S. 325-339.

Workload
contact hours (1 HpW = 1 h x 15 weeks):

- lecture, exercise: 45 h
- discussion on term paper: 15 h

independent study:

- preparation and follow-up lectures, exercises: 20 h
- preparation of term paper (partial exam): 80 h
- examination preparation (partial exam): 20 h

total: 180 h

M Module: Technical Hydraulics (bauiM2S17-SM3) [M-BGU-103385]

Responsibility: Olivier Eiff

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Water and Environment

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each summer term	1 term	German	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-106770	Technical Hydraulics (S. 400)	6	Olivier Eiff

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-106770 with written examination according to § 4 Par. 2 No. 1
details about the learning control see at the 'Teilleistung'

Grade of the Module
grade of the module is grade of the exam

Prerequisites
none

Qualification Goals
see German version

Content
see German version

Recommendations
module Advanced Fluid Mechanics [bauiM2P9-ADVFM]

Remarks
IMPORTANT:
The module will not be offered in summer term 2019.

Literature
Vorlesungsskript Rohrhydraulik, 2009Lang, C., Jirka, G., 2009, Einführung in die Gerinnehydraulik, Universitätsverlag KarlsruheNaudascher, E., 1992, Hydraulik der Gerinne und Gerinnebauwerke, Springer Verlag Berlin

Workload
contact hours (1 HpW = 1 h x 15 weeks):

- lecture, exercise: 60 h

independent study:

- preparation and follow-up lectures, exercises: 60 h
- examination preparation: 60 h

total: 180 h

M Module: Theoretical Soil Mechanics (bauiM5P1-THEOBM) [M-BGU-100067]

Responsibility: Theodoros Triantafyllidis

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Geotechnical Engineering

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each summer term	1 term	German	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-100067	Theoretical Soil Mechanics (S. 405)	6	Theodoros Triantafyllidis

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017

- 'Teilleistung' T-BGU-100067 with written examination according to § 4 Par. 2 No. 1
details about the learning control see at the 'Teilleistung'

Grade of the Module

grade of the module is grade of the exam

Prerequisites

none

Qualification Goals

The students obtained a scientific based understanding of the essential behavior of soil under monotonic and cyclic load with and without effects of time regarding large and small deformations. They are able to describe relations in soil mechanics mathematically and physically correctly. They can understand the tensorial terminology of modern geotechnical literature and can apply computing programs to comprehend element tests. They recognize self-reliantly relevant mechanisms of boundary value problems and can specify the limitations of simple engineering models.

Content

advanced theoretical basics of soil behavior:

- geotechnical invariants of stress and strain
- failure criteria according to Coulomb, Matsuoka-Nakai etc.
- contractancy and dilatancy
- critical density
- failure criteria according to Krey-Tiedemann
- soil behavior under partial saturation
- collapse theorems and their application (Kinematic Element Analysis)
- elasticity in soil mechanics (isotropic and anisotropic)
- elastoplasticity with volumetric hardening using the example of the Cam-Clay-Model
- soil behavior under cyclic loading
- one-dimensional viscoplasticity

Recommendations

fundamentals in soil mechanics and continuum mechanics, module Basics of Numerical Modelling [bauiM5P1-THEOBM]

Remarks

none

Literature

Niemunis (2009): Über die Anwendung der Kontinuumstheorie auf bodenmechanische Probleme (download)

Workload
contact hours (1 HpW = 1 h x 15 weeks):

- lecture/exercise: 60 h

independent study:

- preparation and follow-up lecture/exercises: 30 h
- working with available software: 30 h
- examination preparation: 60 h

total: 180 h

M Module: Timber and Wood-Based Materials (bauiM1S13-BAUING-HHW) [M-BGU-100045]

Responsibility: Hans Joachim Blaß

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Structural Engineering

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each summer term	1 term	German	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-100029	Timber and Wood-Based Materials (S. 406)	6	Hans Joachim Blaß, Carmen Sandhaas

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-100029 with oral examination according to § 4 Par. 2 No. 2
details about the learning control see at the 'Teilleistung'

Grade of the Module
grade of the module is grade of the exam

Prerequisites
none

Qualification Goals
The students can utilize the building material timber and its derived products in civil engineering appropriately and are aware of possible problems caused by the hygroscopic, anisotropic, heterogeneous and biological properties of wood. They developed methods to handle the variable properties of timber in construction practice. The students can develop different timber-based materials target-oriented by themselves based on wood-anatomic, wood-physical and biological knowledge. Their questionable and critical cogitation is educated with respect to well realized, robust and reliable details of timber construction and the students can transfer problems from civil engineering to other context. Based on their material understanding the students can analyse and evaluate the material-specific quality of construction details.
Another competence after completing the module is the ability to read, analyse and comprehend coherently and critically English-language technical texts. A short scientific presentation is developed and presented in English as teamwork.

Content

- wood anatomy
- wood characteristics
- wood physics
- durability
- drying and strength grading of wood
- solid timber
- engineered wood products
- glued laminated timber
- wood-based panels

Recommendations
module Timber Structures [bauiM1S12-HB]

Remarks
none

Literature
lecture notes „Holz und Holzwerkstoffe", Lehrstuhl für Holzbau und Baukonstruktionen, Karlsruher Institut für Technologie (in German)

Workload
contact hours (1 HpW = 1 h x 15 weeks):

- lecture/exercise: 60 h

independent study:

- preparation and follow-up lecture/exercises, preparation of scientific presentation: 60 h
- examination preparation: 60 h

total: 180 h

M Module: Timber Structures (bauiM1S12-BAUING-HB) [M-BGU-100044]

Responsibility: Hans Joachim Blaß

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Structural Engineering

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each summer term	1 term	German	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-100028	Timber Structures (S. 407)	6	Hans Joachim Blaß

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-100028 with written examination according to § 4 Par. 2 No. 1
details about the learning control see at the 'Teilleistung'

Grade of the Module
grade of the module is grade of the exam

Prerequisites
none

Qualification Goals
The students are able to design composite glued or mechanically jointed components as well as special connection details. They have knowledge about detailing for durability and fire resistance of timber. The students are qualified to design timber structures.

Content
- elements: mechanically jointed beams, stressed skin panels, purlins
- joints: moment resisting connections, multiple-shear joints with dowel-type fasteners, joist hangers and framing anchors, reinforced connections
- construction details: tension perpendicular to the grain in joints, notched beam and holes in glulam beams, fire resistance, detailing for durability, durability - preservative treatment

Recommendations
none

Remarks
none

Literature
Blaß, H.J.; Görlacher, R.; Steck, G. (Ed.) Holzbauwerke STEP 1 - Bemessung und Baustoffe. Fachverlag Holz, Düsseldorf, 1995 (ISSN-Nr. 04462114)

Workload
contact hours (1 HpW = 1 h x 15 weeks):
- lecture, exercise: 60 h

independent study:
- preparation and follow-up lectures, exercises: 45 h
- examination preparation: 75 h

total: 180 h

M Module: Track Guided Transport Systems - Operation and Capacity (bauiM3S18-EBBETRKAP) [M-BGU-100581]

Responsibility: Jan Tzschaschel

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Mobility and Infrastructure

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each summer term	1 term	German	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-101002	Track Guided Transport Systems - Operation and Capacity (S. 408)	6	Jan Tzschaschel

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-101002 with oral examination according to § 4 Par. 2 No. 2
details about the learning control see at the 'Teilleistung'

Grade of the Module
grade of the module is grade of the exam

Prerequisites
none

Qualification Goals
The Students can analyse, structure and describe formally problems in the field of operation of track guided transport systems. They are able to process methodically questions of security and capacity of railway tracks and to propose solutions.

Content

- operation and signal systems
- safety and signalbox technologies
- time table compilation
- performance and capacity of railway lines
- proof of safety
- operation and dimensioning of marshalling yards

Recommendations
none

Remarks
IMPORTANT:
The module will be offered further on as from summer term 2019.

Literature
Fiedler, Grundlagen der Bahntechnik, Werner-Verlag, Düsseldorf
Hausmann, Enders, Grundlagen des Bahnbetriebs, Bahn-Fachverlag, Heidelberg
Pachl, Systemtechnik des Schienenverkehrs, Teubner-Verlag, Stuttgart

Workload
contact hours (1 HpW = 1 h x 15 weeks):

- Operation Track Guided Systems lectures: 30 h
- Operation Systems and Track Guided Infrastructure Capacity lectures: 30 h

independent study:

- preparation and follow-up Operation Track Guided Systems lectures: 30 h
- preparation and follow-up Operation Systems and Track Guided Infrastructure Capacity lectures: 30 h
- examination preparation: 60 h

total: 180 h

M Module: Traffic Management und Simulation Methods (bauiM3S03-VERMANAGE) [M-BGU-100015]

Responsibility: Peter Vortisch

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Mobility and Infrastructure

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each term	1 term	German	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-100008	Traffic Management und Simulation Methods (S. 409)	6	Peter Vortisch

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-100008 with oral examination according to § 4 Par. 2 No. 2
details about the learning control see at the 'Teilleistung'

Grade of the Module
grade of the module is grade of the exam

Prerequisites
none

Qualification Goals
Acquisition of the specific and advanced knowledge and the relevant methodologies in the field of traffic engineering. Basic considerations in the development and the application of simulation models in transport planning and traffic engineering.

Content
In excess of the basic module "Model approaches and methods in transportation" more advanced methods of traffic engineering will be dealt with (advanced signalisation, control of routes and networks). Furthermore methods for the development of simulation models as well as their application will be in the focus (application of professional software tools for transport planning and traffic engineering). Another issue are transport telematics and intelligent transportation system.

Recommendations
none

Remarks
none

Literature
lecture notes
guidelines ('Handbuch zur Bemessung von Straßen', 'Richtlinien für Lichtsignalanlagen'),
software documentations

Workload
contact hours (1 HpW = 1 h x 15 weeks):
- Traffic Management and Transport Telematics lectures/exercises: 30 h
- Traffic Flow Simulation lectures/exercises: 30 h

independent study:
- preparation and follow-up Traffic Management and Transport Telematics lectures/exercises: 30 h
- preparation and follow-up Traffic Flow Simulation lectures/exercises: 30
- examination preparation: 60 h

total: 180 h

M Module: Turnkey Construction (bauiM4S15-) [M-BGU-100676]

Responsibility:	Shervin Haghsheno
Institution:	KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften
Curricular Embedding:	Compulsory Elective
Contained in:	Study Focus / Technology and Management in Construction

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each summer term	1 term	German	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-101208	Turnkey Construction (S. 411)	6	Shervin Haghsheno

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-101208 with written examination according to § 4 Par. 2 No. 1
details about the learning control see at the 'Teilleistung'

Grade of the Module
grade of the module is grade of the exam

Prerequisites
none

Qualification Goals
Students are able to describe the basic technologies and design techniques in shell and finishes as well as in building services. Furthermore, they are able to apply technologies and techniques under project-specific conditions. They know the basic processes in turnkey construction.
Students know the eligibility requirements for the calculation of additional or reduced cost based on VOB/B. They are able to created, examine and avoid claims.

Content
In the area of turnkey projects the detailed design and basic construction services for various construction trades (e.g. drywall construction, floating screed, Facing) are discussed. Furthermore, processes of turnkey construction are explained from the beginning of the design phase till the acceptance of the work and the beginning of warranty.
In terms of claim management the course clarifies, how to create, justify, and calculate claims based on the VOB by using practical examples.

Recommendations
none

Remarks
none

Literature
ELWERT, Ulrich, Flassak, Alexander: Nachtragsmanagement in der Baupraxis - Grundlagen, Beispiele, Anwendung, Vieweg, 2., erw. und aktualisierte Aufl., Wiesbaden, 2008.
WÜRFELE, Falk [Hrsg.]: Nachtragsmanagement - Leistungsbeschreibung, Leistungsabweichung, Bauzeitverzögerung, Werner, Neuwied, 2006.
SCHERER, Holger: Integriertes Nachtragsmanagement - Verfahrenshandbuch für die Dokumentation von Behinderungen, Störungen und Nachtragssachverhalten auf der Grundlage der VOB,Zeittechnik-Verlag, Neu-Isenburg, 2001.
HELLER, Jörg: Sicherung der Nachtragsvergütung nach VOB und BGB, Zeittechnik-Verlag, Neu-Isenburg, 2000.

Workload

contact hours (1 HpW = 1 h x 15 weeks):

- Turkey Construction I - Processes and Methods lecture: 15 h
- Turnkey Construction II - Trades and Technology lecture/exercise: 30 h
- Supplementary Claim Management lecture: 15 h

independent study:

- preparation and follow-up lectures Turnkey Construction I - Processes and Methods: 15 h
- preparation and follow-up lecture/exercises Turnkey Construction II - Trades and Technology: 30 h
- preparation and follow-up lectures Supplementary Claim Management: 15 h
- examination preparation: 60 h

total: 180 h

M Module: Upgrading of Existing Buildings and Energetic Refurbishment (bauiM4S07-) [M-BGU-100108]

Responsibility: Kunibert Lennerts

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Technology and Management in Construction

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each winter term	1 term	German	3

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-100621	Term Paper Upgrading of Existing Buildings and Energetic Refurbishment (S. 404)	1,5	Kunibert Lennerts
T-BGU-108001	Upgrading of Existing Buildings and Energetic Refurbishment (S. 412)	4,5	Kunibert Lennerts

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017

- 'Teilleistung' T-BGU-100621 with examination of pther type according to § 4 Par. 2 No. 3
- 'Teilleistung' T-BGU-108001 with written examination according to § 4 Par. 2 No. 1

details about the learning controls see at the respective 'Teilleistung'

Grade of the Module

grade of the module is CP weighted average of grades of the partial exams

Prerequisites

none

Qualification Goals

Students understand the economic, ecological and cultural significance of the building stock and to describe the specific tasks for a civil engineer in this field of activity. You can explain the advantages and disadvantages of different maintenance strategies and maintenance budgets can be calculated for real estate stocks. You know the basics of a technical due diligence and the basics of building information modeling. In addition, students may constitute the legal framework for energy rehabilitation measures and can use the methods of the energy performance of buildings apply.

Content

- durability and wear of components
- determination of component lifetimes
- budgeting of maintenance costs
- condition assessment & action planning
- monument and Historic Monuments
- building Information Modeling (BIM)
- policy development and historical development of the energy savings
- forms of energy and calculation of energy use
- energy efficiency of buildings by Energy Saving Ordinance
- renewables

Recommendations

none

Remarks

none

Workload

contact hours (1 HpW = 1 h x 15 weeks):

- Upgrading of Existing Buildings lecture, exercise: 45 h
- Energetic Refurbishment lecture: 15 h

independent study:

- preparation and follow-up lectures/exercises Upgrading of Existing Buildings: 30 h
- preparation and follow-up lectures Energetic Refurbishment: 15 h
- preparation of term paper (partial examination): 25 h
- examination preparation (partial examination): 50 h

total: 180 h

M Module: Urban and Regional Planning (bauiM3P1-PLSTAREG) [M-BGU-100007]

Responsibility: Peter Vortisch

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften
Curricular Embedding: Compulsory Elective
Contained in: Study Focus / Mobility and Infrastructure

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each winter term	1 term	German	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-100050	Urban and Regional Planning (S. 413)	6	Tamer Soylu, Sebastian Wilske

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-100050 with oral examination according to § 4 Par. 2 No. 2
details about the learning control see at the 'Teilleistung'

Grade of the Module
grade of the module is grade of the exam

Prerequisites
none

Qualification Goals
The aim is to provide an overview of important tasks for spatial planning, of the legal principles, methods and strategies for solving spatial problems on urban and regional level. The students shall be able to develop planning strategies, particularly in the field of planning on a supra-local level.

Content
In the lectures basic goals and tasks of planning of different levels, procedures and instruments, the relationship between governmental and private planning are taught. The scientific contexts are developed systematically to strengthen the various methodological approaches to understand and evaluate them. Particular attention will be paid inter alia to changing conditions, such as demographic and economic developments.

Recommendations
module Mobility and Infrastructure [bauiBFP5-MOBIN]

Remarks
none

Literature
list of literature to module

Workload
contact hours (1 HpW = 1 h x 15 weeks):

- Urban Planning lectures/exercises: 30 h
- Regional Planning lectures: 30 h

independent study:

- preparation and follow-up Urban Planning lectures/exercises: 30 h
- preparation and follow-up Regional Planning lectures: 30 h
- examination preparation: 60 h

total: 180 h

M Module: Urban Renewal (bauiM3S01-PLSTUMB) [M-BGU-100013]

Responsibility: Peter Vortisch

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Mobility and Infrastructure

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each summer term	1 term	German	2

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-108441	History of Urban Planning (S. 311)	3	Joachim Vogt
T-BGU-108442	Urban Management (S. 414)	3	Anke Karmann-Woessner

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- ‘Teilleistung’ T-BGU-108441 with oral examination according to § 4 Par. 2 No. 2
- ‘Teilleistung’ T-BGU-108442 with oral examination according to § 4 Par. 2 No. 2

details about the learning controls see at the respective ‘Teilleistung’

Grade of the Module
grade of the module is CP weighted average of grades of the partial exams

Prerequisites
none

Qualification Goals
The aim is to convey the principles and methods of urban renewal. In the module adaptation strategies are taught, by which cities and city regions react to changing conditions. These changes -such as climate change, demographics or changing economic practices- are encountered by urban concepts city-wide, on the level of city quarters or on the building level. In addition to the urban redevelopment in Germany selected references from Europe are examined.

Content
Based on the core module “Urban and Regional Planning” this lecture is focused on adaptation strategies of cities and urban regions. In addition to a classification in the current discussions on urban redevelopment basic methods and tools are taught. The students of the module Urban Renewal shall be able to elaborate strategies of urban renewal and redevelopment. The basic methodological framework is the discussion of projects as examples for good practice. The module will be supplemented by courses such as “History of Urban Planning and the Built Environment” to consider the historical development and cultural heritage. In addition, in the course “Building Theory” urban qualities and implementation on the building level are taught.

Recommendations
none

Remarks
none

Literature
list of literature to module

Workload
contact hours (1 HpW = 1 h x 15 weeks):

- Urban Management lectures/exercises: 30 h
- Urban Planning I: History of Urban Planning and the Built Environment lectures: 30 h

independent study:

- preparation and follow-up Urban Management lectures/exercises: 30 h
- examination preparation Urban Management: 30 h
- preparation and follow-up Urban Planning I: History of Urban Planning and the Built Environment lectures: 30 h
- examination preparation History of Urban Planning: 30 h

total: 180 h

M Module: Urban Water Infrastructure and Management (bauiM2P10-URBIM) [M-BGU-103358]

Responsibility: Stephan Fuchs

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Water and Environment

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each winter term	1 term	English	2

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-106600	Urban Water Infrastructure and Management (S. 415)	6	Stephan Fuchs

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-106600 with written examination according to § 4 Par. 2 No. 1
details about the learning control see at the 'Teilleistung'

Grade of the Module
grade of the module is grade of the exam

Prerequisites
none

Qualification Goals
Students analyze and evaluate basic methods of urban water management. They recognize the interactions between natural and technical systems. They acquire knowledge necessary to identify process engineering solutions and to implement them into functional systems (infrastructure elements). Students are able to describe urban water management issues in the context of watersheds and to take appropriate and environmentally-sound decisions in terms of energy efficiency and costs.

Content
This module provides a deep understanding of basic principles needed for the design, analysis and evaluation of urban water systems. The concept of system analysis is introduced to develop models that consider the most important biological, chemical and physical processes and are used to solve water management problems. Based on a detailed consideration of individual elements (subsystems), an overall picture of the water management system Urban Settlement and its interaction with surface and groundwater bodies can be gained. For this purpose, theoretical tools are developed and modeling approaches are reviewed. Students consider the factors energy and costs in the analysis and assessment of water management systems.

Recommendations
course Sanitary Environmental Engineering (6200603)

Remarks
keine

Literature
Metcalf and Eddy (2003) Wastewater Engineering – Treatment and Reuse, McGraw-Hill, New York
Imhoff, K. u. K.R. (1999) Taschenbuch der Stadtentwässerung, 29. Aufl., Oldenbourg Verlag, München, Wien

Workload

contact hours (1 HpW = 1 h x 15 weeks):

- lecture/exercise: 60 h

independent study:

- preparation and follow-up lecture/exercises: 60 h
- examination preparation: 60 h

total: 90 h

M Module: Wastewater and Storm Water Treatment (bauiM2S40-SW7) [M-BGU-103362]

Responsibility: Stephan Fuchs, Tobias Morck

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Water and Environment

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each summer term	1 term	English	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-106601	Wastewater and Storm Water Treatment (S. 416)	6	Stephan Fuchs, Tobias Morck

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-106601 with examination of other type according to § 4 Par. 2 No. 3
details about the learning control see at the 'Teilleistung'

Grade of the Module
grade of the module is grade of the exam

Prerequisites
none

Qualification Goals
Students get familiar with technical plants for wastewater and storm water treatment. They can explain operating principles of individual system components as well as assess their suitability for specific applications and apply basic dimensioning approaches.

Content
Guided visits, description and evaluation of different water treatment plants:

- storm water sedimentation tanks
- storm water overflow
- retention soil filters
- sewage treatment plants

Dimensioning approaches for the design of storm water treatment facilities.

Recommendations
module 'Urban Water Infrastructure and Management' [bauiM2P10-URBIM]

Remarks
IMPORTANT:

The module will not be offered anymore as from summer term 2019. It will be replaced by the module Wastewater and Storm Water Treatment Facilities.

The number of participants in the course is limited to 20 persons. The registration is to be made via ILIAS. The places are allocated with priority to students from *Water Science and Engineering*, then *Civil Engineering* and *Geoecology* and further study programs. The allocation is made by consideration of the semester and the time of entry of the registration. The attendance at the first meeting is mandatory. In case of absence the place will be assigned to a person on the waiting list.

Literature

Gujer, W. „Siedlungswasserwirtschaft“, Springer, Berlin 3.Aufl., 2007Grigg, N, S „Water, Wastewater, and Stormwater Infrastructure Management“, Second Edition (Englisch) Francis and Taylor 2012

Workload

contact hours (1 HpW = 1 h x 15 weeks):

- lecture/exercise: 60 h

independent study:

- preparation and follow-up lecture/exercises: 30 h
- presentation and preparation of term paper (exam): 90 h

total: 180 h

M Module: Wastewater and Storm Water Treatment Facilities (bauiM2S40-SW7) [M-BGU-104898]

Responsibility: Stephan Fuchs, Tobias Morck

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Water and Environment

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each summer term	1 term	English	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-109934	Wastewater and Storm Water Treatment Facilities (S. 417)	6	Stephan Fuchs, Tobias Morck

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-109934 with examination of other type according to § 4 Par. 2 No. 3
details about the learning control see at the 'Teilleistung'

Grade of the Module
grade of the module is grade of the exam

Prerequisites
none

Modeled Conditions
The following conditions must be met:

- The module [M-BGU-103362] *Wastewater and Storm Water Treatment* must not have been started.

Qualification Goals
Students get familiar with technical plants for wastewater and storm water treatment. They can explain operating principles of individual system components as well as assess their suitability for specific applications and apply basic dimensioning approaches.

Content
Guided visits, description and evaluation of different water treatment plants:

- storm water sedimentation tanks
- storm water overflow
- retention soil filters
- sewage treatment plants

Dimensioning approaches for the design of storm water treatment facilities.

Recommendations
module 'Urban Water Infrastructure and Management' [bauiM2P10-URBIM]

Remarks
The module is offered newly as from summer term 2019 and replaces the module Wastewater and Storm Water Treatment.

The number of participants in the course is limited to 20 persons. The registration is to be made via ILIAS. The places are allocated with priority to students from *Water Science and Engineering*, then *Civil Engineering* and *Geoecology* and further study programs. The allocation is made by consideration of the semester and the time of entry of the registration. The attendance at the first meeting is mandatory. In case of absence the place will be assigned to a person on the waiting list.

Literature
Gujer, W. „Siedlungswasserwirtschaft“, Springer, Berlin 3.Aufl., 2007Grigg, N, S „Water, Wastewater, and Stormwater Infrastructure Management“, Second Edition (Englisch) Francis and Taylor 2012

Workload
contact hours (1 HpW = 1 h x 15 weeks):

- lecture/exercise: 60 h

independent study:

- preparation and follow-up lecture/exercises: 30 h
- presentation and preparation of term paper (examination): 90 h

total: 180 h

M Module: Wastewater Treatment Technologies (bauiM2S43-SW10) [M-BGU-104917]

Responsibility: Tobias Morck

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften
Curricular Embedding: Compulsory Elective
Contained in: Study Focus / Water and Environment

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each winter term	1 term	English	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-109265	Term Paper 'International Sanitary Engineering' (S. 402)	1	Stephan Fuchs, Tobias Morck
T-BGU-109948	Wastewater Treatment Technologies (S. 418)	5	Stephan Fuchs, Tobias Morck

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-109265 with not graded accomplishment according to § 4 Par. 3 as examination prerequisite
- 'Teilleistung' T-BGU-109948 with written examination according to § 4 Par. 2 No. 1
details about the learning controls see at the respective 'Teilleistung'

Grade of the Module
grade of the module is grade of the exam

Prerequisites
none

Modeled Conditions
The following conditions must be met:

- The module [M-BGU-103399] *Process Engineering in Wastewater Treatment* must not have been started.

Qualification Goals
Students acquire knowledge about typical techniques in wastewater treatment at local and international level. They are able to perform a technical evaluation and describe dimensioning approaches taking into consideration legal boundary conditions. Students analyze, evaluate and optimize operation of plant technologies. They focus on energy-efficient plant designs considering the most relevant factors affecting the total costs.Students can analyze the situation in emerging and developing countries making a comparison with that in industrialized countries. Based on that, they are able to develop water-related management strategies.

Content
Municipal Wastewater Treatment:Students gain deep knowledge about design and operation of typical process technologies in municipal wastewater treatment in Germany. Following processes are covered:

- different activated sludge processes
- anaerobic technologies and energy-recovery systems
- filtration technologies
- wastewater disinfection and pathogen removal
- chemical and biological phosphorus removal
- micro-pollutants removal
- resource management and energy efficiency

International Sanitary Engineering:Students get acquainted with the design and operation used for wastewater treatment at international level. They analyze, evaluate and take decisions when new and more holistic oriented met hods can be implemented. Following topics are covered:

- activated sludge processes

- trickling filters and rotating biological contactors
- treatment ponds
- retention soil filter / Wetlands
- UASB/EGSB/Anaerobic filter
- decentralized versus centralized systems
- material flow separation
- energy-recovery from wastewater
- drinking water purification
- waste management

Recommendations
module Urban Water Infrastructure and Management [bauiM2S43-SW10]

Remarks
The module is offered newly as from summer term 2019 and replaces the module Water Treatment Technologies.

Literature
Imhoff, K. u. K.R. (1999) Taschenbuch der Stadtentwässerung, 29. Aufl., Oldenbourg Verlag, München, WienATV-DVWK (1997) Handbuch der Abwassertechnik: Biologische und weitergehende Abwasserreinigung, Band 5, Verlag Ernst & Sohn, BerlinATV-DVWK(1997) Handbuch der Abwassertechnik: Mechanische Abwasserreinigung, Band 6, Verlag Ernst & Sohn , BerlinSperling, M.; Chernicaro, C.A.L. (2005) Biological wastewater treatment in warm climate regions, IWA publishing, LondonWilderer, P.A., Schroeder, E.D. and Kopp, H. (2004) Global Sustainability - The Impact of Local Cultures. A New Perspective for Science and Engineering, Economics and Politics WILEY-VCH

Workload
contact hours (1 HpW = 1 h x 15 weeks):

- Municipal Wastewater Treatment lecture/exercise: 30 h
- International Sanitary Engineering lecture/exercise: 30 h

independent study:

- preparation and follow-up lecture/exercises Municipal Wastewater Treatment: 30 h
- preparation of Term paper 'International Sanitary Engineering' (exam prerequisite): 45 h
- examination preparation: 45 h

total: 180 h

M Module: Water and Energy Cycles (bauiM2P8-WATENCYC) [M-BGU-103360]

Responsibility: Erwin Zehe

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Water and Environment

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each winter term	1 term	English	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-106596	Water and Energy Cycles (S. 419)	6	Erwin Zehe

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-106596 with oral examination according to § 4 Par. 2 No. 2
details about the learning control see at the 'Teilleistung'

Grade of the Module
grade of the module is grade of the exam

Prerequisites
none

Qualification Goals
Students are able to explain the most relevant processes of the terrestrial water and energy cycles including their feedbacks and limitations. They know the concepts to quantitatively describe and predict these processes in the context of science and water management and are able to independently apply related computer-based tools for analysis and prediction for standard situations.Students are able to evaluate the required data and to quantify and evaluate the uncertainties related to the simulations and predictions.

Content
This module deepens the fundamentals of the water and energy cycles with particular regard to:

- the soil as the central control element of the water and energy cycle and the interplay of soil water and ground heat balance
- evaporation, energy balance and processes in the atmospheric boundary layer
- runoff and evaporation regimes in different hydro-climates;
- water balance and floods at the catchment scale and statistics for water management
- the interplay between runoff processes and soil water balance, and the soil as filter system
- concepts of hydrological similarity and comparative hydrology
- process-based and conceptual models to predict floods, the water balance and evaporation

Recommendations
course Hydrology (6200511) and module Water Resources Management and Engineering [bauiBFW9-WASSRM]; preliminary knowledge in Matlab programming, otherwise the attendance of the course 'Introduction to Matlab' (6224907) is strongly recommended

Remarks
none

Literature
Kraus, H. (2000): Die Atmosphäre der Erde. ViewegS. P. Aryan (2001): Introduction to Micrometeorology, 2nd Ed., Academic PressHornberger et al. (1998): Elements of physical hydrology. John Hopkins University PressBeven, K. (2004): Rainfall runoff modelling – The primer: John Wiley and SonsPlate, E. J.,Zehe, E. (2008): Hydrologie und Stoffdynamik kleiner Einzugsgebiete. Prozesse und Modelle, Schweizerbart, Stuttgart, 2008.

Workload
contact hours (1 HpW = 1 h x 15 weeks):

- lecture/exercise: 60 h

independent study:

- preparation and follow-up lecture/exercises, incl. optional homework: 60 h
- examination preparation: 60 h

total: 180 h

M Module: Water Distribution Systems (bauiM2S38-WB11) [M-BGU-104100]

Responsibility: Franz Nestmann

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften
Curricular Embedding: Compulsory Elective
Contained in: Study Focus / Water and Environment

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each winter term	1 term	English	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-108485	Project Report Water Distribution Systems (S. 356)	2	Franz Nestmann
T-BGU-108486	Water Distribution Systems (S. 420)	4	Franz Nestmann

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-108485 with not graded accomplishment according to § 4 Par. 3 as examination prerequisite
- 'Teilleistung' T-BGU-108486 with oral examination according to § 4 Par. 2 No. 2

details about the learning controls see at the respective 'Teilleistung'

Grade of the Module
grade of the module is grade of the exam

Prerequisites
none

Qualification Goals
Students will have profound knowledge of the components and operational requirements of water supply systems. They are enabled to plan, design and optimize water distribution systems. They are capable to critically analyze concepts and designs based on their knowledge. Participants are able to set up and apply numerical models of water distribution systems for planning and analysis. Students have competences in work organization, presentation and discussion of results.

Content
The module covers the following topics:

- fundamentals of water distribution
- fundamentals of water distribution system modeling
- introduction to the software Epanet (water distribution system model) and ArcGIS (geographic information system)
- water demand
- water losses
- calibrating a water distribution system model
- designing pipe networks, storage tanks and pump stations
- application of the technical standards (DVGW)

The participants apply the theoretical knowledge to analyze and design an exemplary water distribution network.

Recommendations
hydromechanics (specifically pipe hydraulics)

Remarks
This module is offered purely in English as from summer term 2018. It replaces the module M-BGU-103443 Water Distribution Systems (offered in German).

Literature
Mutschmann und Stimmelmayr (2007). Taschenbuch der Wasserversorgung, 14. Auflg., Vieweg.
Walski, T. M., Chase, D. V., Savic, D. A., Grayman, W., Beckwith, S. und Koelle, E. (2003). Advanced Water Distribution Modeling Management, Haestad Methods Inc., Waterbury.

Schrifttum zur Vorlesung (auf Deutsch und Englisch)

Workload
contact hours (1 HpW = 1 h x 15 weeks):

- lecture/exercise: 60 h

independent study:

- preparation and follow-up lecture/exercises: 30 h
- project work water distribution (exam prerequisite): 60 h
- examination preparation: 30 h

total: 180 h

M Module: Water Ecology (bauiM2S41-SW8) [M-BGU-103361]

Responsibility: Stephan Fuchs

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften
Curricular Embedding: Compulsory Elective
Contained in: Study Focus / Water and Environment

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each summer term	1 term	English	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-106602	Water Ecology (S. 421)	6	Stephan Fuchs, Stephan Hilgert
T-BGU-106668	Field Training Water Quality (S. 291)	0	Stephan Fuchs, Stephan Hilgert

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-106602 with examination of other type according to § 4 Par. 2 No. 3
- 'Teilleistung' T-BGU-106668 with not graded accomplishment according to § 4 Par. 3
details about the learning controls see at the respective 'Teilleistung'

Grade of the Module
grade of the module is grade of the exam

Prerequisites
none

Qualification Goals
Students get familiar with the basic principles of water ecology in surface waters. They are able to explain interactions between abiotic control factors (flow, chemistry, structure) and their relevance for the ecological status of standing waters and streams and to evaluate them critically. They become acquainted with field and laboratory techniques to establish water quality.With the help of these methods, they evaluate data-quality of information collected in the field regarding chemical, biological and structural water quality and determine the level of uncertainty intrinsic to the data-collection methods.Using case studies, students are able to convey and evaluate positive results as well as restrictions from water restoration processes.

Content
As part of the module, water ecology principles, their practical significance and implementation of restoring measures are presented. The following topics are covered:
- pollutants loads discharged into water bodies: discharge points, pollutants, sediment problems
- sampling methods
- oxygen content
- methods for the assessment of water quality and water general status
- practical exercises to measure water quality and condition in the field

Students get acquainted with practical examples of water protection and water remediation measures and they interpret and discuss them as part of an individual assignment. For this purpose, they implement their own framework, based on visible requirements and achievable targets.

Recommendations
none

Remarks
IMPORTANT:

The module will not be offered anymore as from summer term 2019. It will be replaced by the module Freshwater Ecology.

The number of participants in the courses is limited to 20 persons. The registration is to be made via ILIAS. The places are allocated with priority to students from *Water Science and Engineering*, then *Civil Engineering* and *Geoecology* and further study programs. The allocation is made by consideration of the semester and the time of entry of the registration. The attendance at the first meeting is mandatory. In case of absence the place will be assigned to a person on the waiting list.

Literature
Wetzel, Limnology, 3rd Edition, Academic Press 2001Jürgen Schwörbel, Methoden der Hydrobiologie, UTB für Wissenschaft 1999kursbegleitende Materialien

Workload
contact hours (1 HpW = 1 h x 15 weeks):

- Applied Ecology and Water Quality lecture/seminar: 45 h
- Field Training Water Quality (block): 20 h

independent study:

- preparation of the report on Field Training Water Quality (not graded accomplishment): 55 h
- preparation of the seminar paper with presentation (exam): 60 h

total: 180 h

M Module: Waterway Engineering (bauiM2S12-WB4) [M-BGU-103392]

Responsibility: Andreas Kron

Institution: KIT-Fakultät für Bauingenieur-, Geo- und Umweltwissenschaften

Curricular Embedding: Compulsory Elective

Contained in: Study Focus / Water and Environment

Credit Points	Recurrence Frequency	Duration	Language	Version
6	Each summer term	1 term	German	1

Compulsory

Identifier	'Teilleistung'	CP	Responsibility
T-BGU-106779	Seminar Paper 'Waterway Engineering' (S. 371)	1	Andreas Kron
T-BGU-106780	Waterway Engineering (S. 422)	5	Andreas Kron

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
- 'Teilleistung' T-BGU-106779 with not graded accomplishment according to § 4 Par. 3 as examination prerequisite
- 'Teilleistung' T-BGU-106780 with oral examination according to § 4 Par. 2 No. 2
details about the learning controls see at the respective 'Teilleistung'

Grade of the Module
grade of the module is grade of the exam

Prerequisites
none

Qualification Goals
Students are knowledgeable about the various types of navigable waterways and their hydraulic structures. They are able to describe and apply the hydraulic basics for the design of these hydraulic structures and the interaction between ship and waterway. Students can assign the tasks and responsibilities of waterway engineering to the administrative structure of the waterways and shipping.

Content
- inland waterways
- types of navigation locks and ship lifts
- hydraulics and design of navigation locks and ship lifts
- reinforcement of embankments, banks and beds
- interaction ship-waterway

Recommendations
course Hydraulic Engineering and Water Management (6200511)

Remarks
none

Workload
contact hours (1 HpW = 1 h x 15 weeks):
- lecture/exercise: 60 h

independent study:
- preparation and follow-up lectures/exercises: 30 h
- preparation of the seminar paper (exam prerequisite): 30 h
- examination preparation: 60 h

total: 180 h

Part III
'Teilleistungen'

T 'Teilleistung': Advanced Fluid Mechanics [T-BGU-106612]

Responsibility: Olivier Eiff
Contained in: [M-BGU-103359] Advanced Fluid Mechanics

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
6	English	Each term	written examination	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
SS 2019	6221701	Advanced Fluid Mechanics	Vorlesung / Übung (VÜ)	4	Olivier Eiff

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
written exam, 90 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Advanced Studies in Construction Engineering [T-BGU-108003]

Responsibility: Shervin Haghsheno
Contained in: [M-BGU-100344] Advanced Studies in Construction Engineering

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
6	German	Each term	written examination	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
WS 18/19	6241903		Vorlesung (V)	2	Shervin Haghsheno, Ulrich Matz, Leopold Scheuble
WS 18/19	6241904		Vorlesung (V)	1	Shervin Haghsheno, Harald Schneider
WS 18/19	6241905		Vorlesung (V)	1	Shervin Haghsheno, Heinrich Schlick

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
written exam, 90 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Analysis and Evolution of Mobility [T-BGU-101004]

Responsibility: Martin Kagerbauer
Contained in: [M-BGU-100583] Analysis and Evolution of Mobility

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
6	German	Each term	oral examination	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
WS 18/19	6232901		Vorlesung / Übung (VÜ)	2	Martin Kagerbauer
SS 2019	6232811		Vorlesung / Übung (VÜ)	2	Martin Kagerbauer

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
oral exam, appr. 30 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Analysis of Turbulent Flows [T-BGU-103561]

Responsibility: Markus Uhlmann
Contained in: [M-BGU-103363] Analysis of Turbulent Flows

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
6	English	Each term	oral examination	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
WS 18/19	6221911	Modelling of Turbulent Flows - RANS and LES	Vorlesung (V)	2	Markus Uhlmann
SS 2019	6221806	Fluid Mechanics of Turbulent Flows	Vorlesung (V)	2	Markus Uhlmann

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
oral exam, appr. 45 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Anchorage in Concrete [T-BGU-100022]

Responsibility: Lothar Stempniewski
Contained in: [M-BGU-100001] Anchorage in Concrete

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
6	German	Each term	oral examination	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
WS 18/19	6211905		Vorlesung (V)	1	Werner Fuchs
WS 18/19	6211906		Übung (Ü)	1	Werner Fuchs, Stefania Rizzo
SS 2019	6211807		Vorlesung (V)	1	Werner Fuchs
SS 2019	6211808		Übung (Ü)	1	Werner Fuchs

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
oral exam, appr. 20 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Anchoring, Piling and Slurry Wall Technology [T-BGU-100079]

Responsibility: Theodoros Triantafyllidis
Contained in: [M-BGU-100078] Special Underground Engineering

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
3	German	Each term	oral examination	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
SS 2019	6251822	Anchoring, Piling and Slurry Wall Technology	Vorlesung / Übung (VÜ)	2	Theodoros Triantafyllidis

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
oral exam, appr. 20 min.

Prerequisites
none

Recommendations
none

Remarks
none

V Course Excerpt: Anchoring, Piling and Slurry Wall Technology (SS 2019)

Aim
The students know performance, ranges of application, necessary preliminary investigations and accompanying controls (monitoring) for anchoring, piling and slurry walls. They can select self-reliantly required pre-investigations, specify parameters for the realization, perform static proofs and define the type of controls of execution. They are familiar with the principles of the observation method and the construction measurement technology and the controls for quality assurance.

Content
- Slurry walls: Application rangs of diaphragm and slurry walls, guide walls, trench excavation, internal and external stability of open slurry trenches, corner trenches, support fluids, suspension clays and their testing, joints and joint constructions, reinforcement and concreteing diaphragm walls, FE simulation of construction.
- Anchoring: Ground anchor types, standards, certifications, recommendations, function and constructions, corrosion protection, anchor drilling and mounting, dimensioning and load capacity, group effects, checks due to DIN 1537, supervision, use in aggressive environment
- Piling: cast concrete caissons, borehole support, machinery, drilling technology and tools, distinctive features, pile reinforcement and concreting

Literature
Triantafyllidis, Th. (1990), Planung und Bauausführung im Spezialtiefbau, Teil 1, Ernst & S.
Seitz, J. & Schmidt, H.-G. (2000), Bohrpfähle Ernst & S.
Witt, J. (Hrsg.), Grundbau-Taschenbuch Teil 1-3, 8. Aufl. (2018), Ernst & Sohn

T 'Teilleistung': Applied Building Physics [T-BGU-100039]

Responsibility: Engin Kotan
Contained in: [M-BGU-103950] Building Physics I

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
3	German	Each term	oral examination	2

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
WS 18/19	6211909		Vorlesung (V)	2	Frank Dehn, Engin Kotan, Michael Vogel

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
oral exam, appr. 20 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Applied Dynamics of Structures [T-BGU-100021]

Responsibility: Lothar Stempniewski
Contained in: [M-BGU-100038] Applied Dynamics of Structures

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
6	German	Each term	oral examination	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
WS 18/19	6211903		Vorlesung (V)	1	Lothar Stempniewski
WS 18/19	6211904		Übung (Ü)	1	Roman Sedlmair
SS 2019	6211805		Vorlesung (V)	1	Lothar Stempniewski
SS 2019	6211806		Übung (Ü)	1	Roman Sedlmair

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
oral exam, appr. 30 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Applied Ecology and Water Quality [T-BGU-109956]

Responsibility: Stephan Fuchs, Stephan Hilgert
Contained in: [M-BGU-104922] Freshwater Ecology

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
3	English	Each summer term	examination of other type	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
SS 2019	6223813	Applied Ecology and Water Quality	Seminar (S)	3	Stephan Fuchs, Stephan Hilgert

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
term paper, appr. 8-15 pages, and
presentation, appr. 15 min.

Prerequisites
none

Recommendations
none

Remarks
The number of participants in the course is limited to 20 persons. The registration is to be made via ILIAS. The places are allocated with priority to students from *Water Science and Engineering*, then *Civil Engineering* and *Geoecology* and further study programs. The allocation is made by consideration of the semester and the time of entry of the registration. The attendance at the first meeting is mandatory. In case of absence the place will be assigned to a person on the waiting list.

T 'Teilleistung': Applied Geotechnics [T-BGU-100073]

Responsibility: Peter Kudella
Contained in: [M-BGU-100072] Applied Geotechnics

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
6	German	Each term	written examination	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
SS 2019	6251810	Foundations and Retaining Structures	Vorlesung / Übung (VÜ)	2	Peter Kudella
SS 2019	6251812	Special Foundation Engineering and Design	Vorlesung / Übung (VÜ)	2	Peter Kudella

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
written exam, 90 min.

Prerequisites
none

Recommendations
none

Remarks
none

V Course Excerpt: Foundations and Retaining Structures (SS 2019)

Aim
The students know the construction technologies for pile foundations and deep excavations. They make self-dependent reasonable design decisions with regard to geological engineering, site managing and economical boundary conditions. They can evaluate the interaction of building, foundation and subsoil and perform design and proof of ultimate limit state by themselves. They know and use relevant guidelines and link constructional experience, dimensioning rules and standardization to theoretical knowledge about soil mechanics.

Content

- pile types
- load bearing resistance and deformations of individual piles in axial and lateral direction
- negative skin friction
- elastic subgrade reaction and plastic flow resistance
- load bearing resistance and settlement of pile groups
- recommendations EA-Pfähle and pile tests
- pile raft design
- stress trapezoid, ground reaction and elastic halfspace method for slab foundations
- gravity walls, cantilever retaining walls, stone cages, space lattice walls, underpinning
- trench sheeting, timber sheeting
- soldier pile walls, sheetpile walls, diaphragm walls
- anchoring and struts
- dig-and-cast construction method
- bottom sealing and immersed troughs, grouted slabs, jetgrout slabs, underwater concrete
- uplift piles and anchors

Literature
Seitz, J. & Schmidt, H.-G. (2000), Bohrpfähle Ernst & S.
Triantafyllidis, Th. (1990), Planung und Bauausführung im Spezialtiefbau, Teil 1, Ernst & S.

Weißenbach, A. (2001), Baugruben, Teil 1-3, Wiley
EA Pfähle (2012), Deutsche Ges. f. Geotechnik, 2. Aufl. Ernst & S.
Witt, J. (Hrsg.), Grundbau-Taschenbuch Teil 1-3, 8. Aufl. (2018), Ernst & Sohn

V Course Excerpt: Special Foundation Engineering and Design (SS 2019)

Aim

The students overlook geotechnical constructions for slope stabilization, geotextiles, caissons and other specialized technologies and know their relevant design rules and proofs of stability. For proofs of ultimate limit state and serviceability limit state they can establish simple mechanical models by themselves and use customary numerical tools as well. They know and use relevant guidelines.

Content

- static and dynamic pile testing
- combined pile-raft foundations
- caisson foundations
- soil reinforcement, geosynthetics and EBGEO recommendations
- soil nailing
- recommendations EAB: load approaches, special shapes of excavations, excavations next to buildings, excavations in rock and soft soils
- buried structures
- numerical design and deformation prediction using elastic-beam models
- numerical design and deformation prediction using elastoplastic FE-models, recommendations for modelling, 3D-FEM in examples
- recommendations EAU

Literature

EAB (2012), Deutsche Ges. f. Geotechnik, 5. Aufl., Ernst & S.
EAU (2012), HTG und Deutsche Ges. f. Geotechnik, 11. Aufl., Ernst & S.
EBGEO (2010), Deutsche Ges. f. Geotechnik, 2. Aufl. Ernst & S.

T 'Teilleistung': Aquatic Ecosystems [T-BGU-106789]

Responsibility: Charlotte Kämpf
Contained in: [M-BGU-103400] Aquatic Ecosystems

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
6	German	Each winter term	examination of other type	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
WS 18/19	6224903		Seminar (S)	4	Charlotte Kämpf

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
about a topic selected by oneself:
presentation, appr. 15-20 min.,
maunscript, appr. 4000 words, and
poster DIN A1

Prerequisites
The accomplishment 'Examination Prerequisite Aquatic Ecosystems' (T-BGU-106788) has to be passed.

Modeled Conditions
The following conditions must be met:

- The course [T-BGU-106788] *Examination Prerequisite Aquatic Ecosystems* must have been passed.

Recommendations
none

Remarks
none

T 'Teilleistung': Basics of Finite Elements [T-BGU-100047]

Responsibility: Peter Betsch
Contained in: [M-BGU-100052] Basics of Finite Elements

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
5	German	Each term	oral examination	2

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
WS 18/19	6215901		Vorlesung (V)	2	Peter Betsch
WS 18/19	6215902		Übung (Ü)	2	Mitarbeiter/innen

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
oral exam, appr. 30 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Basics of Prestressed Concrete [T-BGU-100019]

Responsibility: Lothar Stempniewski
Contained in: [M-BGU-100036] Basics of Prestressed Concrete

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
6	German	Each term	written examination	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
SS 2019	6211803		Vorlesung (V)	2	Lothar Stempniewski
SS 2019	6211804		Übung (Ü)	2	Anthea Müller

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
written exam, 90 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Bracing and Stability in Reinforced Concrete [T-BGU-100018]

Responsibility: Lothar Stempniewski
Contained in: [M-BGU-100003] Bracing and Stability in Reinforced Concrete

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
6	German	Each term	written examination	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
SS 2019	6211801		Vorlesung (V)	2	Lothar Stempniewski
SS 2019	6211802		Übung (Ü)	2	Mareike Kohm

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
written exam, 90 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Brownfield Sites - Investigation, Evaluation, Rehabilitation [T-BGU-100089]

Responsibility: Andreas Bieberstein
Contained in: [M-BGU-100079] Environmental Geotechnics

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
3	German	Each winter term	oral examination	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
WS 18/19	6251915	Brownfield Sites - Investigation, Evaluation, Rehabilitation	Vorlesung (V)	2	Andreas Bieberstein, Elisabeth Eiche, Ulf Mohrlok, Hilke Würdemann

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
oral exam, appr. 20 min.

Prerequisites
none

Recommendations
none

Remarks
none

V Course Excerpt: Brownfield Sites - Investigation, Evaluation, Rehabilitation (WS 18/19)

Aim
The students are able to interlink interdisciplinary the chemical, mineralogical, biological, hydraulic and geotechnical aspects dealing with brownfields. They can choose reasonably between the relevant remediation technologies and assess their limits of applications and risks.

Content
- introduction to the problematic of brownfields investigation and location assessment of brownfields
- harmful substances and their behavior in the environment
- environmental-chemical and mineralogical aspects of the accumulation of harmful substances in soil
- natural attenuation and active microbiological decontamination procedures
- reactive walls and electro-kinetic decontamination procedures
- soil washing, combustion, pyrolysis
- immobilization and compression, geotechnical aspects of the containment of industrial waste landfills
- hydraulic and pneumatic decontamination procedures
- sustainability aspects for brownfield rehabilitation
- case-studies, excursion

Literature
Reiersloh, D und Reinhard, M. (2010): Altlastenratgeber für die Praxis, Vulkan-V. Essen

T 'Teilleistung': Building and Environmental Aerodynamics [T-BGU-103563]

Responsibility: Christof-Bernhard Gromke
Contained in: [M-BGU-103897] Interaction Flow - Building Structure

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
3	German	Each term	oral examination	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
WS 18/19	6221905		Vorlesung (V)	1	Bodo Ruck
WS 18/19	6221906		Übung (Ü)	1	Bodo Ruck

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
oral exam, appr. 30 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Building Information Modeling (BIM) [T-BGU-108007]

Responsibility: Shervin Haghsheno
Contained in: [M-BGU-103916] Building Information Modeling (BIM)

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
6	German	Each summer term	examination of other type	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
SS 2019	6241812	Building Information Modeling	Vorlesung / Übung (VÜ)	4	Maximilian Deubel, Shervin Haghsheno

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
project report appr. 10 pages and presentation appr. 10 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Building Preservation of Concrete and Masonry Constructions [T-BGU-100038]

Responsibility: Engin Kotan
Contained in: [M-BGU-100058] Building Preservation of Concrete and Masonry Constructions

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
5	German	Each term	oral examination	2

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
SS 2019	6211811		Vorlesung (V)	2	Engin Kotan
SS 2019	6211812		Übung (Ü)	1	Engin Kotan
SS 2019	6211813		Vorlesung (V)	1	Engin Kotan, Michael Vogel

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
oral exam, appr. 30 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Building Preservation of Steel and Timber Structures [T-BGU-100027]

Responsibility: Matthias Frese, Thomas Ummenhofer
Contained in: [M-BGU-100043] Building Preservation of Steel and Timber Structures

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
6	German	Each term	written examination	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
WS 18/19	6212909		Vorlesung (V)	2	Jannis Damm, Thomas Ummenhofer
WS 18/19	6213903		Vorlesung / Übung (VÜ)	2	Matthias Frese, Mitarbeiter/innen

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
written exam, 90 min. (45 min. for each course)

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Building Technology [T-BGU-100040]

Responsibility: Stefan Wirth
Contained in: [M-BGU-103950] Building Physics I

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
3	German	Each term	oral examination	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
WS 18/19	6211910		Vorlesung (V)	2	Stefan Wirth

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
oral exam, appr. 20 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Business and Human Resource Management [T-BGU-108002]

Responsibility: Shervin Haghsheno
Contained in: [M-BGU-100111] Business and Human Resource Management

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
6	German	Each term	written examination	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
SS 2019	6241805		Vorlesung / Übung (VÜ)	3	Erik Eschen, Shervin Haghsheno
SS 2019	6241807		Vorlesung (V)	1	Peter Steffek

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
written exam, 90 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': City Transport Facilities [T-BGU-100083]

Responsibility: Ralf Roos
Contained in: [M-BGU-100026] City Transport Facilities

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
4	German	Each term	oral examination	2

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
WS 18/19	6233909		Vorlesung / Übung (VÜ)	4	Ralf Roos, Matthias Zimmermann

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
oral exam, appr. 45 min.

Prerequisites
Exercises and student research project City Transport Facilities has to be passed.

Modeled Conditions
The following conditions must be met:

- The course [T-BGU-109912] *Exercises and student research project City Transport Facilities* must have been passed.

Recommendations
none

Remarks
none

T 'Teilleistung': Computational Analysis of Structures [T-BGU-100031]

Responsibility: Werner Wagner
Contained in: [M-BGU-100047] Computational Analysis of Structures

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
4	German	Each term	oral examination	3

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
SS 2019	6214801		Vorlesung (V)	2	Werner Wagner
SS 2019	6214802		Übung (Ü)	2	Marc Fina

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
oral exam, appr. 30 min.

Prerequisites
Student research project "Computational Analysis of Structures" has to be passed.

Modeled Conditions
The following conditions must be met:

- The course [T-BGU-100174] *Student Research Project 'Computational Analysis of Structures'* must have been passed.

Recommendations
none

Remarks
none

T 'Teilleistung': Computational Structural Dynamics [T-BGU-100999]

Responsibility: Peter Betsch
Contained in: [M-BGU-100579] Numerical Structural Dynamics

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
6	German	Each term	oral examination	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
SS 2019	6215810		Vorlesung / Übung (VÜ)	4	Alexander Janz, Timo Ströhle

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
oral exam, appr. 30 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Concrete Construction Technology [T-BGU-100036]

Responsibility: Frank Dehn
Contained in: [M-BGU-100056] Concrete Construction Technology

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
6	German	Each term	oral examination	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
WS 18/19	6211914		Vorlesung / Übung (VÜ)	3	Frank Dehn, Michael Haist, Vladislav Kvitsel
WS 18/19	6211915		Vorlesung (V)	1	Frank Dehn, Engin Kotan

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
oral exam, appr. 30 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Construction of Steel and Composite Bridges [T-BGU-100024]

Responsibility: Thomas Ummenhofer
Contained in: [M-BGU-100040] Construction of Steel and Composite Bridges

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
6	German	Each term	written examination	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
SS 2019	6212805		Vorlesung (V)	2	Thomas Ummenhofer
SS 2019	6212806		Übung (Ü)	2	Jannis Damm

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
oral exam, 60 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Contact Mechanics [T-BGU-109947]

Responsibility: Marlon Franke
Contained in: [M-BGU-104916] Contact Mechanics

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
6	German	Each term	oral examination	1

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
oral exam, appr. 30 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Contact Mechanics - Computational Algorithms in a Geometrically Exact Form [T-BGU-100618]

Responsibility: Alexander Konyukhov
Contained in: [M-BGU-100337] Contact Mechanics - Computational Algorithms in a Geometrically Exact Form

Credit Points	Recurrence Frequency	Type of Learning Control	Version
6	Each term	oral examination	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
WS 18/19	6215907		Vorlesung (V)	2	Alexander Konyukhov
WS 18/19	6215908		Übung (Ü)	2	Alexander Konyukhov

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
oral exam, appr. 30 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Contact Mechanics - Fundamentals and Basics [T-BGU-100617]

Responsibility: Marlon Franke
Contained in: [M-BGU-100336] Contact Mechanics - Fundamentals and Basics

Credit Points	Recurrence Frequency	Type of Learning Control	Version
6	Each term	oral examination	1

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
oral exam, appr. 30 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Contimuum Mechanics [T-BGU-106196]

Responsibility: Marlon Franke
Contained in: [M-BGU-100064] Continuum Mechanics of Heterogeneous Solids
[M-BGU-100070] Basics of Numeric Modeling

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
3	German	Each term	oral examination	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
WS 18/19	6215702		Vorlesung (V)	2	Marlon Franke

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
oral exam, appr. 30 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Coupled Geomechanic Processes [T-BGU-100085]

Responsibility: Theodoros Triantafyllidis
Contained in: [M-BGU-100077] Coupled Geomechanic Processes

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
6	German	Each term	oral examination	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
WS 18/19	6251916	Special Issues in Rock Mechanics	Vorlesung / Übung (VÜ)	2	Carlos Grandas Tavera
WS 18/19	6251918	Coupled Phenomena in Geomechanics	Vorlesung / Übung (VÜ)	2	Carlos Grandas Tavera

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
oral exam, appr. 40 min.

Prerequisites
none

Recommendations
none

Remarks
none

V Course Excerpt: Coupled Phenomena in Geomechanics (WS 18/19)

Aim
The students recognize and evaluate the basic physical and chemical alteration parameters of geomaterials. They are able to describe the involved hydromechanical, chemomechanical, thermomechanical and biomechanical processes and to express mathematically their interdependence with mechanical properties.

Content
· hydromechanical phenomena: effect of wetting, internal erosion, liquefaction, hydraulic fracturing
· chemomechanical phenomena: dissolution, precipitation, swelling, solute transport
· thermomechanical phenomena: heat production and transport, effect on mechanical properties, coupling to hydraulic effects
· biomechanical phenomena: effect of bacteria and flora

V Course Excerpt: Special Issues in Rock Mechanics (WS 18/19)

Aim
The students have deepened and supplementary knowledge about time-varying strength and deformation properties of rocks. They apply this knowledge on preliminary rock investigation, survey of construction progress and monitoring of structures in rock.

Content
· time-dependent material phenomena: swelling, creep
· scale effects
· rock as multi-phase system (Biot theory)
· rock and fissure hydraulics, permeability,
· rock dynamics and basics of blasting techniques,
· rock drilling, cutting performance and bit consumption
· numerical methods in rock mechanics

Literature

Brady, B.H.G. & Brown, E.T. (2004), Rock Mechanics for Underground Mining, 3rd Ed., Kluwer.
Fecker, Edwin, 1997: Geotechnische Messgeräte und Feldversuche im Fels, Ferdinand Enke Verlag Stuttgart.
Hoek, Evert, 2007: Practical Rock Engineering (kostenloser Download unter http://www.rocscience.com/education/hoeks_corner)

T 'Teilleistung': Decommissioning of Nuclear Facilities [T-BGU-100627]

Responsibility: Sascha Gentes
Contained in: [M-BGU-100345] Decommissioning of Nuclear Facilities

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
6	German	Each term	oral examination	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
WS 18/19	6243901		Vorlesung / Übung (VÜ)	2	Sascha Gentes, Mitarbeiter/innen
WS 18/19	6243903		Vorlesung / Übung (VÜ)	2	Sascha Gentes, Mitarbeiter/innen

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
oral exam, appr. 30 min.

Prerequisites
keine

Recommendations
none

Remarks
none

T 'Teilleistung': Design and Construction of Components in Reinforced Concrete [T-BGU-100015]

Responsibility: Lothar Stempniewski
Contained in: [M-BGU-100033] Design and Construction of Components in Reinforced Concrete

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
4	German	Each term	written examination	2

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
WS 18/19	6211701		Vorlesung (V)	2	Lothar Stempniewski
WS 18/19	6211702		Übung (Ü)	2	Stefania Rizzo

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
written exam, 90 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Digitalization in Facility and Real Estate Management [T-BGU-108941]

Responsibility: Kunibert Lennerts
Contained in: [M-BGU-104348] Digitalization in Facility and Real Estate Management

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
6	German	Each term	examination of other type	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
WS 18/19	6241908		Vorlesung / Übung (VÜ)	4	Kunibert Lennerts, Mitarbeiter/innen

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
project work incl. report, appr. 15 pages, and presentation/colloquium, appr. 15 min

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Durability and Service Life Design [T-BGU-100037]

Responsibility: Michael Vogel
Contained in: [M-BGU-100057] Durability and Service Life Design

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
6	German	Each term	oral examination	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
WS 18/19	6211907		Vorlesung / Übung (VÜ)	3	Frank Dehn, Michael Vogel
WS 18/19	6211908		Übung (Ü)	1	Michael Haist, Michael Vogel

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
oral exam, appr. 30 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Dynamics of Structures [T-BGU-100077]

Responsibility: Peter Betsch
Contained in: [M-BGU-100035] Surface Structures and Dynamics of Structures

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
2	German	Each term	written examination	2

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
WS 18/19	6215701		Vorlesung (V)	2	Marlon Franke

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
written exam, 60 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Earthworks and Foundation Engineering [T-BGU-100068]

Responsibility: Theodoros Triantafyllidis
Contained in: [M-BGU-100068] Earthworks and Foundation Engineering

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
4	German	Each term	written examination	2

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
WS 18/19	6251701	Foundation Types	Vorlesung / Übung (VÜ)	2	Theodoros Triantafyllidis
WS 18/19	6251703	Basics in Earthworks and Embankment Dams	Vorlesung / Übung (VÜ)	2	Andreas Bieberstein

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
written exam, 90 min.

Prerequisites
none

Recommendations
preparation of the student research project for examination preparation

Remarks
none

V Course Excerpt: Basics in Earthworks and Embankment Dams (WS 18/19)

Aim
The students are able to select and apply appropriate methods for exploration, modelling, dimensioning, realization and control for earthworks and dam construction. They can identify all geotechnically relevant problems occuring with dams and can apply design and dimensioning rules in outline self-reliantly.

Content
- cross section and longitudinal section of filled dams
- requirements for zonation
- sealing
- combined effects dam/subsoil
- construction methods for seepage cuttoff
- building materials for dams with requirements and characteristics
- construction of dams
- seepage and flow nets
- flow cases with known and unknown boundaries
- erosion, suffosion, piping, colmatation and joint erosion
- dam stability

Literature
Striegler (1998), Dammbau in Theorie und Praxis, Verlag für Bauwesen Berlin
Kutzner (1996), Erd- und Steinschüttdämme für Stauanlagen, Enke Verlag Stuttgart

V Course Excerpt: Foundation Types (WS 18/19)

Aim
The students are able to select and apply appropriate methods for exploration, modelling, dimensioning, realization and control for geotechnical constructions of average complexity. They gained competence in solving geotechnical problems,

also with respect to the managerial organization, expense budgeting, use of documents and presentation of results.

Content

- safety concepts in earthworks and foundation engineering
- project design for foundation problems
- frame constructions on partially soft soil, bridge abutment and embankments on soft soil
- types of retaining constructions for a cut-and-cover metro tunnel
- ground anchors
- quay wall structures with tied-back sheetpiles
- stabilization and drainage of embankments
- retaining constructions with structural slope stabilisation
- underpinning and supporting
- observational method

Literature

Witt. K.J. (2008), Grundbau-Taschenbuch, Teil 1,
U. Smoltczyk, U. (2001), Grundbau-Taschenbuch, Teil 2-3,
S. Schmidt, H.G. & Seitz, J. (1998), Grundbau , Bilfinger & Berger

T 'Teilleistung': Economics and Management in Construction [T-BGU-100143]

Responsibility: Shervin Haghsheno
Contained in: [M-BGU-100102] Economics and Management in Construction

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
5	German	Each term	written examination	2

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
SS 2019	6241801		Vorlesung / Übung (VÜ)	2	Shervin Haghsheno
SS 2019	6241803		Vorlesung (V)	2	Rainer Kohlhammer, Helmut Johannes Miernik

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
written exam, 90 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Environmental Communication [T-BGU-101676]

Responsibility: Charlotte Kämpf
Contained in: [M-BGU-101108] Environmental Communication

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
6	German	Each term	examination of other type	2

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
WS 18/19	6224905		Seminar (S)	2	Charlotte Kämpf
SS 2019	6224905	Environmental Communication	Seminar (S)	2	Charlotte Kämpf

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
presentation, appr. 15 min.,
manuscript, appr. 6000 words, and
Poster DIN-A3

Prerequisites
The accomplishment 'Examination Prerequisite Environmental Communication' (T-BGU-106620) has to be passend.

Modeled Conditions
The following conditions must be met:

- The course [T-BGU-106620] *Examination Prerequisite Environmental Communication* must have been passed.

Recommendations
none

Remarks
none

T 'Teilleistung': Environmental Fluid Mechanics [T-BGU-106767]

Responsibility: Olivier Eiff
Contained in: [M-BGU-103383] Environmental Fluid Mechanics

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
6	English	Each winter term	written examination	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
WS 18/19	6221909	Environmental Fluid Mechanics	Vorlesung / Übung (VÜ)	4	Olivier Eiff

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
written exam, 90 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Environmentally-Friendly Recycling and Disassembly of Buildings [T-BGU-100146]

Responsibility: Sascha Gentes
Contained in: [M-BGU-100110] Environmentally-friendly Recycling and Disassembly of Buildings

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
6	German	Each term	oral examination	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
SS 2019	6243801		Vorlesung / Übung (VÜ)	2	Sascha Gentes, Stephan Haupenthal
SS 2019	6243803		Vorlesung / Übung (VÜ)	2	Sascha Gentes

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
oral exam, appr. 30 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Equipment and special Construction Techniques in Building Practice [T-BGU-108009]

Responsibility: Sascha Gentes
Contained in: [M-BGU-103918] Equipment and special Construction Techniques in Building Practice

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
6	German	Each term	oral examination	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
WS 18/19	6241907		Vorlesung (V)	2	Sascha Gentes, Harald Schneider
SS 2019	6241815		Vorlesung (V)	2	Sascha Gentes, Mitarbeiter/innen

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
oral exam, appr. 45 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Examination Prerequisite Aquatic Ecosystems [T-BGU-106788]

Responsibility: Charlotte Kämpf
Contained in: [M-BGU-103400] Aquatic Ecosystems

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
0	German	Each winter term	not graded accomplishment	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
WS 18/19	6224903		Seminar (S)	4	Charlotte Kämpf

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
literature annotation, appr. 150 words, and
short presentation, appr. 10 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Examination Prerequisite Environmental Communication [T-BGU-106620]

Responsibility: Charlotte Kämpf
Contained in: [M-BGU-101108] Environmental Communication

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
0	German	Each summer term	not graded accomplishment	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
WS 18/19	6224905		Seminar (S)	2	Charlotte Kämpf
SS 2019	6224905	Environmental Communication	Seminar (S)	2	Charlotte Kämpf

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
2 literature annotations, appr. 150 words each, and
short presentation, appr. 10 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Exercises and student research project City Transport Facilities [T-BGU-109912]

Responsibility: Ralf Roos
Contained in: [M-BGU-100026] City Transport Facilities

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
2	German	Each winter term	not graded accomplishment	1

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
1 report approx. 5 pages and 3 planning documents

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Experimental Hydraulics II [T-BGU-106773]

Responsibility: Frank Seidel
Contained in: [M-BGU-103388] Experimental Hydraulics and Measuring Techniques

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
3	German	Each winter term	examination of other type	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
WS 18/19	6222907	Experimental Hydraulics II	Vorlesung / Übung (VÜ)	2	Franz Nestmann, Frank Seidel

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
term paper, appr. 10 pages

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Experiments in Fluid Mechanics [T-BGU-106760]

Responsibility: Olivier Eiff
Contained in: [M-BGU-103377] Experiments in Fluid Mechanics

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
6	English	Each summer term	examination of other type	2

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
SS 2019	6221802	Experiments in Fluid Mechanics	Vorlesung / Übung (VÜ)	4	Olivier Eiff, Mitarbeiter/innen

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
laboratory reports with analyses of the experiments in small teams, each appr. 10 pages including figures and tables, and oral exam, appr. 30 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Facility Management in Hospitals and Hospital Management [T-BGU-109291]

Responsibility: Kunibert Lennerts
Contained in: [M-BGU-100347] Facility Management in Hospitals and Hospital Management

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
6	German	Each winter term	examination of other type	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
WS 18/19	6242905		Vorlesung / Übung (VÜ)	3	Kunibert Lennerts, Mitarbeiter/innen
WS 18/19	6242906		Vorlesung (V)	1	Kunibert Lennerts, Mitarbeiter/innen

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
term paper appr. 10 pages, with final presentation appr. 10 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': FE-Applications in Practical Engineering [T-BGU-100032]

Responsibility: Werner Wagner
Contained in: [M-BGU-100048] FE-Applications in Practical Engineering

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
6	German	Each term	oral examination	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
SS 2019	6214803		Vorlesung (V)	2	Werner Wagner
SS 2019	6214804		Übung (Ü)	2	Alexander Keller

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
oral exam, appr. 30 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Field Training Water Quality [T-BGU-109957]

Responsibility: Stephan Fuchs, Stephan Hilgert
Contained in: [M-BGU-104922] Freshwater Ecology

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
3	English	Each summer term	examination of other type	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
SS 2019	6223814	Field Training Water Quality	Übung (Ü)	1	Stephan Fuchs, Stephan Hilgert

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
report on field training, appr. 8-15 pages

Prerequisites
The 'Teilleistung' Applied Ecology and Water Quality (T-BGU-109956, seminar paper with presentation) has to be begun, i.e. at least the registration has to be made.

Modeled Conditions
The following conditions must be met:

- The course [T-BGU-109956] *Applied Ecology and Water Quality* must have been started.

Recommendations
none

Remarks
The number of participants in the course is limited to 20 persons. The registration is to be made via ILIAS. The places are allocated with priority to students from *Water Science and Engineering*, then *Civil Engineering* and *Geoecology* and further study programs. The allocation is made by consideration of the semester and the time of entry of the registration. The attendance at the first meeting is mandatory. In case of absence the place will be assigned to a person on the waiting list.

T 'Teilleistung': Field Training Water Quality [T-BGU-106668]

Responsibility: Stephan Fuchs, Stephan Hilgert
Contained in: [M-BGU-103361] Water Ecology

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
0	English	Each summer term	not graded accomplishment	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
SS 2019	6223814	Field Training Water Quality	Übung (Ü)	1	Stephan Fuchs, Stephan Hilgert

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
report on field training, appr. 8-15 pages

Prerequisites
The 'Teilleistung' Water Ecology (T-BGU-106602, seminar paper with presentation) has to be begun, i.e. at least the registration has to be made.

Modeled Conditions
The following conditions must be met:

- The course [T-BGU-106602] *Water Ecology* must have been started.

Recommendations
none

Remarks
The number of participants in the course is limited to 20 persons. The registration is to be made via ILIAS. The places are allocated with priority to students from *Water Science and Engineering*, then *Civil Engineering* and *Geoecology* and further study programs. The allocation is made by consideration of the semester and the time of entry of the registration. The attendance at the first meeting is mandatory. In case of absence the place will be assigned to a person on the waiting list.

T 'Teilleistung': Finite Elements in Solid Mechanics [T-BGU-100998]

Responsibility: Peter Betsch
Contained in: [M-BGU-100578] Finite Elements in Solid Mechanics

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
6	German	Each term	oral examination	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
SS 2019	6215808		Vorlesung (V)	2	Marlon Franke
SS 2019	6215809		Übung (Ü)	2	Robin Pfefferkorn

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
oral exam, appr. 30 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Flow and Sediment Dynamics in Rivers [T-BGU-108467]

Responsibility: Franz Nestmann
Contained in: [M-BGU-104083] Flow and Sediment Dynamics in Rivers

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
4	English	Each term	oral examination	2

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
SS 2019	6222805	Morphodynamics	Vorlesung / Übung (VÜ)	2	Franz Nestmann
SS 2019	6222807	Flow Behavior of Rivers	Vorlesung / Übung (VÜ)	2	Victor Dupuis, Olivier Eiff, Frank Seidel

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
oral exam, appr. 30 min.

Prerequisites
The accomplishment 'Seminar Paper Flow Behavior of Rivers' (T-BGU-108466) has to be passed.

Modeled Conditions
The following conditions must be met:

- The course [T-BGU-108466] *Seminar Paper 'Flow Behavior of Rivers'* must have been passed.

Recommendations
none

Remarks
none

T 'Teilleistung': Flow Measuring Technique [T-BGU-103562]

Responsibility: Christof-Bernhard Gromke
Contained in: [M-BGU-103904] Experimental Techniques II: Measurement Techniques
[M-BGU-103388] Experimental Hydraulics and Measuring Techniques

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
3	German	Each term	oral examination	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
WS 18/19	6221907		Vorlesung / Übung (VÜ)	2	Bodo Ruck

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
oral exam, appr. 30 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Fracture and Damage Mechanics [T-BGU-100087]

Responsibility: Thomas Seelig
Contained in: [M-BGU-100053] Fracture and Damage Mechanics

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
6	German	Each term	oral examination	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
WS 18/19	6215903		Vorlesung (V)	2	Thomas Seelig
WS 18/19	6215904		Übung (Ü)	2	Mitarbeiter/innen

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
oral exam, appr. 45 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Freight Transport [T-BGU-106611]

Responsibility: Bastian Chlond
Contained in: [M-BGU-100020] Intermodality in Freight, Long-Distance and Air Transport

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
3	German	Each term	written examination	2

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
SS 2019	6232809		Vorlesung / Übung (VÜ)	2	Bastian Chlond

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
written exam, 60 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Geostatistics [T-BGU-106605]

Responsibility: Erwin Zehe
Contained in: [M-BGU-103762] Analysis of Spatial Data

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
6	English	Each term	oral examination	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
SS 2019	6224805	Geostatistics	Vorlesung / Übung (VÜ)	4	Uwe Ehret, Erwin Zehe

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
oral exam, appr. 30 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Geotechnical Testing and Measuring Technology [T-BGU-100075]

Responsibility: Theodoros Triantafyllidis
Contained in: [M-BGU-100076] Geotechnical Testing and Measuring Technology

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
6	German	Each term	oral examination	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
WS 18/19	6251909	Rock Testing	Vorlesung (V)	1	Gerhard Huber
WS 18/19	6251910	Testing in Dam and Wastefill Engineering	Vorlesung (V)	1	Andreas Bieberstein
WS 18/19	6251911	Geotechnical Measuring Technology	Vorlesung / Übung (VÜ)	2	Gerhard Huber

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
oral exam, appr. 40 min.

Prerequisites
none

Recommendations
none

Remarks
none

V Course Excerpt: Testing in Dam and Wastefill Engineering (WS 18/19)

Aim
The students have basic knowledge in geophysics and overview the procedures and methods for subsoil exploration and testing techniques in dam and wastefill engineering. They are familiar with their specific application conditions and prerequisites and can select reasonably appropriate combinations of techniques.

Content
· investigation of groundwater situation
· geophysical exploration
· overview of lab and field tests for compressibility, shear resistance, permeability, filter tests
· dispersivity of soils
· rheological properties of suspensions
· testing of densification and deformability

V Course Excerpt: Rock Testing (WS 18/19)

Aim
The students overview masterfully the procedures and methods for subsoil exploration and testing techniques in rock engineering and tunneling. They can select reasonably appropriate combinations of techniques.

Content
· presentation of national and international standards for testing procedures
· basic measuring techniques in rock
· structure and function of testing devices
· selection and preparation of samples
· test execution: uniaxial and triaxial compression test, uniaxial and triaxial creep test, relaxation test, direct shear test, Brazilian test, swelling test, point load test, large-scale triaxial test, further index tests

Literature
Fecker, Edwin, 1997: Geotechnische Messgeräte und Feldversuche im Fels, Ferdinand Enke Verlag Stuttgart.

V Course Excerpt: Geotechnical Measuring Technology (WS 18/19)

Aim
The students have basic knowledge in measurement technologies and the functioning principles of sensors and data acquisition. They have own experiences with the handling of sensor application, wiring, data acquisition, control elements, measuring and analysis procedures. As a result of this they can select equipment reasonably with respect to resolution, accuracy, long term stability and interpretation.

Content
· measurement of physical quantities: displacement, strain, velocity, acceleration, force, pressure, stress tensor, time, temperature, flow, moisture
· introduction to their measuring methods, sensors and limitations
· measuring electrical quantities: methods and devices, signal filtering
· optical measurements and correlation techniques using the example of the Particle-Image-Velocimetry (PIV)
· development and analysis of a measurement chain from a physical quantity to a final reading
· influence of measurement on observed processes, influences of errors, noise e.g.
· comparison of direct and compensating methods
· transmission of analogue and digital data, smart sensors
· description of dynamic measurement categories: time domain, frequency domain, state space,
· control technology: concepts and application
· examples of measurements on construction site and in situ: anchor tests, measurement of settlement and inclination, stress measurement and borehole measurements in rock
· measurements in relation to the observational method (DIN1054)
· training: electrical measuring, data acquisition, influence of noise, mounting of DMS to strain gauges, setup and test of a measurement chain for field measurements (anchor test or cone penetration test), density measurement

T 'Teilleistung': Glass, Plastic and Cable Structures [T-BGU-100025]

Responsibility: Daniel Ruff
Contained in: [M-BGU-100041] Glass, Plastic and Cable Structures

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
6	German	Each term	oral examination	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
WS 18/19	6212905		Vorlesung (V)	3	Daniel Ruff
WS 18/19	6212906		Übung (Ü)	1	Daniel Ruff

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
oral exam, appr. 30 min.

Prerequisites
none

Recommendations
none

Remarks
none

V Course Excerpt: (WS 18/19)

Content

- Glas im Bauwesen
- nichtrostende Stähle, Veredelungsprodukte
- Konstruktionsdetails Glas, Bemessung von Bauprodukten aus Glas
- Kunststoffe im Bauwesen, Klebverbindungen, Konstruktionsdetails Kunststoffe
- Stahldrähte für Seile, Seile, Paralleldrahtbündel
- Zugstabsysteme
- Endverbindungen, Umlenkungen
- statisches Tragverhalten
- dynamisches Tragverhalten
- Bemessung von Tragwerken mit hochfesten Zuggliedern
- Konstruktionsdetails hochfeste Zugglieder
- Montage von Seiltragwerken

Literature

- vorlesungsbegleitende Unterlagen
- Siebert, G., Maniatis, I: Tragende Bauteile aus Glas: Grundlagen, Konstruktion, Bemessung, Beispiele. Verlag Ernst & Sohn, Berlin, 2012.
- DIN 18008 Teil 1 bis Teil 6: Glas im Bauwesen. Beuth-Verlag, Berlin, 2010 bis 2015.
- Domininghaus, H. et. al.: Kunststoffe: Eigenschaften und Anwendungen. Springer-Verlag, Berlin, 2012.
- Hellerich, W.: Werkstoff-Führer Kunststoffe. Springer-Verlag, Berlin, 2010.
- DIN 18800-1: 2008-11: Stahlbauten – Teil 1: Bemessung und Konstruktion. Beuth-Verlag, Berlin.
- DIN EN 1993-1-11: 2010-12: Eurocode 3: Bemessung und Konstruktion von Stahlbauten – Teil 1-11: Bemessung und Konstruktion von Tragwerken mit Zuggliedern aus Stahl. Beuth-Verlag, Berlin.
- Feyrer, K: Drahtseile: Bemessung, Betrieb, Sicherheit. Springer-Verlag, Berlin, 2001.
- Seidel, M: Textile Hüllen - Bauen mit biegeweichen Tragelementen: Materialien, Konstruktion, Montage. Verlag Ernst & Sohn, Berlin, 2008.

T 'Teilleistung': Ground Improvement, Grouting and Soil Freezing [T-BGU-100080]

Responsibility: Wolfgang Orth
Contained in: [M-BGU-100078] Special Underground Engineering

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
3	German	Each term	oral examination	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
SS 2019	6251820	Ground Improvement, Grouting and Soil Freezing	Vorlesung / Übung (VÜ)	2	Wolfgang Orth

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
oral exam, appr. 20 min.

Prerequisites
none

Recommendations
none

Remarks
none

V Course Excerpt: Ground Improvement, Grouting and Soil Freezing (SS 2019)

Aim
The students know performance, ranges of application, necessary preliminary investigations and accompanying controls (monitoring) for special underground engineering technologies of subsoil improvement and sealing. They can select required pre-investigations, specify parameters for the realization and define the type of controls of execution.

Content

- soil freezing: brine and nitrogen cooling, frost spreading under artificial and natural influence, frost heave and thaw settlement, mechanical behaviour of frozen soils, mechanical and thermal calculation of simple frost bodies (underpinning and tunnel ring), monitoring
- grouting technology: execution and application boundaries of injections, monitoring, pore and gap injection, soil fracturing, jet grouting, theory of the injections, characteristics of suspensions and solutions, permeability and strength of injected soils
- soil improvement: application areas, obtainable effects, monitoring, deep vibro compaction, vibro replacement compaction, dynamic (heavy) compaction

Literature
Witt, J. (Hrsg.), Grundbau-Taschenbuch Teil 1-3, 8. Aufl. (2018), Ernst & Sohn
Kutzner, Ch. (1991), Injektionen im Baugrund, F.Enke

T 'Teilleistung': Ground Investigation [T-BGU-100072]

Responsibility: Theodoros Triantafyllidis
Contained in: [M-BGU-100071] Ground Investigation

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
6	German	Each summer term	oral examination	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
SS 2019	6251808	Soil Mechanical Laboratory Exercises	Übung (Ü)	2	Lukas Knittel, Peter Kudella
SS 2019	6251809	Geomechanical Field Exercise	Übung (Ü)	2	Lukas Knittel, Peter Kudella

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
oral exam, appr. 40 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Ground Water and Earth Dams [T-BGU-100091]

Responsibility: Andreas Bieberstein
Contained in: [M-BGU-100073] Ground Water and Earth Dams

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
6	German	Each term	oral examination	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
SS 2019	6251814	Geotechnical Ground Water Problems	Vorlesung / Übung (VÜ)	2	Andreas Bieberstein
SS 2019	6251816	Embankment Dams (Advanced)	Vorlesung / Übung (VÜ)	2	Andreas Bieberstein

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
oral exam, appr. 40 min.

Prerequisites
none

Recommendations
none

Remarks
none

V Course Excerpt: Geotechnical Ground Water Problems (SS 2019)

Aim
The students have deepened knowledge about different geotechnical groundwater problems. They can dimension dewatering measures under various boundary conditions and demonstrate geohydraulic relationships by example calculations.

Content
- basics of groundwater conditions
- investigation and monitoring of the groundwater conditions
- types and application possibilities of sounding equipment and measuring procedures
- permeability tests in the laboratory and in-situ
- air permeability of soils
- saturation and propagation of saturation fronts
- permeability anisotropy
- dewatering technologies, time scale of dewatering
- dewatering along rivers
- quantitative relations for drainage ditches and dewatering wells
- dewatering effects
- seepage through dams and flow nets, load cases, underseepage of dams.

Literature
Cedergren, H.R. (1989), Seepage, Drainage, and Flow Nets, 3. Aufl. Wiley
Herdt, W. & Arndts, E. (1985), Theorie und Praxis der Grundwasserabsenkung, 2. Aufl. Ernst & S.

V Course Excerpt: Embankment Dams (Advanced) (SS 2019)

Aim
The students are able to develop their own solution approaches for earth dam design problems, to evaluate the relevant construction techniques and to conduct the requested geotechnical proofs.

Content

- hydrologic and hydraulic design of dams
- regulations for dams and embankments
- design of freeboard
- slope stability concepts
- proof of sliding stability
- uplift stability
- stress distribution in the dam base
- spread stability
- settlements
- hydraulic stability
- seepage and flow nets
- determination of the phreatic line
- erosion criteria, methods to prove inner erosion stability
- filters and drains
- subsoil sealing
- deformation of embankments
- safety against flaws
- earthquake design
- monitoring of dams
- buried auxiliary structures
- artificial sealings
- dams and embankments designed for overtopping

Literature

Cedergren, H.R. (1989), Seepage, Drainage, and Flow Nets, 3. Aufl. Wiley
Herdt, W. & Arndts, E. (1985), Theorie und Praxis der Grundwasserabsenkung, 2. Aufl. Ernst & S.

T 'Teilleistung': Groundwater Flow around Structures [T-BGU-106774]

Responsibility: Luca Trevisan
Contained in: [M-BGU-103389] Hydraulic Structures

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
3	English	Each term	oral examination	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
SS 2019	6221815	Groundwater Flow around Structures	Vorlesung / Übung (VÜ)	2	Luca Trevisan

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
oral exam, appr. 30 min.

Prerequisites
none

Recommendations
none

Remarks
none

V Course Excerpt: Groundwater Flow around Structures (SS 2019)

Content
The course will cover topics related to groundwater hydrology and geotechnical engineering:

- Properties of porous medium
- Groundwater movement
- Potential theory and flow nets
- Subsurface characterization
- Soil strength and stress balance
- Water-induced instabilities

Some applications related to the topics taught during the course include:

- Water level abatement for dry excavations
- Relationship between groundwater extraction and ground subsidence
- Interaction between groundwater and linear structures (tunnels, drains)
- Interaction between groundwater and hydraulic structures (dams)

T 'Teilleistung': Groundwater Hydraulics [T-BGU-100624]

Responsibility: Ulf Mohrlok
Contained in: [M-BGU-100340] Groundwater Management

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
3	English	Each term	oral examination	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
SS 2019	6221801	Groundwater Hydraulics	Vorlesung (V)	2	Ulf Mohrlok

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
oral exam, appr. 20 min.

Prerequisites
none

Recommendations
none

Remarks
none

V Course Excerpt: Groundwater Hydraulics (SS 2019)

Aim
The participants can describe the hydrogeologic situations in groundwater systems. They are able to calculate groundwater level and fluxes for simple flow processes depending on the boundary conditions using analytical methods. They can also describe the transport processes of solutes and calculte concentrations and mass fluxes respectively. They are able to apply these balance approaches in management scenarios for quantity and quality of groundwater resources.

Content

- fluid mechanical processes in porous media
- groundwater flow: regional, potential flow, flow towards a well
- processes of groundwater recharge
- solute transport processes
- groundwater management: well catchments, protection zones, groundwater pollution, salt water intrusion

Literature

Bear, J. (1979). Hydraulics of Groundwater. McGraw Hill.
Fetter, C.W. (1999). Contaminant Hydrogeology , 2/e. Upper Saddle River, NJ, U.S.A.: Prentice Hall.
Hiscock, K.M. (2005). Hydrogeology: principles and practice. Malden, MA, U.S.A.: Blackwell.
Kruseman, G.P. and N.A. de Ridder (1991). Analysis and Evaluation of Pumping Test Data. NL: ILRI public 47.
Mohrlok, U. (2009). Bilanzmodelle in der Grundwasserhydraulik: quantitative Beschreibung von Strömung und Transport im Untergrund. Karlsruhe, Universitätsverlag. (in German)
Nielsen, D.M. and A.J. Johnson (1990). Ground Water and Vadose Zone Monitoring. Albuquerque, NM, USA: ASTM.
Schwartz, F. and H. Zhang (2003). Fundamentals of Ground Water. New York, NY, U.S.A.: John Wiley & Sons.

T 'Teilleistung': Group exercise Project Integrated Planning [T-BGU-109916]

Responsibility: Ralf Roos
Contained in: [M-BGU-100018] Project Integrated Planning

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
5	German	Each winter term	not graded accomplishment	1

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
integrated term paper of the whole group and 2 presentations of the result

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Group Exercise Project Management in Construction and Real Estate Industry [T-BGU-101006]

Responsibility: Shervin Haghsheno
Contained in: [M-BGU-100338] Project Management in Construction and Real Estate Industry

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
1	German	Each winter term	not graded accomplishment	2

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
WS 18/19	6241701		Vorlesung / Übung (VÜ)	4	Shervin Haghsheno, Susanne Hirschberger, Nils Münzl, Jürgen Sittinger

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
term paper, appr. 10 pages

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Highway Design [T-BGU-100057]

Responsibility: Ralf Roos, Matthias Zimmermann
Contained in: [M-BGU-100017] Highway Design

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
4	German	Each term	oral examination	2

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
WS 18/19	6233901		Vorlesung / Übung (VÜ)	2	Matthias Zimmermann
WS 18/19	6233903		Vorlesung / Übung (VÜ)	2	Ralf Roos, Matthias Zimmermann

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
oral exam, appr. 30 min.

Prerequisites
Study project Design of a Rural Road hat to be passed.

Modeled Conditions
The following conditions must be met:

- The course [T-BGU-109917] *Study project Design of a Rural Road* must have been passed.

Recommendations
none

Remarks
none

V Course Excerpt: (WS 18/19)

Aim
Die Absolventinnen und Absolventen können Methoden und manuelle Verfahren für den Entwurf einer Straße in Lage, Höhe und Querschnitt anwenden und neue Straßen bemessen. Weiterhin sind sie in der Lage, Varianten für neue Straßen unter Berücksichtigung verkehrlicher, topographischer, ökologischer und ökonomischer Anforderungen zu entwickeln und zu bewerten sowie Straßenentwürfe auf Konformität mit dem technischen Regelwerk zu beurteilen.

Content
Zunächst wird die grundsätzliche Herangehensweise zur Trassenfindung einer Ortsumgehungsstraße erörtert und anschließend an einem praktischen Planungsbeispiel angewendet.
Nach Festlegung der Randbedingungen für den Entwurf dieser Umgehungsstraße werden in Kleingruppen Entwurfslösungen im Lageplan, Höhenplan und Querschnitt manuell entwickelt und die Ergebnisse diskutiert. Hierbei erfolgen auch Prüfungen über die Einhaltung der Regelwerte und bezogen auf die Anforderungen der räumlichen Linienführung. Anschließend wird ein plangleicher Knotenpunkt als Anbindung der Umgehungsstraße an das nachgeordnete Netz im Detail entworfen.

V Course Excerpt: (WS 18/19)

Aim
Die Absolventinnen und Absolventen können DV-gestützte Verfahren für den Entwurf einer Straße in Lage, Höhe und Querschnitt anwenden und neue Straßen bemessen.

Content

In einer digitalen Welt werden auch zunehmend Planungs- und Entwurfsaufgaben DV-gestützt bearbeitet. In dieser Lehrveranstaltung wird daher die Methode des DV-gestützten Straßenentwurfs in der Theorie sowie praktisch an grundlegenden Entwurfsbeispielen behandelt. Die Übungen hierzu werden mit den beiden gängigsten Entwurfsprogrammen durchgeführt.

T 'Teilleistung': History of Urban Planning [T-BGU-108441]

Responsibility: Joachim Vogt
Contained in: [M-BGU-100013] Urban Renewal

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
3	German	Each term	oral examination	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
SS 2019	6328016		Vorlesung (V)	2	Steven Ross, Joachim Vogt

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
oral exam, appr. 25 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Hollow Section Structures [T-BGU-100086]

Responsibility: Stefan Herion
Contained in: [M-BGU-100004] Hollow Section Structures

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
6	German	Each term	oral examination	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
WS 18/19	6212903		Vorlesung (V)	2	Stefan Herion
WS 18/19	6212904		Übung (Ü)	2	Stefan Herion

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
oral exam, appr. 30 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Homework 'Basics of Finite Elements' [T-BGU-109908]

Responsibility: Peter Betsch
Contained in: [M-BGU-100052] Basics of Finite Elements

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
1	German	Each winter term	not graded accomplishment	1

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
processing of two exercise sheets

Prerequisites
none

T 'Teilleistung': Homework 'Introduction to Environmental Data Analysis and Statistical Learning' [T-BGU-109950]

Responsibility: Uwe Ehret
Contained in: [M-BGU-104880] Introduction to Environmental Data Analysis and Statistical Learning

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
2	English	Each winter term	not graded accomplishment	1

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
course associated assignments, short reports appr. 1 page each

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Homework 'Practical Noise Control' [T-BGU-109946]

Responsibility: Reiner Grigo
Contained in: [M-BGU-100060] Building Physics II

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
1	German	Each summer term	examination of other type	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
SS 2019	6211814		Vorlesung (V)	2	Reiner Grigo, Oliver Grunau

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
2 short reports, appr. 5 pages each

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Hydraulic Engineering [T-BGU-106759]

Responsibility: Franz Nestmann
Contained in: [M-BGU-103376] Hydraulic Engineering

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
6	English	Each term	written examination	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
SS 2019	6222701	Multiphase Flow in Hydraulic Engineering	Vorlesung / Übung (VÜ)	2	Franz Nestmann
SS 2019	6222703	Design of Hydraulic Structures	Vorlesung / Übung (VÜ)	2	Franz Nestmann

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
written exam, 75 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Hydro Power Engineering [T-BGU-100139]

Responsibility: Peter Oberle
Contained in: [M-BGU-100103] Hydro Power Engineering

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
6	German	Each term	oral examination	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
SS 2019	6222801	Hydro Power Engineering	Vorlesung / Übung (VÜ)	4	Peter Oberle

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
oral exam, appr. 20 min.

Prerequisites
none

Recommendations
none

Remarks
none

V Course Excerpt: Hydro Power Engineering (SS 2019)

Aim
Students are able to describe the different turbine types and can define selection criteria for their usage. They are able to reproduce the basic approach in the planning and design of hydropower plants and to make own calculations to select turbines. They can select and apply the necessary tolls in a methodical matter.
Students are able to discuss the current political conditions in terms of energy policy with other students and support their personal opinion on these issues with technical arguments.

Content
- political frame conditions (EEG)
- Environmental requirements
- Turbine technology and electrical aspects
- Constructive characteristics of hydro power plats
- Development and design of hydro power plants
- Lecture accompanying excursions and projekt examples

Workload
Attendance time: 60h
Preparation/follow-up: 60h
Examination + exam preparation: 60h

Literature
Mosonyi E., 2009, Water Power Development,

T 'Teilleistung': Hydrological Measurements in Environmental Systems [T-BGU-106599]

Responsibility: Jan Wienhöfer
Contained in: [M-BGU-103763] Hydrological Measurements in Environmental Systems

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
6	English	Each summer term	examination of other type	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
SS 2019	6224807	Hydrological Measurements in Environmental Systems	Praktische Übung (PÜ)	4	Uwe Ehret, Jan Wienhöfer

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
The examination consists of four parts:

1. active participation in the seminar (presentation ~ 20 mins)
2. active participation in field and lab work
3. documentation of the field experiments (report ~ 10 pages)
4. analysis of field data (presentation ~ 20 mins and report ~10 pages)

Each part is graded with points, and the overall grade is determined by the number of points obtained.
Passing the exam requires at least 1 point in each of the four parts, and in total the minimum number of points.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Industrial Water Management [T-BGU-108448]

Responsibility: Tobias Morck
Contained in: [M-BGU-104073] Industrial Water Management

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
5	English	Each term	oral examination	2

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
SS 2019	6223810	Industrial Water Management	Vorlesung / Übung (VÜ)	4	Tobias Morck

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
oral exam, appr. 30 min.

Prerequisites
Lab report 'Industrial Water Management' has to bve passed.

Modeled Conditions
The following conditions must be met:

- The course [T-BGU-109980] *Lab report 'Industrial Water Management'* must have been passed.

Recommendations
none

Remarks
none

T 'Teilleistung': Information Management for Public Mobility Services [T-BGU-106608]

Responsibility: Peter Vortisch
Contained in: [M-BGU-103357] Special Issues of Public Transport

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
3	German	Each summer term	examination of other type	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
SS 2019	6232813		Block (B)	2	Peter Vortisch

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
lecture accompanying exercises, appr. 5 pieces

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Infrastructure Management [T-BGU-106300]

Responsibility: Ralf Roos
Contained in: [M-BGU-100009] Infrastructure Management

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
6	German	Each term	written examination	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
SS 2019	6233801		Vorlesung (V)	2	Ralf Roos
SS 2019	6233802		Vorlesung (V)	2	Ralf Roos

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
written exam, 120 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Interaction Flow – Hydraulic Structures [T-BGU-106775]

Responsibility: Michael Gebhardt

Contained in: [M-BGU-103897] Interaction Flow - Building Structure
[M-BGU-103389] Hydraulic Structures

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
3	German	Each term	oral examination	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
WS 18/19	6221903		Vorlesung / Übung (VÜ)	2	Michael Gebhardt

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
oral exam, appr. 30 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Introduction to Environmental Data Analysis and Statistical Learning [T-BGU-109949]

Responsibility: Uwe Ehret
Contained in: [M-BGU-104880] Introduction to Environmental Data Analysis and Statistical Learning

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
3	English	Each term	written examination	1

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
written exam, 60 min.

Prerequisites
The accomplishment Homework 'Introduction to Environmental Data Analysis and Statistical Learning' (T-BGU-109265) has to be passend.

Modeled Conditions
The following conditions must be met:

- The course [T-BGU-109950] *Homework 'Introduction to Environmental Data Analysis and Statistical Learning'* must have been passed.

Recommendations
none

Remarks
none

T 'Teilleistung': Introduction to Matlab [T-BGU-106765]

Responsibility: Uwe Ehret
Contained in: [M-BGU-103927] Interdisciplinary Qualifications

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
3	English	Each winter term	not graded accomplishment	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
WS 18/19	6224907	Introduction to Matlab	Vorlesung / Übung (VÜ)	2	Uwe Ehret, Jan Wienhöfer

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
implementation of a Matlab code with report, appr. 1 page

Prerequisites
none

Recommendations
none

Remarks
none

V Course Excerpt: Introduction to Matlab (WS 18/19)

Aim
Students are familiar with common programming rules and the working environment and basic syntax of Matlab. They are capable of independently formulating and coding simple programs for data analysis and visualization as well as simulation of dynamical systems with Matlab.
Students have thus gained the competence to independently solve computer-based modeling tasks in advanced courses.
Students are able to solve problems and to present the related results in teamwork.

Content

- Universal programming basics: Programing strategies, program structures, control structures, operators and variables, functions and objects, matrix calculations
- Basics of Matlab: History, installation, graphical user interface, tool boxes, using help
- Matlab programming basics: syntax, debugging, reading and writing of files, data visualization

Workload
Attendance time: 30 h
Preparation/follow-up: 10 h
Homework: 30 h
Take-home exam: 20 h

T 'Teilleistung': Lab report 'Industrial Water Management' [T-BGU-109980]

Responsibility: Tobias Morck
Contained in: [M-BGU-104073] Industrial Water Management

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
1	English	Each summer term	not graded accomplishment	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
SS 2019	6223810	Industrial Water Management	Vorlesung / Übung (VÜ)	4	Tobias Morck

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
report on laboratory work, appr. 10 pages, as examination prerequisite

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Landfills [T-BGU-100084]

Responsibility: Andreas Bieberstein
Contained in: [M-BGU-100079] Environmental Geotechnics

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
3	German	Each winter term	oral examination	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
WS 18/19	6251913	Landfills	Vorlesung / Übung (VÜ)	2	Andreas Bieberstein

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
oral exam, appr. 20 min.

Prerequisites
none

Recommendations
none

Remarks
none

V Course Excerpt: Landfills (WS 18/19)

Aim
The students know the legal guidelines regarding the disposal of wastes and the permitted threshold value for brownfields. They overview the geotechnical concerns in the construction of landfill sites depending on the particular landfill classification, landfill elements, their relevant requirements and necessary certifications.

Content
- waste-situation and waste catalogue
- requirements from the authorities, legal basis
- planning landfill sites
- multi-barrier system
- construction elements
- hydraulic analysis
- technical equipment for gas treatment of landfills
- static analysis
- serviceability analysis
- construction
- special design solutions
- strengthening of landfills

Literature
DGGT, GDA-Empfehlungen – Geotechnik der Deponien und Altlasten, Ernst und Sohn, Berlin
Drescher (1997), Deponiebau, Ernst und Sohn, Berlin

T 'Teilleistung': Laws and Proceedings concerning Traffic and Roads [T-BGU-106297]

Responsibility: Dietmar Hönig, Ralf Roos, Peter Vortisch
Contained in: [M-BGU-100011] Laws and Proceedings Concerning Traffic and Roads

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
6	German	Each term	written examination	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
SS 2019	6232801		Vorlesung (V)	1	Bastian Chlond
SS 2019	6233803		Vorlesung (V)	2	Dietmar Hönig
SS 2019	6233804		Vorlesung (V)	1	Ralf Roos

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
written exam, 120 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Lean Construction [T-BGU-108000]

Responsibility: Shervin Haghsheno
Contained in: [M-BGU-100104] Lean Construction

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
4.5	German	Each term	written examination	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
WS 18/19	6241901	Lean Construction	Vorlesung / Übung (VÜ)	4	Shervin Haghsheno, Mitarbeiter/innen

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
written exam, 70 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Long-Distance and Air Traffic [T-BGU-106301]

Responsibility: Bastian Chlond
Contained in: [M-BGU-100020] Intermodality in Freight, Long-Distance and Air Transport

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
3	German	Each term	written examination	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
WS 18/19	6232904		Vorlesung (V)	2	Bastian Chlond, KIT Dozenten

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
written exam, 60 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Machinery and Process Engineering [T-BGU-100623]

Responsibility: Sascha Gentes
Contained in: [M-BGU-100339] Machinery and Process Engineering

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
5	German	Each term	written examination	2

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
WS 18/19	6241703		Vorlesung (V)	2	Uwe Görisch, Heinrich Schlick, Harald Schneider
WS 18/19	6243701		Vorlesung (V)	2	Günther Dörfler, Sascha Gentes

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
written exam, 90 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Management of Water Resources and River Basins [T-BGU-106597]

Responsibility: Uwe Ehret
Contained in: [M-BGU-103364] Management of Water Resources and River Basins

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
6	English	Each summer term	examination of other type	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
SS 2019	6224801	Management of Water Resources and River Basins	Vorlesung / Übung (VÜ)	4	Uwe Ehret

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
course associated assignments, short reports appr. 2 pages each, and
final take home exam, report appr. 10 pages and colloquium

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Master Thesis [T-BGU-108097]

Responsibility: Peter Vortisch
Contained in: [M-BGU-103953] Module Master Thesis

Credit Points	Recurrence Frequency	Type of Learning Control	Version
30	Each term	Final thesis	1

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
duration appr. 6 months
presentation within one month after submission of the thesis

Prerequisites
defined for the module Master Thesis

Recommendations
see module

Remarks
Information about the procedure regarding admission and registration of the Master Thesis see chap. 1.8.

T 'Teilleistung': Material Models in Solid Mechanics [T-BGU-100044]

Responsibility: Thomas Seelig
Contained in: [M-BGU-100054] Material Models in Solid Mechanics

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
6	German	Each term	oral examination	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
WS 18/19	6215801		Vorlesung (V)	2	Thomas Seelig
WS 18/19	6215802		Übung (Ü)	2	Mitarbeiter/innen

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
oral exam, appr. 45 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Material Science, Welding and Fatigue [T-BGU-100023]

Responsibility: Peter Knödel
Contained in: [M-BGU-100039] Material Science, Welding and Fatigue

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
6	German	Each term	written examination	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
SS 2019	6212803		Vorlesung / Übung (VÜ)	4	Katharina Bräutigam, Peter Knödel

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
written exam, 90 min.

Prerequisites
none

Recommendations
none

Remarks
none

V Course Excerpt: (SS 2019)

Content

- materials: denotation of steels, physical and technological properties
- fatigue: influencing parameters, calculation concepts
- welding technology: welding techniques, welding instructions
- quality management: building law, implementation categories, competences
- fracture toughness: linear fracture mechanics
- desing of welded constructions: internal stresses, welding distortion
- material testing: non-destructive testing, material and weld joint failures

Literature

- lecture notes
- DIN EN 1993-1-9: Design of steel structures – Part 1-9: Fatigue
- DIN EN 1993-1-10: Design of steel structures- Part1-10: Material toughness and through-thickness properties
- DIN EN 1090: Execution of steel structures and aluminium structures

T 'Teilleistung': Materials Testing and Measuring Techniques [T-BGU-100043]

Responsibility: Nico Herrmann
Contained in: [M-BGU-100061] Materials Testing and Measuring Techniques

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
6	German	Each term	oral examination	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
WS 18/19	6211911		Vorlesung (V)	1	Frank Dehn, Nico Herrmann
WS 18/19	6211912		Übung (Ü)	1	Nico Herrmann
WS 18/19	6211913		Vorlesung (V)	2	Frank Dehn, Nico Herrmann

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
oral exam, appr. 30 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Micromechanics of Heterogeneous Solids [T-BGU-108879]

Responsibility: Ingo Schmidt
Contained in: [M-BGU-100064] Continuum Mechanics of Heterogeneous Solids

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
3	German	Each term	oral examination	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
SS 2019	6215805		Vorlesung (V)	2	Ingo Schmidt

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
oral exam, appr. 20 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Modeling Techniques in Solid Mechanics [T-BGU-103223]

Responsibility: Alexander Konyukhov
Contained in: [M-BGU-101673] Modeling in Solid Mechanics

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
6	German	Each term	oral examination	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
SS 2019	6215807		Vorlesung / Übung (VÜ)	4	Alexander Konyukhov

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
oral exam, appr. 30 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Models and Methods in Traffic Engineering and Transportation Planning [T-BGU-100012]

Responsibility: Peter Vortisch
Contained in: [M-BGU-100008] Models and Methods in Traffic Engineering and Transportation Planning

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
6	German	Each term	oral examination	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
WS 18/19	6232701		Vorlesung / Übung (VÜ)	2	Mitarbeiter/innen, Peter Vortisch
WS 18/19	6232703		Vorlesung / Übung (VÜ)	2	Mitarbeiter/innen, Peter Vortisch

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
oral exam, appr. 20 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Non-linear Analysis of Beam Structures [T-BGU-100030]

Responsibility: Ingo Münch, Werner Wagner
Contained in: [M-BGU-100046] Non-linear Analysis of Beam Structures

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
6	German	Each term	written examination	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
WS 18/19	6214702		Vorlesung (V)	2	Ingo Münch
WS 18/19	6214703		Übung (Ü)	2	Patrick Weber

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
written exam, 90 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Non-linear Analysis of Surface Structures [T-BGU-100035]

Responsibility: Werner Wagner
Contained in: [M-BGU-100051] Non-linear Analysis of Surface Structures

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
6	German	Each term	oral examination	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
WS 18/19	6214903		Vorlesung (V)	2	Werner Wagner
WS 18/19	6214904		Übung (Ü)	2	Patrick Weber

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
oral exam, appr. 3 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Numerical Flow Modeling in Hydraulic Engineering [T-BGU-106776]

Responsibility: Peter Oberle
Contained in: [M-BGU-103390] Numerical Flow Modeling in Hydraulic Engineering

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
6	German	Each term	oral examination	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
WS 18/19	6222903		Vorlesung / Übung (VÜ)	4	Peter Oberle

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
oral exam, appr. 20 min.

Prerequisites
none

Recommendations
none

Remarks
none

V Course Excerpt: (WS 18/19)

Aim
The students learn to use geographic information systems (GIS) as a tool of pre- and postprocessing to simulate river flows. They are able to reflect the fundamentals of the methods used and their methodology. The students have the ability to assess the areas of application of different hydrodynamic-numerical methods. They have the skills to analyze case studies regarding the applicability of the various methods and derive solutions.

Content
The course explains physical and numerical basics as well as operating conditions and application examples of different hydrodynamic-numerical (HN-) methods. Furthermore, geographic information systems (GIS) as a tool of pre- and postprocessing and their linking with HN-methods will be introduced. Other aspects covered are the coupling of elements of automation technology with HN-methods and the use of morphodynamic processes.

Workload
Attendance time lecture: 30 h
Attendance time exercise: 30 h
Preparation/ follow-up: 60 h
Examination + exam preparation: 60 h

T 'Teilleistung': Numerical Fluid Mechanics [T-BGU-106758]

Responsibility: Markus Uhlmann
Contained in: [M-BGU-103375] Numerical Fluid Mechanics

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
6	English	Each term	written examination	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
WS 18/19	6221702	Numerical Fluid Mechanics I	Vorlesung / Übung (VÜ)	4	Markus Uhlmann

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
written exam, 90 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Numerical Fluid Mechanics II [T-BGU-106768]

Responsibility: Markus Uhlmann
Contained in: [M-BGU-103384] Advanced Computational Fluid Dynamics

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
3	English	Each term	oral examination	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
SS 2019	6221809	Numerical Fluid Mechanics II	Vorlesung / Übung (VÜ)	2	Markus Uhlmann

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
oral exam, appr. 30 min.

Prerequisites
module Numerical Fluid Mechanics [bauiM2P5-NUMFLMECH] must be completed

Modeled Conditions
The following conditions must be met:

- The module [M-BGU-103375] *Numerical Fluid Mechanics* must have been passed.

Recommendations
none

Remarks
none

T 'Teilleistung': Numerical Groundwater Modeling [T-BGU-100625]

Responsibility: Ulf Mohrlok
Contained in: [M-BGU-100340] Groundwater Management

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
3	English	Each winter term	examination of other type	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
WS 18/19	6221901	Numerical Groundwater Modelling	Projekt (PRO)	2	Ulf Mohrlok

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
project report, appr. 15 pages

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Numerical Methods in Structural Analysis [T-BGU-100034]

Responsibility: Ingo Münch, Werner Wagner
Contained in: [M-BGU-100050] Numerical Methods in Structural Analysis

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
6	German	Each term	oral examination	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
WS 18/19	6214901		Vorlesung (V)	2	Ingo Münch
WS 18/19	6214902		Übung (Ü)	2	Ingo Münch

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
oral exam, appr. 30 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Numerical Modelling in Geotechnics [T-BGU-100107]

Responsibility: Andrzej Niemunis
Contained in: [M-BGU-100075] Numerical Modelling in Geotechnics

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
6	German	Each term	oral examination	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
SS 2019	6251818	Exercises in Numerical Modelling	Übung (Ü)	2	Andrzej Niemunis
SS 2019	6251819	FEM Applications in Geotechnical Modelling	Vorlesung (V)	2	Andrzej Niemunis

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
oral exam, appr. 30 min.;
on base of a programming project worked at during the semseter

Prerequisites
none

Recommendations
none

Remarks
none

V Course Excerpt: FEM Applications in Geotechnical Modelling (SS 2019)

Aim
The students got to know FE applications in several fields of geotechnics (foundation, rock and tunnel construction, dam construction), got practical experience with the FE code ABAQUS (TM) and applied this for the modelling of example problems.

Content

- introduction to the FE-program ABAQUS: definition of joints and elements, assignment of material laws, definition of initial and boundary conditions
- examples of FE-applications in tunnel engineering
- numerical FE-modeling of a deep pit excavation under consideration of the construction sequence
- numerical FE-modeling of seepage through a zoned dam with partial saturation (different load cases)
- linear dynamics using ABAQUS

Literature
Hibbit, Karlsson, Sorensen: ABAQUS for geotechnical problems
Helwany, S. (2007) Applied Soil Mechanics with ABAQUS Applications, Wiley
Hibbit, Karlsson, Sorensen (1997): Contact in ABAQUS/Standard

T 'Teilleistung': Numerics in Geotechnics [T-BGU-106197]

Responsibility: Andrzej Niemunis
Contained in: [M-BGU-100070] Basics of Numeric Modeling

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
3	German	Each term	oral examination	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
WS 18/19	6251707	Numerics in Geotechnics	Vorlesung (V)	2	Andrzej Niemunis

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
oral exam, appr. 30 min.

Prerequisites
none

Recommendations
none

Remarks
none

V Course Excerpt: Numerics in Geotechnics (WS 18/19)

Aim
The students know operational methods for the discretization of the typical differential equations. They are able to comprehend the modelling of geomechanical boundary value problems using Finite Difference and Finite Element Methods and to work independently on standard problems. They can assess the errors possible with numerical calculations, select commercial FE-codes reasonably and test and evaluate numerical results critically.

Content
· time dependent and time-independent numerical problems in soil mechanics
· finite difference method: implicit and explicit solution of time-dependent ordinary differential equations, stability of the FD-scheme
· partial differential equations (consolidation, waves): numerical methods, stability, errors
· finite elements: weak form, discretization, boundary conditions according to Neumann and Dirichlet
· sample finite element computation for stationary two dimensional seepage flow
· finite element computation for static equilibrium (2D)
· locking, reduced integration, static condensation
· weak form of the consolidation equation and GN-time integration
· material non-linearity
· return-mapping and equilibrium iteration
· geometrical non-linearity, follower loads, simplified integration schemes
· introduction to the boundary-element-method.

Literature
Presss, W., e.a. (1992), Numerical Recipies, Cambridge Univ. Press
Hughes, T.J.R. (2000): The FEM, Linear Static and Dynamic FE Analysis. Dover
Bathe, K.-J. (200): Finite-Elemente-Methoden. Springer
Smith, I.M.; Griffith, D.V. (2004): Programming the Finite Element Method. JWS
Potts, D.M. Zdravkovic, L. (1999): Finite element analysis in geotechnical engineering. Thomas Telford Ltd
Zienkewicz O.C. et.al. (2005): The Finite Element Method, Vol. 1, Wiley
Hartmann, F. (1987): Methode der Randelemente, Springer
Strang, G. (2007): Wissenschaftliches Rechnen, Springer

T 'Teilleistung': Parallel Programming Techniques for Engineering [T-BGU-106769]

Responsibility: Markus Uhlmann
Contained in: [M-BGU-103384] Advanced Computational Fluid Dynamics

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
3	English	Each term	written examination	2

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
SS 2019	6221807	Parallel programming techniques for engineering problems	Vorlesung / Übung (VÜ)	2	Markus Uhlmann

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
oral exam, appr. 30 min.

Prerequisites
module Numerical Fluid Mechanics [bauiM2P5-NUMFLMECH] must be completed

Modeled Conditions
The following conditions must be met:

- The module [M-BGU-103375] *Numerical Fluid Mechanics* must have been passed.

Recommendations
none

Remarks
none

T 'Teilleistung': Planning of Transportation Systems [T-BGU-100013]

Responsibility: Peter Vortisch
Contained in: [M-BGU-100016] Planning of Transportation Systems

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
6	German	Each term	oral examination	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
SS 2019	6232806		Vorlesung (V)	2	Peter Vortisch
SS 2019	6232808		Vorlesung (V)	2	Volker Waßmuth

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
oral exam, appr. 20 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Practical Fire Protection [T-BGU-100042]

Responsibility: Hermann Schröder
Contained in: [M-BGU-100060] Building Physics II

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
3	German	Each term	oral examination	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
SS 2019	6211815		Vorlesung (V)	2	Hermann Schröder

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
oral exam, appr. 20 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Practical Noise Control [T-BGU-108024]

Responsibility: Reiner Grigo
Contained in: [M-BGU-100060] Building Physics II

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
2	German	Each term	oral examination	2

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
SS 2019	6211814		Vorlesung (V)	2	Reiner Grigo, Oliver Grunau

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
oral exam, appr. 20 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Process Engineering in Wastewater Treatment [T-BGU-106787]

Responsibility: Tobias Morck
Contained in: [M-BGU-103399] Process Engineering in Wastewater Treatment

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
6	English	Each winter term	written examination	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
WS 18/19	6223901	Municipal Wastewater Treatment	Vorlesung / Übung (VÜ)	2	Tobias Morck
WS 18/19	6223902	International Sanitary Engineering	Vorlesung / Übung (VÜ)	2	Stephan Fuchs, Tobias Morck

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
written exam, 60 min.

Prerequisites
internal examination prerequisite: group presentation, appr. 20 min., and written report, appr. 10 pages

Recommendations
none

Remarks
none

T 'Teilleistung': Project Integrated Planning [T-BGU-100061]

Responsibility: Ralf Roos
Contained in: [M-BGU-100018] Project Integrated Planning

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
1	German	Each term	oral examination	2

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
WS 18/19	6230901		Projekt (PRO)	4	Bastian Chlond, Ralf Roos, Matthias Zimmermann

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
oral exam, appr. 30 min.

Prerequisites
Group exercise Project Integrated Planning has to be passed.

Modeled Conditions
The following conditions must be met:

- The course [T-BGU-109916] *Group exercise Project Integrated Planning* must have been passed.

Recommendations
none

Remarks
none

T 'Teilleistung': Project Management in Construction and Real Estate Industry [T-BGU-100622]

Responsibility: Shervin Haghsheno
Contained in: [M-BGU-100338] Project Management in Construction and Real Estate Industry

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
4	German	Each term	written examination	3

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
WS 18/19	6241701		Vorlesung / Übung (VÜ)	4	Shervin Haghsheno, Susanne Hirschberger, Nils Münzl, Jürgen Sittinger

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
written exam, 90 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Project Paper Lean Construction [T-BGU-101007]

Responsibility: Shervin Haghsheno
Contained in: [M-BGU-100104] Lean Construction

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
1.5	German	Each winter term	examination of other type	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
WS 18/19	6241901	Lean Construction	Vorlesung / Übung (VÜ)	4	Shervin Haghsheno, Mitarbeiter/innen

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
project:
report, appr. 10 pages, and
presentation, appr. 10 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Project Report Water Distribution Systems [T-BGU-108485]

Responsibility: Franz Nestmann
Contained in: [M-BGU-104100] Water Distribution Systems

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
2	English	Each winter term	not graded accomplishment	2

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
WS 18/19	6222905	Water Distribution Systems	Vorlesung / Übung (VÜ)	4	Andreas Kron, Peter Oberle

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
project report, appr. 15 pages, and
presentation, appr. 15 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Project Studies in Water Resources Management [T-BGU-106783]

Responsibility: Franz Nestmann, Frank Seidel
Contained in: [M-BGU-103394] Project Studies in Water Resources Management

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
6	German	Each winter term	examination of other type	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
WS 18/19	6222901		Vorlesung / Übung (VÜ)	4	Franz Nestmann, Frank Seidel

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
project work: term paper, appr. 15 pages, with presentation

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Real Estate Management [T-BGU-100629]

Responsibility: Kunibert Lennerts
Contained in: [M-BGU-100346] Real Estate Management

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
6	German	Each term	oral examination	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
WS 18/19	6242901		Vorlesung (V)	1	Gunnar Adams, Kunibert Lennerts
WS 18/19	6242902		Vorlesung (V)	1	Gunnar Adams, Kunibert Lennerts
WS 18/19	6242903		Vorlesung (V)	1	Klaus Janowski, Kunibert Lennerts
WS 18/19	6242904		Vorlesung (V)	1	Kunibert Lennerts, Mitarbeiter/innen

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
oral exam, appr. 40 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Research Seminar Construction Management [T-BGU-108008]

Responsibility: Shervin Haghsheno
Contained in: [M-BGU-103917] Research Seminar Construction Management

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
6	German	Each term	examination of other type	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
WS 18/19	6241906		Seminar (S)	2	Shervin Haghsheno, Mitarbeiter/innen
SS 2019	6241814		Seminar (S)	2	Shervin Haghsheno, Mitarbeiter/innen

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
project report, appr. 25 pages, and colloquium

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': River Basin Modelling [T-BGU-106603]

Responsibility: Stephan Fuchs
Contained in: [M-BGU-103373] River Basin Modeling

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
6	English	Each term	examination of other type	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
WS 18/19	6223904	Modelling Mass Fluxes in River Basins	Vorlesung / Übung (VÜ)	2	Stephan Fuchs
SS 2019	6223812	Mass Fluxes in River Basins	Vorlesung (V)	2	Stephan Fuchs

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
project report, appr. 10 pages, and
presentation, appr. 15 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Road Construction [T-BGU-100058]

Responsibility: Ralf Roos
Contained in: [M-BGU-100006] Road Construction

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
6	German	Each term	oral examination	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
WS 18/19	6233904		Vorlesung / Übung (VÜ)	2	Plamena Plachkova-Dzhurova
WS 18/19	6233905		Vorlesung (V)	2	Plamena Plachkova-Dzhurova

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
oral exam, appr. 30 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Road Safety [T-BGU-100062]

Responsibility: Matthias Zimmermann
Contained in: [M-BGU-100021] Road Safety

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
3	German	Each term	oral examination	2

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
WS 18/19	6233906		Vorlesung / Übung (VÜ)	2	Matthias Zimmermann
WS 18/19	6233908		Seminar (S)	2	Matthias Zimmermann

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
oral exam, appr. 30 min.

Prerequisites
Seminar paper Road Safety has to be passed.

Modeled Conditions
The following conditions must be met:

- The course [T-BGU-109915] *Seminar paper Road Safety* must have been passed.

Recommendations
none

Remarks
none

V Course Excerpt: (WS 18/19)

Aim
Die Absolventinnen und Absolventen können an einem Praxisbeispiel, nach einer Analyse der dortigen Unfälle und einer Beurteilung der Verkehrssicherheit, Methoden und Verfahren zur Erhöhung der Verkehrssicherheit auf dieser Straße anwenden, Maßnahmen hierzu entwickeln und in ihrer Wirkung bewerten. Darüber hinaus können sie selbstorganisiert arbeiten und verfügen über organisatorische und didaktische Kompetenzen bezogen auf Teamarbeit und Präsentationen.

Content
Im Rahmen dieses Seminares wird ein von der Polizei detektierter Unfallschwerpunkt aus der Region um Karlsruhe ingenieurmäßig untersucht. In Abhängigkeit des Ergebnisses der Unfallanalyse erarbeiten die Studierenden in Gruppen Maßnahmen zur Erhöhung der Verkehrssicherheit für diesen Praxisfall und schlagen diese der zuständigen Straßenbauverwaltung sowie der Polizei in einer Präsentation vor.

V Course Excerpt: (WS 18/19)

Aim
Die Absolventinnen und Absolventen können grundsätzlich Methoden und Verfahren zur Erhöhung der Verkehrssicherheit auf Straßen anwenden, die Verkehrssicherheit von Straßennetzen, Streckenabschnitten und Knotenpunkten beurteilen, Unfallschwerpunkte identifizieren, Unfälle und deren Ursachen analysieren sowie Maßnahmen zur Erhöhung der Verkehrssicherheit entwickeln und in ihrer Wirkung bewerten.

Content
In dieser Lehrveranstaltung werden die Inhalte der Verkehrssicherheitsarbeit von Seiten der Baulastträger, der Straßen-

verkehrsbehörden und der Polizei (Unfallaufnahme, Unfallanalyse, Beurteilung der Verkehrssicherheit von Netzen, Strecken und Knotenpunkten etc.), von Seiten der Wissenschaft (sicherheitsrelevante Aspekte im technischen Regelwerk) und im Lebenszyklus einer Straße (Sicherheitsaudits in der Planung, im Entwurf und während des Betriebs) vorgestellt, erörtert und grundsätzliche Verbesserungsmöglichkeiten diskutiert.

T 'Teilleistung': Rock Engineering and Underground Construction [T-BGU-100074]

Responsibility: Peter Kudella
Contained in: [M-BGU-100074] Rock Engineering and Underground Construction

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
6	German	Each term	written examination	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
WS 18/19	6251905	Aboveground Rock Engineering	Vorlesung / Übung (VÜ)	2	Peter Kudella
WS 18/19	6251907	Tunnel Construction in Soils and in Existence	Vorlesung / Übung (VÜ)	2	Thomas Grundhoff, Peter Kudella

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
written exam, 90 min.

Prerequisites
none

Recommendations
none

Remarks
none

V Course Excerpt: Aboveground Rock Engineering (WS 18/19)

Aim
The students are familiar with planning, construction and design of safety systems for embankments and hillsides in bedrock. They can identify critical failure mechanisms, conduct respective stability analyses and design anchoring.

Content
- types of rock slopes and failure mechanisms
- survey, analysis and interpretation of structural interface data
- computational procedures for sliding of rock embankments: graphical (stereonet projection)
- analytical computational procedures
- safety definitions
- different failure mechanisms, block overturning
- rockfall protection methods and design, geocompatible slope design
- block and slope stabilization, retaining walls, anchors, monitoring systems
- rock excavation, slope construction, blasting technology

Literature
Brady, B. H. G. and Brown, E. T., (2004): Rock Mechanics for Underground Mining, 3rd. Edition, Kluwer Academic Publishers.

V Course Excerpt: Tunnel Construction in Soils and in Existence (WS 18/19)

Aim
The students know setup and function of tunnel boring machines and tunneling techniques by own perception and can select appropriate tunnel boring technologies. They can transfer deepened knowledge about strength and deformation properties of bedrock and the precursory and accompanied exploration to the rehabilitation of existing tunnels.

Content
- tunnel sealing

· tunnel lining
· tunnel security (fire protection, escape concept)
· rehabilitation of existing tunnels, safety analysis of existing tunnels (exploration, rehabilitation, restoration, renewal)
· tunnelling shield machines, compressed air, hydro and earth pressure support, pipe and frame
· jacking, microtunneling and steered horizontal borings
· earth static analysis and deformation prediction for surface-near tunneling in loose ground
· settlement compensation

Literature

Maidl B., Herrenknecht M., Maidl U., Wehrmeyer G. Maschineller Tunnelbau im Schildvortrieb, 2. Auflage 2011, Ernst & Sohn
Kolymbas, D. (1998), Geotechnik - Tunnelbau und Tunnelmechanik, Springer.

T 'Teilleistung': Rock Mechanics and Tunneling [T-BGU-100069]

Responsibility: Carlos Grandas Tavera, Theodoros Triantafyllidis
Contained in: [M-BGU-100069] Rock Mechanics and Tunneling

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
5	German	Each term	written examination	2

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
SS 2019	6251804	Basics in Rock Mechanics	Vorlesung / Übung (VÜ)	2	Carlos Grandas Tavera
SS 2019	6251806	Basics in Tunnel Construction	Vorlesung / Übung (VÜ)	2	Martin Wagner

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
written exam, 90 min.

Prerequisites
none

Recommendations
preparation of the student research project for examination preparation

Remarks
none

V Course Excerpt: Basics in Tunnel Construction (SS 2019)

Aim
The students can select basic construction methods and constructions in underground tunnel construction and apply self-reliantly the methods and static calculation and safety assessments in rock mechanics. With regard to the assessment of variants, costs, construction operation and safety aspects they gained geotechnical competence in solving problems.

Content
- tunneling by excavator, drilling and blasting, driving by TBM
- tunnel driving classification
- measuring technologies in tunnel construction
- rock exploration and classification
- rock pressure and in-situ stress measurement
- introduction to tunnel constructions (types and purposes)
- tunnel construction methods: historic, full-circle and segmental, calotte, roof and wall mining
- safety measures and sequence
- collaps mechanisms of bedrock
- stresses and deformations around a tunnel: primary stresses, convergence, plastification, crack stresses, ground reaction line method

Literature
Maidl, B. 1997: Tunnelbau im Sprengvortrieb
Müller, L. 1978: Der Felsbau, Bd. 3 Tunnelbau

V Course Excerpt: Basics in Rock Mechanics (SS 2019)

Aim
The students understand the essential strength and deformation properties of rock and can deduce the behavior of the discontinuum. They apply the basic analytical methods to solve boundary value problems of surface and underground

rock excavation.

Content

- basics of petropraphy
- rocks and rock mass classification
- rock pressure
- genity and tropy
- stress-strain-behaviour
- shear strength, compressive strength and tensile strength of compact and jointed rock
- shear resistance of discontinuities
- basics and methods to determine compressibility parameters for rocks and rock mass
- in situ and laboratory testing
- circular tunnels in isotrope and biaxial primary stress fields (elastic)
- circular tunnels in elastoplastic ground
- elliptical cross sections
- shaft problem

Literature

Brady, B. H. G. and Brown, E. T., (2004): Rock Mechanics for Underground Mining, 3rd. Edition, Kluwer Academic Publishers.
Kolymbas, D. (1998), Geotechnik - Tunnelbau und Tunnelmechanik, Springer.
Goodmann, R.E., (1989): Introduction to Rock Mechanics, John Wiley & Sons.
Hoek, E., 2007: Practical Rock Engineering, kostenloser Download unter: http://www.rocscience.com/hoek/PracticalRockEngineerin
Jäger, J.C., Cook, N.G.W. and Zimmerman, R.W., 2007: Fundamentals of Rock Mechanics, Blackwell Publishing.
Wittke, W., 1982: Felsmechanik, Springer-Verlag.

T 'Teilleistung': Seminar in Transportation [T-BGU-100014]

Responsibility: Bastian Chlond, Peter Vortisch
Contained in: [M-BGU-103357] Special Issues of Public Transport

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
3	German	Each term	examination of other type	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
WS 18/19	6232903		Seminar (S)	2	Mitarbeiter/Innen KIT, Peter Vortisch
SS 2019	6232903		Seminar (S)	2	Martin Kagerbauer, Peter Vortisch

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
seminar paper, appr. 10 pages, and presentation, appr. 10 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Seminar Paper 'Flow Behavior of Rivers' [T-BGU-108466]

Responsibility: Franz Nestmann, Frank Seidel
Contained in: [M-BGU-104083] Flow and Sediment Dynamics in Rivers

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
2	English	Each summer term	not graded accomplishment	2

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
SS 2019	6222807	Flow Behavior of Rivers	Vorlesung / Übung (VÜ)	2	Victor Dupuis, Olivier Eiff, Frank Seidel

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
seminar paper in the course Flow Behavior of Rivers, appr. 15 pages

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Seminar paper Road Safety [T-BGU-109915]

Responsibility: Matthias Zimmermann
Contained in: [M-BGU-100021] Road Safety

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
3	German	Each winter term	not graded accomplishment	1

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
integrated seminar paper of the team, appr. 10 pages/person and plan documents, presentation appr. 10 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Seminar Paper 'Waterway Engineering' [T-BGU-106779]

Responsibility: Andreas Kron
Contained in: [M-BGU-103392] Waterway Engineering

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
1	German	Each summer term	not graded accomplishment	2

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
SS 2019	6222803	Waterway Engineering	Vorlesung / Übung (VÜ)	4	Andreas Kron

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
seminar paper, appr. 15 pages

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Shell Structures and Stability of Structures [T-BGU-100033]

Responsibility: Ingo Münch, Werner Wagner
Contained in: [M-BGU-100049] Shell Structures and Stability of Structures

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
4	German	Each term	oral examination	3

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
SS 2019	6214805		Vorlesung (V)	1	Ingo Münch
SS 2019	6214806		Übung (Ü)	1	Ingo Münch
SS 2019	6214807		Vorlesung (V)	1	Ingo Münch
SS 2019	6214808		Übung (Ü)	1	Marc Fina

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
oral exam, appr. 40 min.

Prerequisites
Student research project "Shell Structures and Stability of Structures" has to be passed.

Modeled Conditions
The following conditions must be met:

- The course [T-BGU-100254] *Student Research Project 'Shell Structures and Stability of Structures'* must have been passed.

Recommendations
none

Remarks
none

T 'Teilleistung': Signal Processing [T-BGU-107961]

Responsibility: Bodo Ruck
Contained in: [M-BGU-103904] Experimental Techniques II: Measurement Techniques

Credit Points	Recurrence Frequency	Type of Learning Control	Version
3	Each term	oral examination	1

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
oral exam, appr. 30 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Solid Construction Bridges [T-BGU-100020]

Responsibility: Lothar Stempniewski
Contained in: [M-BGU-100037] Solid Construction Bridges

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
6	German	Each term	written examination	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
WS 18/19	6211901		Vorlesung (V)	2	Alfred Krill
WS 18/19	6211902		Übung (Ü)	2	Eric Kirpal

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
written exam, 90 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Space and Infrastructure [T-BGU-100056]

Responsibility: Martin Kagerbauer, Sina Keller
Contained in: [M-BGU-100014] Space and Infrastructure

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
6	German	Each term	oral examination	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
SS 2019	6072201		Vorlesung (V)	2	Sina Keller, Roland Stirnberg
SS 2019	6231805		Vorlesung / Übung (VÜ)	2	Martin Kagerbauer

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
oral exam, appr. 30 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Special Issues of Soil Mechanics [T-BGU-100071]

Responsibility: Theodoros Triantafyllidis
Contained in: [M-BGU-100005] Special Issues of Soil Mechanics

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
6	German	Each term	oral examination	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
WS 18/19	6251901	Unsaturated, Viscous and Cyclic Soil Behaviour - Theory and Element Tests	Vorlesung / Übung (VÜ)	2	Andrzej Niemunis
WS 18/19	6251903	Soil Dynamics	Vorlesung / Übung (VÜ)	2	Gerhard Huber

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
oral exam, appr. 40 min.

Prerequisites
none

Recommendations
none

Remarks
none

V Course Excerpt: Unsaturated, Viscous and Cyclic Soil Behaviour - Theory and Element Tests (WS 18/19)

Aim
The students master a wide range of mechanical, hydraulic and numerical tools for the processing of specific soil mechanical problems. They can comprehend the cross-linking of hydraulic, mechanical and chemical processes under partial saturation. They can use the dynamic and cyclic laboratory techniques and apply material laws operationally for the calculation and calibration of experiments.

Content
- Hypoplastic constitutive laws (1D, 3D): advantages, limitations, identification of parameters, intergranular strain
- visco-hypoplasticity
- application: creeping embankments with shead dowelling
- natural soils in comparison to idealized models
- phenomena of shear localization
- sounding, soil penetration and contact problems
- typical stress-strain-relations for various soils (sand, gravel, silt, clay) for monotonous drained and undrained loading
- soils under high-cycle-loading, strain accumulation, accumulation model
- soils under undrained cyclic loading, soil liquefaction, debris flow
- hydraulic and mechanic Characteristics of partly saturated soils
- recalculation of different element tests

V Course Excerpt: Soil Dynamics (WS 18/19)

Aim
The students can describe vibrations and waves in elastic continua and real soils in the range of strains from small shakes up to earthquakes and evaluate them from an engineering viewpoint. They can design, overview and interprete the relevant dynamic laboratory tests.

Content

- vibrations of systems with one degree of freedom, linear and non-linear (time and frequency domain)
- wave propagation in full and half space, also layered
- vibrations of rigid foundations (linear elastic, substructure method)
- wave propagation: linear and linearised using adapted stiffness, numerical methods
- behaviour of soils under cyclic and dynamic loading: particle models, continuum models
- laboratory tests: resonant column test (RC), cyclic triaxial test
- wave propagation in real soils (influence of hysteretic material damping and increase of stiffness with depth)
- effects related to saturated soil (cyclic mobility, liquefaction)
- 1D-wave propagation for earthquake loading: linearised model using program Shake including adapted
- stiffness, nonlinear using Hypoplasticity
- settlements caused by dynamic loading and transient loss of stiffness

Literature

W. Haupt, Bodendynamik: Grundlagen und Anwendung, Vieweg+Teubner Verlag, 1986

T 'Teilleistung': Special Topics in Highway Engineering [T-BGU-106734]

Responsibility: Rainer Hess, Ralf Roos
Contained in: [M-BGU-100022] Special Topics in Highway Engineering

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
6	German	Each term	oral examination	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
SS 2019	6233805		Vorlesung (V)	2	Rainer Hess
SS 2019	6233806		Vorlesung (V)	1	Mitarbeiter/innen, Ralf Roos
SS 2019	6233807		Vorlesung (V)	1	Ralf Roos

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
oral exam, appr. 30 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Steel and Composite Structures [T-BGU-100016]

Responsibility: Thomas Ummenhofer
Contained in: [M-BGU-100034] Steel and Composite Structures

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
5	German	Each term	written examination	2

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
SS 2019	6212801		Vorlesung (V)	2	Thomas Ummenhofer
SS 2019	6212802		Übung (Ü)	2	Marcel Mott

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
written exam, 90 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Structures in Steel [T-BGU-106798]

Responsibility: Thomas Ummenhofer
Contained in: [M-BGU-100042] Structures in Steel and Timber

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
3	German	Each winter term	examination of other type	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
WS 18/19	6212907		Vorlesung (V)	1	Thomas Ummenhofer
WS 18/19	6212908		Übung (Ü)	1	Thomas Ummenhofer

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
project work with final presentation, presentation and colloquium appr. 30 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Structures in Timber [T-BGU-106799]

Responsibility: Matthias Frese
Contained in: [M-BGU-100042] Structures in Steel and Timber

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
3	German	Each winter term	oral examination	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
WS 18/19	6213901		Vorlesung / Übung (VÜ)	2	Matthias Frese, Mitarbeiter/innen

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
oral examination, appr. 30 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Student Research Project 'Building Preservation of Concrete and Masonry Constructions' [T-BGU-100175]

Responsibility: Engin Kotan
Contained in: [M-BGU-100058] Building Preservation of Concrete and Masonry Constructions

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
1	German	Each summer term	not graded accomplishment	2

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
SS 2019	6211811		Vorlesung (V)	2	Engin Kotan
SS 2019	6211812		Übung (Ü)	1	Engin Kotan
SS 2019	6211813		Vorlesung (V)	1	Engin Kotan, Michael Vogel

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
student research paper, 15-20 pages;
definition of a project available from lecturer

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Student Research Project 'Computational Analysis of Structures' [T-BGU-100174]

Responsibility: Werner Wagner
Contained in: [M-BGU-100047] Computational Analysis of Structures

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
2	German	Each summer term	not graded accomplishment	2

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
SS 2019	6214801		Vorlesung (V)	2	Werner Wagner
SS 2019	6214802		Übung (Ü)	2	Marc Fina

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
student research project, appr. 15 pages
definition of a project available from lecturer

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Student Research Project 'Cost Estimation in Structural Engineering and Earthworks' [T-BGU-108010]

Responsibility: Harald Schneider
Contained in: [M-BGU-100102] Economics and Management in Construction

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
1	German	Each summer term	not graded accomplishment	2

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
SS 2019	6241801		Vorlesung / Übung (VÜ)	2	Shervin Haghsheno

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
term paper, appr. 15 pages, with test

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Student Research Project 'Dynamics of Structures' [T-BGU-107819]

Responsibility: Peter Betsch
Contained in: [M-BGU-100035] Surface Structures and Dynamics of Structures

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
1	German	Each winter term	not graded accomplishment	2

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
WS 18/19	6215701		Vorlesung (V)	2	Marlon Franke

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
term paper;
definition of a project available from lecturer

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Student Research Project 'Earthworks and Foundation Engineering' [T-BGU-100178]

Responsibility: Theodoros Triantafyllidis
Contained in: [M-BGU-100068] Earthworks and Foundation Engineering

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
2	German	Each winter term	not graded accomplishment	2

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
WS 18/19	6251701	Foundation Types	Vorlesung / Übung (VÜ)	2	Theodoros Triantafyllidis
WS 18/19	6251703	Basics in Earthworks and Embankment Dams	Vorlesung / Übung (VÜ)	2	Andreas Bieberstein

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
report appr. 45 pages;
definition of a project available from lecturer

Prerequisites
none

Recommendations
none

Remarks
none

V Course Excerpt: Basics in Earthworks and Embankment Dams (WS 18/19)

Aim
The students are able to select and apply appropriate methods for exploration, modelling, dimensioning, realization and control for earthworks and dam construction. They can identify all geotechnically relevant problems occuring with dams and can apply design and dimensioning rules in outline self-reliantly.

Content
- cross section and longitudinal section of filled dams
- requirements for zonation
- sealing
- combined effects dam/subsoil
- construction methods for seepage cuttoff
- building materials for dams with requirements and characteristics
- construction of dams
- seepage and flow nets
- flow cases with known and unknown boundaries
- erosion, suffosion, piping, colmatation and joint erosion
- dam stability

Literature
Striegler (1998), Dammbau in Theorie und Praxis, Verlag für Bauwesen Berlin
Kutzner (1996), Erd- und Steinschüttdämme für Stauanlagen, Enke Verlag Stuttgart

V Course Excerpt: Foundation Types (WS 18/19)

Aim

The students are able to select and apply appropriate methods for exploration, modelling, dimensioning, realization and control for geotechnical constructions of average complexity. They gained competence in solving geotechnical problems, also with respect to the managerial organization, expense budgeting, use of documents and presentation of results.

Content

- safety concepts in earthworks and foundation engineering
- project design for foundation problems
- frame constructions on partially soft soil, bridge abutment and embankments on soft soil
- types of retaining constructions for a cut-and-cover metro tunnel
- ground anchors
- quay wall structures with tied-back sheetpiles
- stabilization and drainage of embankments
- retaining constructions with structural slope stabilisation
- underpinning and supporting
- observational method

Literature

Witt. K.J. (2008), Grundbau-Taschenbuch, Teil 1,
U. Smoltczyk, U. (2001), Grundbau-Taschenbuch, Teil 2-3,
S. Schmidt, H.G. & Seitz, J. (1998), Grundbau , Bilfinger & Berger

T 'Teilleistung': Student Research Project 'Excavation Pit Development and Shuttering Planning' [T-BGU-108012]

Responsibility: Harald Schneider
Contained in: [M-BGU-100339] Machinery and Process Engineering

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
1	German	Each winter term	not graded accomplishment	2

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
WS 18/19	6241703		Vorlesung (V)	2	Uwe Görisch, Heinrich Schlick, Harald Schneider
WS 18/19	6243701		Vorlesung (V)	2	Günther Dörfler, Sascha Gentes

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
term paper, appr. 15 pages, with test

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Student Research Project 'Reinforced Concrete' [T-BGU-100170]

Responsibility: Lothar Stempniewski
Contained in: [M-BGU-100033] Design and Construction of Components in Reinforced Concrete

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
2	German	Each winter term	not graded accomplishment	2

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
WS 18/19	6211701		Vorlesung (V)	2	Lothar Stempniewski
WS 18/19	6211702		Übung (Ü)	2	Stefania Rizzo

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
term paper;
definition of a project available from lecturer

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Student Research Project 'Rock Mechanics and Tunneling' [T-BGU-100179]

Responsibility: Carlos Grandas Tavera, Theodoros Triantafyllidis
Contained in: [M-BGU-100069] Rock Mechanics and Tunneling

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
1	German	Each summer term	not graded accomplishment	2

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
SS 2019	6251804	Basics in Rock Mechanics	Vorlesung / Übung (VÜ)	2	Carlos Grandas Tavera
SS 2019	6251806	Basics in Tunnel Construction	Vorlesung / Übung (VÜ)	2	Martin Wagner

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
report appr. 15 pages;
definition of a project available from lecturer

Prerequisites
none

Recommendations
none

Remarks
none

V Course Excerpt: Basics in Tunnel Construction (SS 2019)

Aim
The students can select basic construction methods and constructions in underground tunnel construction and apply self-reliantly the methods and static calculation and safety assessments in rock mechanics. With regard to the assessment of variants, costs, construction operation and safety aspects they gained geotechnical competence in solving problems.

Content

- tunneling by excavator, drilling and blasting, driving by TBM
- tunnel driving classification
- measuring technologies in tunnel construction
- rock exploration and classification
- rock pressure and in-situ stress measurement
- introduction to tunnel constructions (types and purposes)
- tunnel construction methods: historic, full-circle and segmental, calotte, roof and wall mining
- safety measures and sequence
- collaps mechanisms of bedrock
- stresses and deformations around a tunnel: primary stresses, convergence, plastification, crack stresses, ground reaction line method

Literature
Maidl, B. 1997: Tunnelbau im Sprengvortrieb
Müller, L. 1978: Der Felsbau, Bd. 3 Tunnelbau

V Course Excerpt: Basics in Rock Mechanics (SS 2019)

Aim

The students understand the essential strength and deformation properties of rock and can deduce the behavior of the discontinuum. They apply the basic analytical methods to solve boundary value problems of surface and underground rock excavation.

Content

- basics of petropraphy
- rocks and rock mass classification
- rock pressure
- genity and tropy
- stress-strain-behaviour
- shear strength, compressive strength and tensile strength of compact and jointed rock
- shear resistance of discontinuities
- basics and methods to determine compressibility parameters for rocks and rock mass
- in situ and laboratory testing
- circular tunnels in isotrope and biaxial primary stress fields (elastic)
- circular tunnels in elastoplastic ground
- elliptical cross sections
- shaft problem

Literature

Brady, B. H. G. and Brown, E. T., (2004): Rock Mechanics for Underground Mining, 3rd. Edition, Kluwer Academic Publishers.
Kolymbas, D. (1998), Geotechnik - Tunnelbau und Tunnelmechanik, Springer.
Goodmann, R.E., (1989): Introduction to Rock Mechanics, John Wiley & Sons.
Hoek, E., 2007: Practical Rock Engineering, kostenloser Download unter: http://www.rocscience.com/hoek/PracticalRockEngineerin
Jäger, J.C., Cook, N.G.W. and Zimmerman, R.W., 2007: Fundamentals of Rock Mechanics, Blackwell Publishing.
Wittke, W., 1982: Felsmechanik, Springer-Verlag.

T 'Teilleistung': Student Research Project 'Scheduling and Building Site Facilities' [T-BGU-108011]

Responsibility: Harald Schneider
Contained in: [M-BGU-100338] Project Management in Construction and Real Estate Industry

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
1	German	Each winter term	not graded accomplishment	2

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
WS 18/19	6241701		Vorlesung / Übung (VÜ)	4	Shervin Haghsheno, Susanne Hirschberger, Nils Münzl, Jürgen Sittinger

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
term paper, appr. 15 pages, with test

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Student Research Project 'Shell Structures and Stability of Structures' [T-BGU-100254]

Responsibility: Ingo Münch, Werner Wagner
Contained in: [M-BGU-100049] Shell Structures and Stability of Structures

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
2	German	Each summer term	not graded accomplishment	2

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
SS 2019	6214805		Vorlesung (V)	1	Ingo Münch
SS 2019	6214806		Übung (Ü)	1	Ingo Münch
SS 2019	6214807		Vorlesung (V)	1	Ingo Münch
SS 2019	6214808		Übung (Ü)	1	Marc Fina

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
student research project, appr. 15 pages
definition of a project available from lecturer

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Student Research Project 'Steel Structures' [T-BGU-100171]

Responsibility: Thomas Ummenhofer
Contained in: [M-BGU-100034] Steel and Composite Structures

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
1	German	Each summer term	not graded accomplishment	2

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
SS 2019	6212801		Vorlesung (V)	2	Thomas Ummenhofer
SS 2019	6212802		Übung (Ü)	2	Marcel Mott

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
term paper;
definition of a project available from lecturer

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Student Research Project 'Surface Structures' [T-BGU-107818]

Responsibility: Werner Wagner
Contained in: [M-BGU-100035] Surface Structures and Dynamics of Structures

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
1	German	Each winter term	not graded accomplishment	2

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
WS 18/19	6214701		Vorlesung (V)	2	Werner Wagner

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
term paper;
definition of a project available from lecturer

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Study project Design of a Rural Road [T-BGU-109917]

Responsibility: Ralf Roos, Matthias Zimmermann
Contained in: [M-BGU-100017] Highway Design

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
2	German	Each winter term	not graded accomplishment	1

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
preparation of 4 planning documents

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Surface Structures [T-BGU-100017]

Responsibility: Werner Wagner
Contained in: [M-BGU-100035] Surface Structures and Dynamics of Structures

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
2	German	Each term	written examination	2

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
WS 18/19	6214701		Vorlesung (V)	2	Werner Wagner

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
written exam, 60 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Sustainability in Real Estate Management [T-BGU-100149]

Responsibility: Kunibert Lennerts
Contained in: [M-BGU-100112] Sustainability in Real Estate Management

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
6	German	Each term	written examination	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
SS 2019	6242801		Vorlesung / Übung (VÜ)	2	Kunibert Lennerts
SS 2019	6242803		Vorlesung (V)	1	Kunibert Lennerts
SS 2019	6242804		Vorlesung (V)	1	Kunibert Lennerts

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
written exam, 90 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Tank Construction [T-BGU-101000]

Responsibility: Peter Knödel
Contained in: [M-BGU-100580] Tank Construction

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
3	German	Each term	oral examination	2

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
WS 18/19	6212910	Tank Construction	Vorlesung (V)	3	Peter Knödel
WS 18/19	6212911		Übung (Ü)	1	Katharina Bräutigam

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
oral exam, appr. 20 min.

Prerequisites
none

Recommendations
none

Remarks
none

V Course Excerpt: Tank Construction (WS 18/19)

Content

- classification of tank types
- impacts: characteristic of loads by wind, filing, internal pressre, earth quake and deonation
- characeristics of shell structures
- proof of strength and stability with linear an non-linear calculation
- design and construction
- specific problems

Literature

- lecture note
- DIN EN 1993-1-6: Design of steel structures – Part 1-6: Strength and stability of shell structures
- DIN EN 1993-4-1: Design of steel structures – Part 4-1: Silos
- DIN EN 1993-4-2: Design of steel structures – Part 4-2: Tanks
- Knödel, P.; Heß, A.; Ummenhofer, T.: Stählerne Tankbauwerke nach DIN EN 1993-4-2. In: Stahlbau-Kalender 2013, S. 523-563.

T 'Teilleistung': Technical Hydraulics [T-BGU-106770]

Responsibility: Olivier Eiff
Contained in: [M-BGU-103385] Technical Hydraulics

Credit Points	Recurrence Frequency	Type of Learning Control	Version
6	Each term	written examination	1

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
written exam, 100 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Tendering, Planning and Financing in Public Transport [T-BGU-101005]

Responsibility: Peter Vortisch
Contained in: [M-BGU-103357] Special Issues of Public Transport

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
3	German	Each term	oral examination	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
SS 2019	6232807		Vorlesung (V)	2	Alexander Pischon

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
oral exam, appr. 20 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Term Paper 'International Sanitary Engineering' [T-BGU-109265]

Responsibility: Stephan Fuchs, Tobias Morck
Contained in: [M-BGU-104917] Wastewater Treatment Technologies

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
1	English	Each winter term	not graded accomplishment	2

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
WS 18/19	6223902	International Sanitary Engineering	Vorlesung / Übung (VÜ)	2	Stephan Fuchs, Tobias Morck

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
presentation, appr. 15 min., term paper, appr. 10 pages

Prerequisites
none

Recommendations
none

Remarks
keine

T 'Teilleistung': Term Paper Tank Construction [T-BGU-101001]

Responsibility: Peter Knödel
Contained in: [M-BGU-100580] Tank Construction

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
3	German	Each winter term	examination of other type	2

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
WS 18/19	6212910	Tank Construction	Vorlesung (V)	3	Peter Knödel
WS 18/19	6212911		Übung (Ü)	1	Katharina Bräutigam

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
term paper with presentation, appr. 20 pages

Prerequisites
none

Recommendations
none

Remarks
none

V Course Excerpt: Tank Construction (WS 18/19)

Content

- classification of tank types
- impacts: characteristic of loads by wind, filing, internal pressre, earth quake and deonation
- characeristics of shell structures
- proof of strength and stability with linear an non-linear calculation
- design and construction
- specific problems

Literature

- lecture note
- DIN EN 1993-1-6: Design of steel structures – Part 1-6: Strength and stability of shell structures
- DIN EN 1993-4-1: Design of steel structures – Part 4-1: Silos
- DIN EN 1993-4-2: Design of steel structures – Part 4-2: Tanks
- Knödel, P.; Heß, A.; Ummenhofer, T.: Stählerne Tankbauwerke nach DIN EN 1993-4-2. In: Stahlbau-Kalender 2013, S. 523-563.

T 'Teilleistung': Term Paper Upgrading of Existing Buildings and Energetic Refurbishment [T-BGU-100621]

Responsibility: Kunibert Lennerts
Contained in: [M-BGU-100108] Upgrading of Existing Buildings and Energetic Refurbishment

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
1.5	German	Each winter term	examination of other type	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
WS 18/19	6240901		Vorlesung / Übung (VÜ)	3	Kunibert Lennerts, Harald Schneider
WS 18/19	6240903		Vorlesung (V)	1	Justus Medgenberg, Harald Schneider

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
term paper, appr. 10 pages, and
presentation, appr. 10 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Theoretical Soil Mechanics [T-BGU-100067]

Responsibility: Theodoros Triantafyllidis
Contained in: [M-BGU-100067] Theoretical Soil Mechanics

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
6	German	Each term	written examination	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
SS 2019	6251801	Theoretical Soil Mechanics	Vorlesung / Übung (VÜ)	4	Andrzej Niemunis

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
written exam, 90 min.

Prerequisites
none

Recommendations
none

Remarks
none

V Course Excerpt: Theoretical Soil Mechanics (SS 2019)

Aim
The students obtained a scientific based understanding of the essential behaviour of soil under monotonic and cyclic load with and without effects of time. They are able to describe relations in soil mechanics mathematically and physically correctly. They can understand the tensorial terminology of modern geotechnical literature and can apply computing programs to comprehend element tests. They recognize self-reliantly relevant mechanisms of boundary value problems and can specify the limitations of simple engineering models.

Content

- geotechnical invariants of stress and strain
- failure criteria according to Coulomb, Matsuoka-Nakai etc.
- contractancy and dilatancy
- critical density
- failure criteria according to Krey-Tiedemann
- soil behaviour under partial saturation
- collapse theorems and their application (Kinematic Element Analysis)
- elasticity in soil mechanics (isotropic and anisotropic)
- acoustic tensor
- elastoplasticity with volumetric hardening using the example of the Cam-Clay-Model
- soil behaviour under cyclic loading
- one-dimensional viscoplasticity

Literature
Niemunis (2009): Über die Anwendung der Kontinuumstheorie auf bodenmechanische Probleme (download)

T 'Teilleistung': Timber and Wood-Based Materials [T-BGU-100029]

Responsibility: Hans Joachim Blaß, Carmen Sandhaas
Contained in: [M-BGU-100045] Timber and Wood-Based Materials

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
6	German	Each term	oral examination	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
SS 2019	6213803	Timber and wood-based materials	Vorlesung / Übung (VÜ)	4	Carmen Sandhaas

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
oral exam, appr. 30 min.

Prerequisites
none

Recommendations
none

Remarks
none

V Course Excerpt: Timber and wood-based materials (SS 2019)

Aim
Die Studierenden können den Baustoff Holz und seine abgeleiteten Produkte materialgerecht im Bauwesen einsetzen und sind sich möglicher Problematiken, hervorgerufen durch die hygroskopischen, anisotropen, heterogenen und biologischen Eigenschaften von Holz, bewusst. Sie haben Methoden entwickelt, um mit den streuenden Eigenschaften von Holz in der Baupraxis umzugehen. Die Studierenden können verschiedene, holzbasierte Werkstoffe, basierend auf holzanatomischem, holzphysikalischem und biologischem Wissen, zielgerichtet selbst entwickeln.
Ihre hinterfragende und kritische Denkfähigkeit bezüglich gut ausgeführter, robuster und zuverlässiger Holzbaudetails ist geschult und die Studierenden können Problematiken aus dem Bauwesen in andere Zusammenhänge übertragen. Basierend auf ihrem Materialverständnis können die Studierenden die materialspezifische Qualität von konstruktiven Details analysieren und bewerten.
Eine weitere Kompetenz nach Abschluss des Moduls ist die Fähigkeit, englische Fachtexte zu lesen, zu analysieren und kohärent und kritisch zusammenzufassen. Ein kleiner Fachartikel wird als Gruppenarbeit auf englisch erarbeitet und in einer englischsprachigen Präsentation vorgetragen.

Content
Holzanatomie
Holzmerkmale
Physik des Holzes
Dauerhaftigkeit
Schnittholztrocknung
Festigkeitssortierung
Vollholz
Brettschichtholz
Brettsperrholz
plattenförmige Holzwerkstoffe

T 'Teilleistung': Timber Structures [T-BGU-100028]

Responsibility: Hans Joachim Blaß
Contained in: [M-BGU-100044] Timber Structures

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
6	German	Each term	written examination	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
SS 2019	6213801		Vorlesung (V)	2	Hans Joachim Blaß
SS 2019	6213802		Übung (Ü)	2	Hans Joachim Blaß, Mitarbeiter/innen

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
written exam, 90 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Track Guided Transport Systems - Operation and Capacity [T-BGU-101002]

Responsibility: Jan Tzschaschel
Contained in: [M-BGU-100581] Track Guided Transport Systems - Operation and Capacity

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
6	German	Each term	oral examination	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
SS 2019	6234801	Operation Track Guided Systems	Vorlesung (V)	2	Jan Tzschaschel
SS 2019	6234804	Operation Systems and Track Guided Infrastructure Capacity	Vorlesung (V)	2	Mitarbeiter/innen, Jan Tzschaschel

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
oral exam, appr. 45 min.

Prerequisites
none

Recommendations
none

Remarks
none

V Course Excerpt: Operation Track Guided Systems (SS 2019)

Content
- Operation Systems
- International Comparison of Operating Modes
- Signalling Systems
- International Comaparison of Railway Signalling
- Basics of Operational Planning
- Railway Timetable Construction

Literature
Fiedler, Grundlagen der Bahntechnik, Werner-Verlag, DüsseldorfHausmann, Enders, Grundlagen des Bahnbetriebs, Bahn-Fachverlag, Heidelberg
Pachl, Systemtechnik des Schienenverkehrs, Teubner-Verlag, Stuttgar

V Course Excerpt: Operation Systems and Track Guided Infrastructure Capacity (SS 2019)

Content
- Blocking Time and Minimum Headway Time
- Signal Box Technologies
- Capacity of Railway Infrastructure
- Modelling Operational Processes

Literature
Fiedler, Grundlagen der Bahntechnik, Werner-Verlag, DüsseldorfHausmann, Enders, Grundlagen des Bahnbetriebs, Bahn-Fachverlag, Heidelberg
Pachl, Systemtechnik des Schienenverkehrs, Teubner-Verlag, Stuttgart

T 'Teilleistung': Traffic Management und Simulation Methods [T-BGU-100008]

Responsibility: Peter Vortisch
Contained in: [M-BGU-100015] Traffic Management und Simulation Methods

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
6	German	Each term	oral examination	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
SS 2019	6232802		Vorlesung / Übung (VÜ)	2	Peter Vortisch
SS 2019	6232804		Vorlesung / Übung (VÜ)	2	Mitarbeiter/innen, Peter Vortisch

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
oral exam, appr. 20 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Transport and Transformation of Contaminants in Hydrological Systems [T-BGU-106598]

Responsibility: Erwin Zehe
Contained in: [M-BGU-103872] Subsurface Flow and Contaminant Transport

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
6	English	Each term	oral examination	2

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
SS 2019	6224803	Transport and Transformation of Contaminants in Hydrological Systems	Vorlesung / Übung (VÜ)	5	Jan Wienhöfer, Erwin Zehe

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
oral exam, appr. 30 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Turnkey Construction [T-BGU-101208]

Responsibility: Shervin Haghsheno
Contained in: [M-BGU-100676] Turnkey Construction

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
6	German	Each term	written examination	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
SS 2019	6241808		Vorlesung (V)	1	Klaus Teizer
SS 2019	6241809		Vorlesung / Übung (VÜ)	2	Michael Denzer, Klaus Teizer
SS 2019	6241811		Vorlesung (V)	1	Shervin Haghsheno, Paul Pietsch

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
written exam, 90 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Upgrading of Existing Buildings and Energetic Refurbishment [T-BGU-108001]

Responsibility: Kunibert Lennerts
Contained in: [M-BGU-100108] Upgrading of Existing Buildings and Energetic Refurbishment

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
4.5	German	Each term	written examination	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
WS 18/19	6240901		Vorlesung / Übung (VÜ)	3	Kunibert Lennerts, Harald Schneider
WS 18/19	6240903		Vorlesung (V)	1	Justus Medgenberg, Harald Schneider

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
written exam, 70 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Urban and Regional Planning [T-BGU-100050]

Responsibility: Tamer Soylu, Sebastian Wilske
Contained in: [M-BGU-100007] Urban and Regional Planning

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
6	German	Each term	oral examination	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
WS 18/19	6231701		Vorlesung / Übung (VÜ)	2	Mitarbeiter/innen, N.N.
WS 18/19	6231703		Vorlesung (V)	2	Sebastian Wilske
SS 2019	6231701		Vorlesung / Übung (VÜ)	2	Tamer Soylu

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
oral exam, appr. 30 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Urban Management [T-BGU-108442]

Responsibility: Anke Karmann-Woessner
Contained in: [M-BGU-100013] Urban Renewal

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
3	German	Each term	oral examination	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
SS 2019	6231801		Vorlesung / Übung (VÜ)	2	Anke Karmann-Woessner

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
oral exam, appr. 15 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Urban Water Infrastructure and Management [T-BGU-106600]

Responsibility: Stephan Fuchs
Contained in: [M-BGU-103358] Urban Water Infrastructure and Management

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
6	English	Each term	written examination	2

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
WS 18/19	6223701	Urban Water Infrastructure and Management	Vorlesung / Übung (VÜ)	4	Stephan Fuchs

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
written exam, 60 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Wastewater and Storm Water Treatment [T-BGU-106601]

Responsibility: Stephan Fuchs, Tobias Morck
Contained in: [M-BGU-103362] Wastewater and Storm Water Treatment

Credit Points	Recurrence Frequency	Type of Learning Control	Version
6	Each summer term	examination of other type	1

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
term paper, appr. 10 pages, and
presentation, appr. 15 min.

Prerequisites
none

Recommendations
none

Remarks
The number of participants in the course is limited to 20 persons. The registration is to be made via ILIAS. The places are allocated with priority to students from *Water Science and Engineering*, then *Civil Engineering* and *Geoecology* and further study programs. The allocation is made by consideration of the semester and the time of entry of the registration. The attendance at the first meeting is mandatory. In case of absence the place will be assigned to a person on the waiting list.

T 'Teilleistung': Wastewater and Storm Water Treatment Facilities [T-BGU-109934]

Responsibility: Stephan Fuchs, Tobias Morck
Contained in: [M-BGU-104898] Wastewater and Storm Water Treatment Facilities

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
6	English	Each summer term	examination of other type	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
SS 2019	6223801	Wastewater and Storm Water Treatment Facilities	Vorlesung / Übung (VÜ)	4	Stephan Fuchs, Tobias Morck

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
term paper, appr. 10 pages, and
presentation, appr. 15 min.

Prerequisites
none

Recommendations
none

Remarks
The number of participants in the course is limited to 20 persons. The registration is to be made via ILIAS. The places are allocated with priority to students from *Water Science and Engineering*, then *Civil Engineering* and *Geoecology* and further study programs. The allocation is made by consideration of the semester and the time of entry of the registration. The attendance at the first meeting is mandatory. In case of absence the place will be assigned to a person on the waiting list.

T 'Teilleistung': Wastewater Treatment Technologies [T-BGU-109948]

Responsibility: Stephan Fuchs, Tobias Morck
Contained in: [M-BGU-104917] Wastewater Treatment Technologies

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
5	English	Each winter term	written examination	1

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
written exam, 60 min.

Prerequisites
The accomplishment Term paper 'International Sanitary Engineering' (T-BGU-109265) has to be passend.

Modeled Conditions
The following conditions must be met:

- The course [T-BGU-109265] *Term Paper 'International Sanitary Engineering'* must have been passed.

Recommendations
none

Remarks
none

T 'Teilleistung': Water and Energy Cycles [T-BGU-106596]

Responsibility: Erwin Zehe
Contained in: [M-BGU-103360] Water and Energy Cycles

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
6	English	Each term	oral examination	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
WS 18/19	6224702	Water and Energy Cycles in Hydrological Systems: Processes, Predictions and Management	Vorlesung / Übung (VÜ)	4	Erwin Zehe

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
oral exam, appr. 30 min.

Prerequisites
none

Recommendations
none

Remarks
none

T 'Teilleistung': Water Distribution Systems [T-BGU-108486]

Responsibility: Franz Nestmann
Contained in: [M-BGU-104100] Water Distribution Systems

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
4	English	Each winter term	oral examination	2

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
WS 18/19	6222905	Water Distribution Systems	Vorlesung / Übung (VÜ)	4	Andreas Kron, Peter Oberle

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
oral exam, appr. 30 min.

Prerequisites
The accomplishment 'Project Report Water Distribution Systems' (T-BGU-108485) has to be passed.

Modeled Conditions
The following conditions must be met:

- The course [T-BGU-108485] *Project Report Water Distribution Systems* must have been passed.

Recommendations
none

Remarks
none

T 'Teilleistung': Water Ecology [T-BGU-106602]

Responsibility: Stephan Fuchs, Stephan Hilgert
Contained in: [M-BGU-103361] Water Ecology

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
6	English	Each summer term	examination of other type	1

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
SS 2019	6223813	Applied Ecology and Water Quality	Seminar (S)	3	Stephan Fuchs, Stephan Hilgert

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
term paper, appr. 8-15 pages, and
presentation, appr. 15 min.

Prerequisites
none

Recommendations
none

Remarks
The number of participants in the course is limited to 20 persons. The registration is to be made via ILIAS. The places are allocated with priority to students from *Water Science and Engineering*, then *Civil Engineering* and *Geoecology* and further study programs. The allocation is made by consideration of the semester and the time of entry of the registration. The attendance at the first meeting is mandatory. In case of absence the place will be assigned to a person on the waiting list.

T 'Teilleistung': Waterway Engineering [T-BGU-106780]

Responsibility: Andreas Kron
Contained in: [M-BGU-103392] Waterway Engineering

Credit Points	Language	Recurrence Frequency	Type of Learning Control	Version
5	German	Each summer term	oral examination	2

Courses

Term	Course-No.	Courses	Type	HpW / SWS	Lecturers
SS 2019	6222803	Waterway Engineering	Vorlesung / Übung (VÜ)	4	Andreas Kron

Learning Control(s), according ER/SPO Civil Engineering (M.Sc.) 2017
oral exam, appr. 20 min.

Prerequisites
The accomplishment 'Seminar Paper Waterway Engineering' (T-BGU-106779) has to be passed.

Modeled Conditions
The following conditions must be met:

- The course [T-BGU-106779] *Seminar Paper 'Waterway Engineering'* must have been passed.

Recommendations
none

Remarks
none

T 'Teilleistung': Wildcard [T-BGU-108027]

Responsibility:
Contained in: [M-BGU-103927] Interdisciplinary Qualifications

Credit Points	Type of Learning Control	Version
1	not graded accomplishment	1

Part IV
Appendix

1 Curriculum by example

The selection of the start of studies, the study focuses and the modules is not at all any recommendation !
It shall only show that the study can be completed within the standard period of study.

Module (baui)	Module Title	Course	Type	1. Term (WS)			2. Term (SS)			3. Term (WS)			4. Term (SS)		
				HpW	CP	LC	HpW	CP	LC	HpW	CP	LC	HpW	CP	LC
Construction Engineering															
M1P1	Design and Construction of Components in Reinforced Concrete	Design and Construction of Components in Reinforced Concrete	L/E	2/2	6	ngA wE									
M1P2	Steel and Composite Structures	Steel and Composite Structures	L/E				2/2	6	ngA wE						
M1P3	Surface Structures and Dynamics of Structures	Surface Structures	L	2	3	ngA wE									
		Dynamics of Structures	L	2	3	ngA wE									
M1S14	Non-linear Analysis of Beam Structures	Non-linear Analysis of Beam Structures	L/E							2/2	6	oE			
M1S20	Basics of Finite Elements	Basics of Finite Elements	L/E							2/2	6	ngA oE			
Geotechnical Engineering															
M5P1	Theoretical Soil Mechanics	Theoretical Soil Mechanics	L/E				4	6	wE						
M5P2	Earthworks and Foundation Engineering	Foundation Types	L/E	2	6	ngA wE									
		Basics in Earthworks and Embankment Dams	L/E	2											
M5P3	Rock Mechanics and Tunnelling	Basics in Rock Mechanics	L/E				2	6	ngA wE						
		Basics in Tunnel Construction	L/E				2								
M5P4	Basics in Numerical Modelling	Continuum Mechanics	L/E	2	3	oE									
		Numerics in Geotechnics	L/E	2	3	oE									
M5S02	Ground Investigation	Soil Mechanical Laboratory Exercises	E				2	6	oE						
		Geomechanical Field Exercise	E				2								
Subject-Specific Supplements															
M1S03	Solid Construction Bridges	Solid Construction Bridges	L/E							2/2	6	wE			
M1S08	Hollow Section Structures	Hollow Section Structures	L/E							2/2	6	oE			
M1S16	FE-Applications in Practical Engineering	FE-Applications in Practical Engineering	L/E				2/2	6	oE						
M5S04	Ground Water and Earth Dams	Geotechnical Ground Water Problems	L/E							2	6	oE			
		Embankment Dams (Advanced)	L/E							2					
Interdisciplinary Qualifications															
MUEQ	Interdisciplinary Qualifications	'Interdis. Qualifications A'	S	2	3	ngA									
		'Interdis. Qualifications B'	Pj	2	3	ngA									
Master Thesis															
MMT	Master Thesis													30	

Sum per semester	20	30	6E+ 6nA	20	30	5E+ 2nA	20	30	5E+ 1nA		30	

explanation for the table:

CP = credit point
LC = learning control
wE = written exam
oE = oral exam
ngA = not graded accomplishment

L = lecture
L/E = lecture and exercise, separate or integrated
E = exercise
S = seminar
Pj = study project

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