Module Handbook
Civil Engineering Master 2017 (Master of Science (M.Sc.))
SPO 2017
Winter term 2019/20
Date: 11.10.2019
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<td><strong>7. Appendix: Curriculum by example</strong></td>
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</table>
1 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 (Chapt. 1). The main function of the Module Handbook is the compilation of the module descriptions (Chapt. 5) and the learning controls (Chapt. 6).

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.

Publisher:

KIT-Department of Civil Engineering, Geo and Environmental Sciences
Karlsruhe Institute of Technology (KIT)
76128 Karlsruhe

Photographs:

Martin Fenchel

Contact:

ulf.mohrloek@kit.edu
2 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)

2.1 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.
### 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's 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 Qualifications** (6 CP). Within the subject Subject-Specific Supplements all modules from all study focuses can 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.

### Curriculum

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<tr>
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<td><strong>Master's Thesis</strong></td>
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<td>selection of one Study Focus, 5 modules of 6 CP</td>
<td>30 CP</td>
<td>in one of the selected focuses:</td>
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<td>(variable number fixed and selectable respectively):</td>
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<td>Technology and Management in Construction (SF 4)</td>
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<td>Geotechnical Engineering (SF 5)</td>
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<th></th>
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<tr>
<td>6 CP</td>
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2.2.1 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

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<td>wE</td>
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*) Practical course Dynamics of Structure recommended as supplementary additional accomplishment

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

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### explanations to Table 1:

#### general:
- **M1PX**: Study Focus I, compulsory modules
- **M1SXX**: Study Focus I, compulsory elective modules
- **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.
- **5)** Module is offered in winter term 2019/20 for the last time in this form.

#### 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
- **ngA**: not graded accomplishment
- **ngA**: not graded accomplishment as examination prerequisite
2.2.2 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.

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<td><strong>PM4</strong></td>
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<tr>
<td><strong>PM5</strong></td>
<td>M2P8 - Water and Energy Cycles</td>
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2 SM have to be selected from M2S01 - M2S44 or M2P5 - M2P10, if not already selected as PM (s. Tab. 2):

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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

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<tr>
<th>Code</th>
<th>Module</th>
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<td>M2P6:</td>
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<tr>
<td>M2P8:</td>
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<td>oE 6</td>
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<td>wE 6</td>
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<tr>
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<td>EoT 3</td>
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**) Course will not be offered in summer term 2019.
### Table 2: Modules in Study Focus Water and Environment (continued)

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**Sum compulsory elective modules** 162

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<td>Project Studies in Water Resources Management</td>
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<td>3)</td>
<td>Module is not offered anymore as from winter term 2019/20.</td>
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<td>4)</td>
<td>Module is newly offered as from winter term 2019/20.</td>
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<td>L/E</td>
<td>Lecture and exercise, separate or integrated</td>
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2.2.3 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 planning, 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.

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<td>Operation and Maintenance of Highways (G)</td>
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<td>Assessment and Evaluation Techniques (G)</td>
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### Table 3: Modules in Study Focus Mobility and Infrastructure (continued)

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<td>Seminar in Highway Engineering (G)</td>
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<td>Mobility Services and new Forms of Mobility (G)</td>
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<td>M3S22: Special Issues of Public Transport 2)</td>
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</table>

#) is the only module further offered about railroads!

### explanations to Table 3:

general:
- M3PX: Study Focus III, compulsory modules
- M3SSX: Study Focus III, compulsory elective modules
- LC: learning control
- CP: credit point
- HpW / SWS: hours per week
- W / S: winter term / summer term
- G / E: language German / English

- Taking this module in the first semester is not recommended.
- Two of these courses with the related learning controls have to be selected.
- Course is offered every semester.

<table>
<thead>
<tr>
<th>type of course:</th>
<th>type of learning control:</th>
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<tbody>
<tr>
<td>L lecture</td>
<td>wE written examination</td>
</tr>
<tr>
<td>L/E lecture and exercise, separate or integrated exercise</td>
<td>oE oral examination</td>
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<td>E exercise</td>
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<td>S seminar</td>
<td>ngA 4) not graded accomplishment as examination prerequisite</td>
</tr>
<tr>
<td>Pj project</td>
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</table>
2.2.4 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’s thesis in this study focus shall attend this once.
### Table 4: Modules in Study Focus Technology and Management in Construction

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<th>Course Code</th>
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<td>Building Laws (G)</td>
<td>L</td>
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<td>Process Engineering (G)</td>
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</table>

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

<table>
<thead>
<tr>
<th>Module</th>
<th>Course</th>
<th>LC</th>
</tr>
</thead>
<tbody>
<tr>
<td>M4S12: Decommissioning of Nuclear Facilities</td>
<td>Removal and Decontamination of Nuclear Facilities (G)</td>
<td>L/E 2 oE 6</td>
</tr>
<tr>
<td></td>
<td>New Development and Optimization of Decommissioning Machine Technology (G)</td>
<td>L/E 2</td>
</tr>
<tr>
<td>M4S13: Facility Management in Hospitals and Hospital Management</td>
<td>Facility Management in Hospitals (G)</td>
<td>L/E 3 EoT 6</td>
</tr>
<tr>
<td></td>
<td>Hospital Management (G)</td>
<td>L 1</td>
</tr>
<tr>
<td>M4S15: Turnkey Construction</td>
<td>Turnkey Construction I - Processes and Methods (G)</td>
<td>L 1 wE 6</td>
</tr>
<tr>
<td></td>
<td>Turnkey Construction II - Trades and Technology (G)</td>
<td>L/E 2</td>
</tr>
<tr>
<td></td>
<td>Claim Management (G)</td>
<td>L 1</td>
</tr>
<tr>
<td>M4S16: Building Information Modeling (BIM)</td>
<td>Building Information Modeling (BIM) (G)</td>
<td>L/E 4 EoT 6</td>
</tr>
<tr>
<td>M4S17: Research Seminar Construction Management</td>
<td>Research Seminar Construction Management I (G)</td>
<td>S 2 oE 6</td>
</tr>
<tr>
<td></td>
<td>Research Seminar Construction Management II (G)</td>
<td>S 2</td>
</tr>
<tr>
<td>M4S18: Equipement and special Construction Techniques in Building Practice</td>
<td>Equipement and special Construction Techniques in Building Practice I (D)</td>
<td>L 2 oE 6</td>
</tr>
<tr>
<td></td>
<td>Equipement and special Construction Techniques in Building Practice II (D)</td>
<td>L 2</td>
</tr>
<tr>
<td>M4S19: Digitalization in Facility and Real Estate Management</td>
<td>Digitalization in Facility and Real Estate Management (G)</td>
<td>L/E 4 EoT 6</td>
</tr>
</tbody>
</table>

Sum compulsory elective modules 78 32 20

explanations to Table 4:

- general: M4PX Study Focus IV, compulsory modules
  M4SXX Study Focus IV, compulsory elective modules
  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
- type of learning control: wE written examination
  oE oral examination
  EoT examination of other type
  ngA not graded accomplishment
2.2.5 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.

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

<table>
<thead>
<tr>
<th>Code</th>
<th>Name</th>
<th>Course</th>
<th>Type</th>
<th>CP</th>
<th>Name (Language)</th>
<th>Type</th>
<th>HpW / SWS</th>
<th>LC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>compulsory modules:</strong></td>
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<td></td>
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</tr>
<tr>
<td></td>
<td><strong>M5P1:</strong> Theoretical Soil Mechanics</td>
<td>6: Theoretical Soil Mechanics (G)</td>
<td>L/E</td>
<td>4</td>
<td>wE 6</td>
<td></td>
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<tr>
<td></td>
<td><strong>M5P2:</strong> Earthworks and Foundation</td>
<td>6: Foundation Types (G)</td>
<td>L/E</td>
<td>2</td>
<td>ngA 2</td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>Engineering</td>
<td>Basics in Earthworks and Embankment Dams (G)</td>
<td>L/E</td>
<td>2</td>
<td>ngA 4</td>
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<tr>
<td></td>
<td><strong>M5P3:</strong> Rock Mechanics and Tunnelling</td>
<td>6: Basics in Rock Mechanics (G)</td>
<td>L/E</td>
<td>2</td>
<td>ngA 1</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Basics in Tunnel Construction (G)</td>
<td>L/E</td>
<td>2</td>
<td>ngA 5</td>
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<tr>
<td></td>
<td><strong>M5P4:</strong> Basics in Numerical Modelling</td>
<td>6: Continuum Mechanics (G)</td>
<td>L</td>
<td>2</td>
<td>oE 3</td>
<td></td>
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<tr>
<td></td>
<td>1)</td>
<td>Numerics in Geotechnics (G)</td>
<td>L</td>
<td>2</td>
<td>oE 3</td>
<td></td>
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</tr>
<tr>
<td></td>
<td><strong>M1P1:</strong> Design and Construction of</td>
<td>6: Design and Construction of Components in Reinforced Concrete (G)</td>
<td>L/E</td>
<td>2/2</td>
<td>ngA 2</td>
<td></td>
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<tr>
<td></td>
<td>Components in Reinforced Concrete *)</td>
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<tr>
<td></td>
<td><strong>Sum compulsory modules</strong></td>
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<td></td>
<td></td>
<td></td>
<td>30</td>
<td>12</td>
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<td><strong>compulsory elective modules:</strong></td>
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<tr>
<td></td>
<td><strong>M5S01:</strong> Special Issues of Soil Mechanics</td>
<td>6: Unsaturated, Viscous and Cyclic Soil Behaviour - Theory and Element Tests (G)</td>
<td>L/E</td>
<td>2</td>
<td>oE 6</td>
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<tr>
<td></td>
<td></td>
<td>Soil Dynamics (G)</td>
<td>L/E</td>
<td>2</td>
<td></td>
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<tr>
<td></td>
<td><strong>M5S02:</strong> Ground Investigation *)</td>
<td>6: Soil Mechanical Laboratory Exercises (G)</td>
<td>E</td>
<td>2</td>
<td>oE 6</td>
<td></td>
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<td></td>
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<tr>
<td></td>
<td></td>
<td>Geomechanical Field Exercise (G)</td>
<td>E</td>
<td>2</td>
<td></td>
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</tr>
<tr>
<td></td>
<td><strong>M5S03:</strong> Applied Geotechnics *)</td>
<td>6: Foundations and Retaining Structures (G)</td>
<td>L/E</td>
<td>2</td>
<td>oE 6</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Special Foundation Engineering and Design (G)</td>
<td>L/E</td>
<td>2</td>
<td></td>
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</tr>
<tr>
<td></td>
<td><strong>M5S04:</strong> Ground Water and Earth Dams</td>
<td>6: Geotechnical Ground Water Problems (G)</td>
<td>L/E</td>
<td>2</td>
<td>oE 6</td>
<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td>Embankment Dams (Advanced) (G)</td>
<td>L/E</td>
<td>2</td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td><strong>M5S05:</strong> Rock Engineering and</td>
<td>6: Aboveground Rock Engineering (G)</td>
<td>L/E</td>
<td>2</td>
<td>wE 6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Underground Construction</td>
<td>Tunnel Construction in Soils and in Existence (G)</td>
<td>L/E</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>M5S06:</strong> Numerical Modelling in</td>
<td>6: Exercises in Numerical Modelling (G)</td>
<td>E</td>
<td>2</td>
<td>oE 6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Geotechnics</td>
<td>FEM Applications in Geotechnical Modelling (G)</td>
<td>L</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>M5S07:</strong> Geotechnical Testing and</td>
<td>6: Rock Testing (G)</td>
<td>L</td>
<td>1</td>
<td>oE 6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Measuring Technology</td>
<td>Testing in Dam and Wastefill Engineering (G)</td>
<td>L</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Geotechnical Measuring Technology (G)</td>
<td>L/E</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(continuing next page)

*) 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)

<table>
<thead>
<tr>
<th>Code</th>
<th>Name</th>
<th>Module Type</th>
<th>Cp</th>
<th>Course</th>
</tr>
</thead>
<tbody>
<tr>
<td>M5S08</td>
<td>Special Underground Engineering</td>
<td>L/E</td>
<td>2</td>
<td>Ground Improvement, Grouting and Soil Freezing (G)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Anchoring, Piling and Slurry Wall Technology (G)</td>
</tr>
<tr>
<td>M5S09</td>
<td>Environmental Geotechnics</td>
<td>L/E</td>
<td>2</td>
<td>Landfills (G)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Brownfield Sites - Investigation, Evaluation, Rehabilitation (G)</td>
</tr>
<tr>
<td>M5S10</td>
<td>Coupled Geomechanical Processes</td>
<td>L/E</td>
<td>2</td>
<td>Special Issues in Rock Mechanics ¹ (G)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Coupled Phenomena in Geomechanics ² (G)</td>
</tr>
</tbody>
</table>

**Sum compulsory elective modules**: 60

**Table 5: General explanations**

- **LC**: Learning Control
  - CP: Credit Point
  - HpW / SWS: Hours per Week / Winter Term / Summer Term
  - W / S: Winter Term / Summer Term
  - G / E: German / English

1) Module must not be selected together with module M1S32 (SF 1).
2) Course is not offered in winter term 2019/20.
2.3 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 (s. Tab. 1 - 5) 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 thematically related master degree program to be selected freely.

The module Interdisciplinary Qualifications (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 to be stored in the Campus Management System. The module selection shall be store 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.

2.4 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.

2.5 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 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 an 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). If failing a written repeat examination a specific oral repeat examination can be taken. This is part of the repeat examination and will not be evaluated independently. After such 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 a specific 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 oder der 'Fachschaft' (student council).

2.6 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' - reconciliation 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.

2.7 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).

2.8 Admission, preparation and completion of the master's thesis

The Master's Thesis has to be prepared usually in semester 4 in one of the selected study focuses (comp. also ER/SPO § 14). The topic of the master's 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's 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's thesis who have 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 supervisor initiates that the master's thesis will be uploaded to the campus management system. After notification via e-mail the master's thesis has to be registered online at the portal Campus Management for Students. The admission is made after verification of the required prerequisites and eventual further conditions. These steps have to be completed before starting the thesis (date of beginning).

The duration of preparation is six months. The master's 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's thesis before beginning the thesis project.

2.9 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") 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 be 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"). This applies also to additional accomplishments which were recognized by the examination committee.
3 Further information

3.1 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.

3.2 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.

3.3 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. Chapt. Current changes).

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.
3.4 Contact persons

Dean of Study Affairs:
Prof. Dr. Peter Vortisch
Institute for Transport Studies, Bldg. 10.30, R. 305
consultation: on appointment
Phone: 0721/608-42255
Email: peter.vortisch@kit.edu

Study Program Coordination:
PD Dr. Ulf Mohrlok
Department of Civil Engineering, Geo and Environmental Sciences, Bldg. 10.81, R. 329
consultation: on appointment
Phone: 0721/608-46517
Email: ulf.mohrlok@kit.edu

Examination Committee Master:
Prof. Dr.-Ing. Kunibert Lennerts (chairperson)
Dr. Gunnar Adams (person in charge)
Institute of Technology and Management in Construction, Bldg. 50.31, R. 005 (ground floor)
consultation: Fr. 14.00 – 15.00 h
Phone: 0721/608-46008
Email: pam@bgu.kit.edu
Web: https://www.tmb.kit.edu/PAM.php

Students’ Advisory Service:
Dr.-Ing. Harald Schneider
Institute of Technology and Management in Construction, Bldg. 50.31, R. 008 (ground floor)
consultation: on appointment
Phone: 0721/608-43881
Email: harald.schneider@kit.edu

Study Program Service ('Studiengangservice Bau-Geo-Umwelt'):
Department of Civil Engineering, Geo and Environmental Sciences, Bldg. 10.81, R. 312
Email: studiengangservice@bgu.kit.edu
Web: http://www.bgu.kit.edu/studiengangservice.php

Fachschaft:
Students in Civil Engineering
Bldg. 10.81 (Altes Bauing. Geb.), R. 317.1 (3rd floor)
consultation: s. http://www.fs-bau.kit.edu
Phone: 0721/608-43895
Email: fsbau@lists.kit.edu
Web: http://www.fs-bau.kit.edu

3.5 Abbreviations

<table>
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<tr>
<th>Abbreviation</th>
<th>English</th>
<th>German</th>
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<tr>
<td>LP/CP</td>
<td>credit points</td>
<td>Leistungspunkte</td>
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<td>LV</td>
<td>course</td>
<td>Lehrveranstaltung</td>
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<td>Pj</td>
<td>project</td>
<td>Projekt</td>
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<td>seminar / summer term</td>
<td>Seminar / Sommersemester</td>
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<td>ER/SPO</td>
<td>examination regulations</td>
<td>Studien- und Prüfungsordnung</td>
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<td>ÜQ</td>
<td>Interdisciplinary Qualifications</td>
<td>Überfachliche Qualifikationen</td>
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<td>HpW/SWS</td>
<td>contact hour per week</td>
<td>Semesterwochenstunde</td>
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<td>exercise</td>
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<td>lecture</td>
<td>Vorlesung</td>
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<td>W</td>
<td>winter term</td>
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4 Current changes

In the following, the important changes are listed as from winter term 2019/20. Although this process was done with great care, other/minor changes may exist.

modules not offered any more as from winter term 2019/20:
- Contact Mechanics - Fundamentals and Basics [bauiM1S35-KONTMECH-BASICS]
- Contact Mechanics - Computational Algorithms in a geometrically exact Form [bauiM1S36-KONTMECH-ALGOR]
- Process Engineering in Wastewater Treatment [bauiM2S43-SW10]
- Aquatic Ecosystems [bauiM2S06-HY6]

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]
- Digital Planning and Building Information Modeling [bauiM1S42-DIGIPLAN]
- Wastewater Treatment Technologies [bauiM2S43-SW10], replaces module Process Engineering in Wastewater Treatment [bauiM2S43-SW10]
- Introduction to Environmental Data Analysis and Statistical Learning [bauiM2S44-ENVDAT]

changes of the courses assigned to the modules as from winter term 2019/20:
- Interaction Flow - Building Structure [bauiM2S36-SM2]:
  The course Interaction Flow - Hydraulic Structures (6221903), 2 HpW / SWS, will be offered in English.
- Hydraulic Structures [bauiM2S36-WB9]:
  The course Interaction Flow - Hydraulic Structures (6221903), 2 HpW / SWS, will be offered in English.
- Experimental Hydraulics and Measuring Techniques [bauiM2S37-WB10]:
  The course Flow Measurement Techniques (6221907), 2 HpW / SWS, will be offered in English.

changed examinations and not graded accomplishments as from winter term 2019/20:
- CPs are assigned to all not graded accomplishments. For that, the CPs 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.
- Interaction Flow - Building Structure [bauiM2S36-SM2]:
  The partial examination Interaction Flow - Hydraulic Structures is a written examination.
- Hydraulic Structures [bauiM2S36-WB9]:
  The partial examination Interaction Flow - Hydraulic Structures is a written examination.
- 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.
- 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.
5 Modules

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

Responsible: Prof. Dr.-Ing. Lothar Stempniewski
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: Study Focus I / Structural Engineering (Pflichtmodule)
Study Focus I / Geotechnical Engineering (Wahlpflichtmodule)
Subject-Specific Supplements
Study Focus II / Structural Engineering (Pflichtmodule)
Study Focus II / Geotechnical Engineering (Wahlpflichtmodule)

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Mandatory

| T-BGU-100170 | Student Research Project 'Reinforced Concrete' | 2 CR | Stempniewski |
| T-BGU-100015 | Design and Construction of Components in Reinforced Concrete | 4 CR | Stempniewski |

Competence Certificate

- ‘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’

Competence Goal

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.

Module grade calculation

grade of module is grade of the exam

Prerequisites

none

Content

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

Recommendation

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

Annotation

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 student research project: 60 h
- examination preparation: 30 h

total: 180 h

Literature

lecture notes
Module: Steel and Composite Structures (bauiM1P2-STAHLBAU) [M-BGU-100034]

Responsible: Prof. Dr.-Ing. Thomas Ummenhofer
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of:
- Study Focus I / Structural Engineering (Pflichtmodule)
- Subject-Specific Supplements
- Study Focus II / Structural Engineering (Pflichtmodule)

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Competence Certificate
- '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'

Competence Goal
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.

Module grade calculation
grade of the module is grade of the exam

Prerequisites
none

Content
- basics of steel composite structures
- light-weight steel construction
- fire protection in steel constructions
- the theory of torsion

Recommendation
lecture Basics in Steel Structures (6200504)

Annotation
none

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
Literature
Module: Surface Structures and Dynamics of Structures (bauM1P3-FTW-BD) [M-BGU-100035]

Responsible: Prof. Dr.-Ing. Werner Wagner

Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences

Part of:
- Study Focus I / Structural Engineering (Pflichtmodule)
- Subject-Specific Supplements
- Study Focus II / Structural Engineering (Pflichtmodule)

Credits: 6
Recurrence: Each winter term
Duration: 1 term
Language: German
Level: 4
Version: 3

Mandatory

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<td>T-BGU-107819</td>
<td>Student Research Project 'Dynamics of Structures'</td>
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Competence Certificate

- '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'

Competence Goal

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.

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

Prerequisites
none

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.
Recommendation
lectures in Structural Analysis I+II (6200401, 6200501);
laboratory course Dynamics of Structures (6215905) in addition to the lecture Dynamics of Structures (6215701)

Annotation
none

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

Literature
Surface Structures:
lecture notes Flächentragwerke

Dynamics of Structures:
lecture notes: P. Vielsack: Grundlagen der Baudynamik
5.4 Module: Bracing and Stability in Reinforced Concrete (bauiM1S01-STABISTB) [M-BGU-100003]

**Responsible:** Prof. Dr.-Ing. Lothar Stempniewski

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:**
- Study Focus I / Structural Engineering (Wahlpflichtmodule)
- Subject-Specific Supplements
- Study Focus II / Structural Engineering (Wahlpflichtmodule)

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**Mandatory**

T-BGU-100018 Bracing and Stability in Reinforced Concrete 6 CR Stempniewski

**Competence Certificate**

- 'Teilleistung' T-BGU-100018 with written examination according to § 4 Par. 2 No. 1

**Competence Goal**

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.

**Module grade calculation**

grade of the module is grade of the exam

**Prerequisites**

none

**Content**

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

**Recommendation**

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

**Annotation**

none

**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

**Literature**

lecture notes
5.5 Module: Basics of Prestressed Concrete (bauIM1S02-GDLSPANNB) [M-BGU-100036]

**Responsible:** Prof. Dr.-Ing. Lothar Stempniewski

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:**
- Study Focus I / Structural Engineering (Wahlpflichtmodule)
- Subject-Specific Supplements
- Study Focus II / Structural Engineering (Wahlpflichtmodule)

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**Mandatory**

| T-BGU-100019 | Basics of Prestressed Concrete | 6 CR | Stempniewski |

**Competence Certificate**

- "Teilleistung" T-BGU-100019 with written examination according to § 4 Par. 2 No. 1

Details about the learning control see at the 'Teilleistung'

**Competence Goal**

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.

**Module grade calculation**

Grade of the module is grade of the exam

**Prerequisites**

none

**Content**

- Types and systems for prestressing
- Loss of prestressing forces
- Proof in ultimate limit state and in serviceability limit state

**Recommendation**

Module Design and Construction of Components in Reinforced Concrete [bauIM1P1-BEMISTB]

**Annotation**

none

**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

**Literature**

Lecture notes
5.6 Module: Solid Construction Bridges (bauiM1S03-MASSBRUE) [M-BGU-100037]

**Responsible:** Prof. Dr.-Ing. Lothar Stempniewski

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:**
- Study Focus I / Structural Engineering (Wahlpflichtmodule)
- Subject-Specific Supplements
- Study Focus II / Structural Engineering (Wahlpflichtmodule)

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**Mandatory**

| T-BGU-100020 | Solid Construction Bridges | 6 CR | Stempniewski |

**Competence Certificate**

- “Teilleistung” T-BGU-100020 with written examination according to § 4 Par. 2 No. 1

**Competence Goal**

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.

**Module grade calculation**

grade of the module is grade of the exam

**Prerequisites**

none

**Content**

- construction methods, production and impacts
- proof in ultimate limit state and in serviceability limit state
- types of supports

**Recommendation**

module Basics of Prestressed Concrete [bauiM1S02-GDLSPANNB]

**Annotation**

none

**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

**Literature**

lecture notes
5.7 Module: Applied Dynamics of Structures (bauIM1S04-BAUDYN) [M-BGU-100038]

**Responsible:** Prof. Dr.-Ing. Lothar Stempniewski

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:**
- Study Focus I / Structural Engineering (Wahlpflichtmodule)
- Subject-Specific Supplements
- Study Focus II / Structural Engineering (Wahlpflichtmodule)

**Credits:** 6

**Recurrence:** Each summer term

**Duration:** 2 term

**Language:** German

**Level:** 4

**Version:** 1

**Mandatory**

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**Competence Certificate**

- "Teilleistung" T-BGU-100021 with oral examination according to § 4 Par. 2 No. 2

**Details about the learning control see at the 'Teilleistung'**

**Competence Goal**

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.

**Module grade calculation**

grade of the module is grade of the exam

**Prerequisites**

none

**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

**Recommendation**

none

**Annotation**

none

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

**Responsible:** Prof. Dr.-Ing. Lothar Stempniewski

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:**
- Study Focus I / Structural Engineering (Wahlpflichtmodule)
- Subject-Specific Supplements
- Study Focus II / Structural Engineering (Wahlpflichtmodule)

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**Mandatory**

| T-BGU-100022 | Anchorage in Concrete | 6 CR | Stempniewski |

**Competence Certificate**
- 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’

**Competence Goal**
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.

**Module grade calculation**
grade of the module is grade of the exam

**Prerequisites**
none

**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.

**Recommendation**
none

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

**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

**Literature**
Eligeghausen, Mallée: 'Befestigungstechnik im Beton- und Mauerwerksbau'
Module: Material Science, Welding and Fatigue (bauM1S06-SCHWEISSEN) [M-BGU-100039]

Responsible: Dr. Peter Knödel
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of:
- Study Focus I / Structural Engineering (Wahlpflichtmodule)
- Subject-Specific Supplements
- Study Focus II / Structural Engineering (Wahlpflichtmodule)

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Knödel

Competence Certificate
- "Teilleistung" T-BGU-100023 with written examination according to § 4 Par. 2 No. 1
details about the learning control see at the 'Teilleistung'

Competence Goal
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.

Module grade calculation
grade of the module is grade of the exam

Prerequisites
none

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

Recommendation
courses Theory of Building Materials (6200206), Basics in Steel Structures (6200504)

Annotation
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
Literature
lecture accompanying documents
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
Module: Construction of Steel and Composite Bridges (bauIM1S07- STAHLBRÜ) [M-BGU-100040]

Responsible: Prof. Dr.-Ing. Thomas Ummenhofer
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of:
- Study Focus I / Structural Engineering (Wahlpflichtmodule)
- Subject-Specific Supplements
- Study Focus II / Structural Engineering (Wahlpflichtmodule)

Credits: 6
Recurrence: Each summer term
Duration: 1 term
Language: German
Level: 4
Version: 1

Mandatory
T-BGU-100024 | Construction of Steel and Composite Bridges | 6 CR | Ummenhofer

Competence Certificate
- "Teilleistung" T-BGU-100024 with written examination according to § 4 Par. 2 No. 1
- details about the learning control see at the 'Teilleistung'

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

Module grade calculation
grade of the module is grade of the exam

Prerequisites
none

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

Recommendation
course Basics in Steel Structures (6200504), module Steel and Composite Structures [bauIM1P2-STAHLBAU]

Annotation
none

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
Literature

lecture accompanying documents


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

**Responsible:** Dr.-Ing. Stefan Herion

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:**
- Study Focus I / Structural Engineering (Wahlpflichtmodule)
- Subject-Specific Supplements
- Study Focus II / Structural Engineering (Wahlpflichtmodule)

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**Mandatory**

| T-BGU-100086 | Hollow Section Structures | 6 CR | Herion |

**Competence Certificate**

- "Teilleistung" T-BGU-100086 with oral examination according to § 4 Par. 2 No. 2
- details about the learning control see at the 'Teilleistung'

**Competence Goal**
The students can design and construct predominantly static and non predominantly static stressed constructions made of hollow sections considering their connections.

**Module grade calculation**
grade of the module is grade of the exam

**Prerequisites**
none

**Content**

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

**Recommendation**
course Basics in Steel Structures (6200504)

**Annotation**
none

**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

**Literature**
lecture notes: 'Hohlprofilkonstruktionen', Karlsruher Institut für Technologie (KIT), Versuchsanstalt für Stahl, Holz und Steine
Module: Glass, Plastic and Cable Structures (bauiM1S09-GlaKunSe) [M-BGU-100041]

Responsible: Dr.-Ing. Daniel Ruff
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: Study Focus I / Structural Engineering (Wahlpflichtmodule)
Subject-Specific Supplements
Study Focus II / Structural Engineering (Wahlpflichtmodule)

Credits: 6
Recurrence: Each winter term
Duration: 1 term
Language: German
Level: 4
Version: 1

Mandatory

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Competence Certificate
- "Teilleistung" T-BGU-100025 with oral examination according to § 4 Par. 2 No. 2

details about the learning control see at the 'Teilleistung'

Competence Goal
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).

Module grade calculation
grade of the module is grade of the exam

Prerequisites
none

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

Recommendation
course Basics in Steel Structures (6200504)

Annotation
none
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

Literature
lecture accompanying documents
Module: Structures in Steel and Timber (bauiM1S10-BAUING-TSH) [M-BGU-100042]

Responsible: Prof. Dr.-Ing. Thomas Ummenhofer
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: Study Focus I / Structural Engineering (Wahlpflichtmodule) (Usage until 3/31/2020)
Study Focus II / Structural Engineering (Wahlpflichtmodule) (Usage until 3/31/2020)

Credits 6
Recurrence Each winter term
Duration 1 term
Language German
Level 4
Version 2

Mandatory

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<td>T-BGU-106799</td>
<td>Structures in Timber</td>
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Competence Certificate
- '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'

Competence Goal
The students can name typical supporting structures for building construction (of steel or 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.

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

Prerequisites
none

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

Recommendation
course Basics in Steel Structures (6200504), modules Steel and Composite Structures [bauiM1P2-STAHLBAU], Timber Structures [bauiM1S12-HB]

Annotation
IMPORTANT:
The module will be offered in this form in winter term 2019/20 for the last time. It will be replaced by a new module offer.
**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

**Literature**
lecture accompanying documents
5.14 Module: Building Preservation of Steel and Timber Structures (bauiM1S11-BAUING-BSH) [M-BGU-100043]

**Responsible:** Dr.-Ing. Matthias Frese  
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:**  
- Study Focus I / Structural Engineering (Wahlpflichtmodule)  
- Subject-Specific Supplements  
- Study Focus II / Structural Engineering (Wahlpflichtmodule)

**Mandatory**

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**Courses:**
- T-BGU-100027 Building Preservation of Steel and Timber Structures [6 CR | Frese, Ummenhofer]

**Competence Certificate**
- ‘Teilleistung’ T-BGU-100027 with written examination according to § 4 Par. 2 No. 1
- Details about the learning control see at the ‘Teilleistung’

**Competence Goal**
- 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 remaining 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.

**Module grade calculation**
- Grade of the module is grade of the exam

**Prerequisites**
- None

**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

**Recommendation**
- Participation in module Timber Structures [bauiM1S12-BAUING-HB]

**Annotation**
- None

**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
Literature
lecture accompanying documents
5.15 Module: Timber Structures (bauiM1S12-BAUING-HB) [M-BGU-100044]

Responsible: Prof. Dr.-Ing. Hans Joachim Blaß
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: Study Focus I / Structural Engineering (Wahlpflichtmodule)
           Subject-Specific Supplements
           Study Focus II / Structural Engineering (Wahlpflichtmodule)

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Competence Certificate
- "Teilleistung" T-BGU-100028 with written examination according to § 4 Par. 2 No. 1

details about the learning control see at the 'Teilleistung'

Competence Goal
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.

Module grade calculation
grade of the module is grade of the exam

Prerequisites
none

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

Recommendation
none

Annotation
none

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

Literature
Blaß, H.J.; Görlacher, R.; Steck, G. (Ed.) Holzbauwerke STEP 1 - Bemessung und Baustoffe. Fachverlag Holz, Düsseldorf, 1995 (ISSN-Nr. 04462114)
5.16 Module: Timber and Wood-Based Materials (bauIM1S13-BAUING-HHW) [M-BGU-100045]

**Responsible:** Prof. Dr.-Ing. Hans Joachim Blaß

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:**
- Study Focus I / Structural Engineering (Wahlpflichtmodule)
- Subject-Specific Supplements
- Study Focus II / Structural Engineering (Wahlpflichtmodule)

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**Mandatory**

| T-BGU-100029 | Timber and Wood-Based Materials | 6 CR | Blaß, Sandhaas |

**Competence Certificate**

- ‘Teilleistung’ T-BGU-100029 with oral examination according to § 4 Par. 2 No. 2

**details about the learning control see at the 'Teilleistung'

**Competence Goal**

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.

**Module grade calculation**

grade of the module is grade of the exam

**Prerequisites**

none

**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

**Recommendation**

module Timber Structures [bauIM1S12-HB]

**Annotation**

none
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

Literature

lecture notes „Holz und Holzwerkstoffe“, Lehrstuhl für Holzbau und Baukonstruktionen, Karlsruher Institut für Technologie (in German)
5.17 Module: Non-linear Analysis of Beam Structures (bauiM1S14-NILI-STAB) [M-BGU-100046]

**Responsible:** Prof. Dr.-Ing. Werner Wagner

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:**
- Study Focus I / Structural Engineering (Wahlpflichtmodule)
- Subject-Specific Supplements
- Study Focus II / Structural Engineering (Wahlpflichtmodule)

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**Mandatory**

| T-BGU-100030 | Non-linear Analysis of Beam Structures | 6 CR | Wagner |

**Competence Certificate**

- "Teilleistung" T-BGU-100030 with written examination according to § 4 Par. 2 No. 1

**Competence Goal**

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.

**Module grade calculation**

Grade of the module is grade of the exam

**Prerequisites**

None

**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

**Recommendation**

Courses Structural Analysis I+II (6200401, 6200501)

**Annotation**

None

**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

**Literature**

Lecture notes 'Nichtlineare Modellierung von Stabtragwerken'
### 5.18 Module: Computational Analysis of Structures (bauM1S15-CTWM) [M-BGU-100047]

**Responsible:** Prof. Dr.-Ing. Werner Wagner  
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:** Study Focus I / Structural Engineering (Wahlpflichtmodule)  
**Subject-Specific Supplements**  
Study Focus II / Structural Engineering (Wahlpflichtmodule)  

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**Mandatory**
- **T-BGU-100174**  
  Student Research Project 'Computational Analysis of Structures'  
  2 CR  
  Wagner
- **T-BGU-100031**  
  Computational Analysis of Structures  
  4 CR  
  Wagner

**Competence Certificate**
- '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'

**Competence Goal**
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.

**Module grade calculation**
grade of the module is grade of the exam

**Prerequisites**
none

**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

**Recommendation**
module Surface Structures and Dynamics of Structures [bauM1P3-FTW-BD]

**Annotation**
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 student research project (exam prerequisite): 50 h  
- examination preparation: 40 h

total: 180 h
Literature

lecture notes 'Computergestützte Tragwerksmodellierung'
5.19 Module: FE-Applications in Practical Engineering (bauiM1S16-FE-PRAXIS) [M-BGU-100048]

Responsible: Prof. Dr.-Ing. Werner Wagner
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of:
- Study Focus I / Structural Engineering (Wahlpflichtmodule)
- Subject-Specific Supplements
- Study Focus II / Structural Engineering (Wahlpflichtmodule)

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Mandatory

T-BGU-100032 FE-Applications in Practical Engineering 6 CR Wagner

Competence Certificate

- 'Teilleistung' T-BGU-100032 with oral examination according to § 4 Par. 2 No. 2
- Details about the learning control see at the 'Teilleistung'

Competence Goal

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

Module grade calculation

Grade of the module is grade of the exam

Prerequisites

None

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.

Recommendation

Module Computational Analysis of Structures [bauiM1S15-CTWM]

Annotation

None

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

Literature

Lecture notes Computational Analysis of Structures
5.20 Module: Shell Structures and Stability of Structures (bauIM1S17-STABISHELL) [M-BGU-100049]

**Responsible:** Prof. Dr.-Ing. Werner Wagner

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:** Study Focus I / Structural Engineering (Wahlpflichtmodule)
Subject-Specific Supplements
Study Focus II / Structural Engineering (Wahlpflichtmodule)

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**Mandatory**

| T-BGU-100254 | Student Research Project ‘Shell Structures and Stability of Structures’ | 2 CR | Wagner |
| T-BGU-100033 | Shell Structures and Stability of Structures | 4 CR | Wagner |

**Competence Certificate**

- ‘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’

**Competence Goal**

The students can formulate and apply analytical and computational modeling of shell structures and of stability problems.

**Module grade calculation**

grade of the module is grade of the exam

**Prerequisites**

none

**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

**Recommendation**

course Surface Structures (6214701)

**Annotation**

none
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

Literature
lecture notes Schalentragwerke
lecture notes Stabilität der Tragwerke
5 MODULES

Module: Numerical Methods in Structural Analysis (bauiM1S18-FEM-BS) [M-BGU-100050]

5.21 Module: Numerical Methods in Structural Analysis (bauiM1S18-FEM-BS) [M-BGU-100050]

Responsible: Prof. Dr.-Ing. Werner Wagner
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of:
- Study Focus I / Structural Engineering (Wahlpflichtmodule)
- Subject-Specific Supplements
- Study Focus II / Structural Engineering (Wahlpflichtmodule)

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**Mandatory**

T-BGU-100034 Numerical Methods in Structural Analysis 6 CR Wagner

**Competence Certificate**

- 'Teilleistung' T-BGU-100034 with oral examination according to § 4 Par. 2 No. 2
- details about the learning control see at the 'Teilleistung'

**Competence Goal**

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.

**Module grade calculation**

grade of the module is grade of the exam

**Prerequisites**

none

**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

**Recommendation**

module Computational Analysis of Structures [bauiM1S15-CTWM]

**Annotation**

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

**Literature**

lecture notes Computational Analysis of Structures
5.22 Module: Non-linear Analysis of Surface Structures (bauiM1S19-NILI-FTW) [M-BGU-100051]

Responsible: Prof. Dr.-Ing. Werner Wagner
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences

Part of:
- Study Focus I / Structural Engineering (Wahlpflichtmodule)
- Subject-Specific Supplements
- Study Focus II / Structural Engineering (Wahlpflichtmodule)

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Competence Certificate
- "Teilleistung" T-BGU-100035 with oral examination according to § 4 Par. 2 No. 2
  details about the learning control see at the 'Teilleistung'

Competence Goal
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.

Module grade calculation
grade of the module is grade of the exam

Prerequisites
none

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

Recommendation
course Surface Structures (6214701), module Computational Analysis of Structures [bauiM1S15-CTWM]

Annotation
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

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

Responsible: Prof. Dr.-Ing. Peter Betsch
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences

Part of:
- Study Focus I / Structural Engineering (Wahlpflichtmodule)
- Subject-Specific Supplements
- Study Focus II / Structural Engineering (Wahlpflichtmodule)

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Mandatory

| T-BGU-109908 | Homework 'Basics of Finite Elements' | 1 CR | Betsch |
| T-BGU-100047 | Basics of Finite Elements | 5 CR | Betsch |

Competence Certificate
- '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'

Competence Goal
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.

Module grade calculation
grade of the module is grade of the exam

Prerequisites
none

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.

Recommendation
none

Annotation
none

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

**Responsible:** Prof. Dr.-Ing. Thomas Seelig  
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:**  
- Study Focus I / Structural Engineering (Wahlpflichtmodule)  
- Subject-Specific Supplements  
- Study Focus II / Structural Engineering (Wahlpflichtmodule)

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**Mandatory**

| T-BGU-100087 | Fracture and Damage Mechanics | 6 CR | Seelig |

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

**Competence Goal**
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.

**Module grade calculation**
grade of the module is grade of the exam

**Prerequisites**
none

**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)

**Recommendation**
course Introduction to Continuum Mechanics (6200607)

**Annotation**
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
Literature

5.25 Module: Material Models in Solid Mechanics (bauIM1S22-MATTHEO) [M-BGU-100054]

Responsible: Prof. Dr.-Ing. Thomas Seelig
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: Study Focus I / Structural Engineering (Wahlpflichtmodule)
Subject-Specific Supplements
Study Focus II / Structural Engineering (Wahlpflichtmodule)

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Mandatory
T-BGU-100044 Material Models in Solid Mechanics

Competence Certificate
- "Teilleistung" T-BGU-100044 with oral examination according to § 4 Par. 2 No. 2
details about the learning control see at the 'Teilleistung'

Competence Goal
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.

Module grade calculation
grade of the module is grade of the exam

Prerequisites
none

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)

Recommendation
course Introduction to Continuum Mechanics (6200607)

Annotation
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


**Literature**

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

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

**Responsible:** Prof. Dr.-Ing. Frank Dehn

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:**
- Study Focus I / Structural Engineering (Wahlpflichtmodule)
- Subject-Specific Supplements
- Study Focus II / Structural Engineering (Wahlpflichtmodule)

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**Mandatory**

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**Competence Certificate**

- 'Teilleistung' T-BGU-100036 with oral examination according to § 4 Par. 2 No. 2
- details about the learning control see at the 'Teilleistung'

**Competence Goal**

see German version

**Module grade calculation**

grade of the module is grade of the exam

**Prerequisites**

none

**Content**

see German version

**Recommendation**

none

**Annotation**

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
Module: Durability and Service Life Design (bauM1S25-DAUERLEB) [M-BGU-100057]

Responsible: Dr.-Ing. Michael Vogel
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of:
  - Study Focus I / Structural Engineering (Wahlpflichtmodule)
  - Study Focus II / Structural Engineering (Wahlpflichtmodule)

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Competence Certificate
- "Teilleistung" T-BGU-100037 with oral examination according to § 4 Par. 2 No. 2
  details about the learning control see at the 'Teilleistung'

Competence Goal
see German version

Module grade calculation
grade of the module is grade of the exam

Prerequisites
none

Content
see German version

Recommendation
course Building Chemistry (6200108)

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

**Responsible:** Dr.-Ing. Engin Kotan  
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:**  
- Study Focus I / Structural Engineering (Wahlpflichtmodule)  
- Subject-Specific Supplements  
- Study Focus II / Structural Engineering (Wahlpflichtmodule)

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#### Mandatory

| T-BGU-100175 | Student Research Project 'Building Preservation of Concrete and Masonry Constructions' | 1 CR | Kotan |
| T-BGU-100038 | Building Preservation of Concrete and Masonry Constructions | 5 CR | Kotan |

#### Competence Certificate

- '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'

#### Competence Goal

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.

#### Module grade calculation

grade of the module is grade of the exam

#### Prerequisites

none

#### 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.

#### Recommendation

none

#### Annotation

none
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

Literature

Hand-outs and (selection):

### Module: Building Physics I (bauiM1S27-BAUPH-I) [MBGU-103950]

**Responsible:** Dr.-Ing. Engin Kotan  
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:**  
- Study Focus I / Structural Engineering (Wahlpflichtmodule)  
- Subject-Specific Supplements  
- Study Focus II / Structural Engineering (Wahlpflichtmodule)

**Credits**: 6  
**Recurrence**: Each winter term  
**Duration**: 1 term  
**Language**: German  
**Level**: 4  
**Version**: 1

#### Mandatory

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<td>T-BGU-100040</td>
<td>Building Technology</td>
<td>3 CR</td>
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**Competence Certificate**  
- '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'  

**Competence Goal**  
see German version

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

**Prerequisites**  
none

**Content**  
see German version

**Recommendation**  
none

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

**total: 180 h**
### 5.30 Module: Building Physics II (bauIM1S28-BAUPH-II) [M-BGU-100060]

**Responsible:** Dr.-Ing. Engin Kotan  
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:**  
- Study Focus I / Structural Engineering (Wahlpflichtmodule)  
- Subject-Specific Supplements  
- Study Focus II / Structural Engineering (Wahlpflichtmodule)

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**Mandatory**

| T-BGU-109946 | Homework 'Practical Noise Control' | 1 CR | Grigo |
| T-BGU-108024 | Practical Noise Control            | 2 CR | Grigo |
| T-BGU-100042 | Practical Fire Protection          | 3 CR | Schröder |

**Competence Certificate**

- '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'

**Competence Goal**

see German version

**Module grade calculation**

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

**Prerequisites**

none

**Content**

see German version

**Recommendation**

none

**Annotation**

none

**Workload**

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

- Practical Noise Control lecture: 30 h
- Practical Fire Protection lecture: 30 h
- 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
Module: Materials Testing and Measuring Techniques (bauiM1S29-MATPRÜF) [M-BGU-100061]

Responsible: Dr.-Ing. Nico Herrmann
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: Study Focus I / Structural Engineering (Wahlpflichtmodule)
Subject-Specific Supplements
Study Focus II / Structural Engineering (Wahlpflichtmodule)

Mandatory

T-BGU-100043 Materials Testing and Measuring Techniques 6 CR Herrmann

Competence Certificate
- "Teilleistung" T-BGU-100043 with oral examination according to § 4 Par. 2 No. 2
details about the learning control see at the 'Teilleistung'

Competence Goal
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.

Module grade calculation
grade of the module is grade of the exam

Prerequisites
none

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

Recommendation
none

Annotation
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
Module: Continuum Mechanics of Heterogeneous Solids (bauIM1S32-KONTIMECH) [M-BGU-100064]

**Responsible:** Prof. Dr.-Ing. Thomas Seelig

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:**
- Study Focus I / Structural Engineering (Wahlpflichtmodule)
- Subject-Specific Supplements
- Study Focus II / Structural Engineering (Wahlpflichtmodule)

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<td>German</td>
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**Mandatory**

- T-BGU-106196 Continuum Mechanics 3 CR Franke
- T-BGU-108879 Micromechanics of Heterogeneous Solids 3 CR Schmidt

**Competence Certificate**
- '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'

**Competence Goal**
see German version

**Module grade calculation**
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 have to be fulfilled:

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

**Content**
see German version

**Recommendation**
one

**Annotation**
one

**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
Literature
Seelig, T.: Kontinuumsmechanik. Skript zur Vorlesung

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

Responsible: Prof. Dr.-Ing. Peter Betsch
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: Study Focus I / Structural Engineering (Wahlpflichtmodule)
Subject-Specific Supplements
Study Focus II / Structural Engineering (Wahlpflichtmodule)

Credits
6
Recurrence
Each summer term
Language
German
Level
4
Version
1

Mandatory
T-BGU-100998 Finite Elements in Solid Mechanics 6 CR Betsch

Competence Certificate
- 'Teilleistung' T-BGU-100998 with oral examination according to § 4 Par. 2 No. 2

details about the learning control see at the 'Teilleistung'

Competence Goal
see German version

Module grade calculation
grade of the module is grade of the exam

Prerequisites
none

Content
see German version

Recommendation
module 'Basics in Finite Elements' [bauiM1S20-GRUNDFE]

Annotation
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
### Module: Numerical Structural Dynamics (bauiM1S38-NUMSTRDYN) [M-BGU-100579]

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**Responsible:** Prof. Dr.-Ing. Peter Betsch  
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:**  
- Study Focus I / Structural Engineering (Wahlpflichtmodule)  
- Subject-Specific Supplements  
- Study Focus II / Structural Engineering (Wahlpflichtmodule)

**Mandatory**

| T-BGU-100999 | Computational Structural Dynamics | 6 CR | Betsch |

**Competence Certificate**
- ‘Teilleistung’ T-BGU-100999 with oral examination according to § 4 Par. 2 No. 2
- Details about the learning control see at the ‘Teilleistung’

**Competence Goal**
see German version

**Module grade calculation**
grade of the module is grade of the exam

**Prerequisites**
one

**Content**
see German version

**Recommendation**
module Basics in Finite Elements [bauiM1S20-GRUNDFE]

**Annotation**
one

**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
Module: Tank Construction (bauIM1S39-BEHBAU) [M-BGU-100580]

Responsible: Dr. Peter Knödel
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of:
- Study Focus I / Structural Engineering (Wahlpflichtmodule)
- Subject-Specific Supplements
- Study Focus II / Structural Engineering (Wahlpflichtmodule)

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Mandatory

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Competence Certificate
- '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'

Competence Goal
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 interdisciplinarily at the interface to plant engineering and construction.
- They can compile complex technical facts and impart them to a plenary assembly.

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

Prerequisites
none

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

Recommendation
The contents of the lecture Basics in Steel Structures (6200504) are required. Contents of the modules Surface Structures and Dynamics of Structures [bauIM1P3-FTW-BD] as well as Steel and Composite Structures [bauIM1P2-STABISTB] are recommended.

Annotation
none
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

Literature

lecture notes
DIN EN 1993-4-1: Bemessung und Konstruktion von Stahlbauten - Teil 4-1: Silos.
Module: Modeling in Solid Mechanics (bauiM1S40-MODFEST) [M-BGU-101673]

Responsible: Prof. Dr.-Ing. Peter Betsch
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: Study Focus I / Structural Engineering (Wahlpflichtmodule)
          Subject-Specific Supplements
          Study Focus II / Structural Engineering (Wahlpflichtmodule)

Credits: 6
Recurrence: Each summer term
Language: German
Level: 4
Version: 2

Mandatory
T-BGU-103223  Modeling Techniques in Solid Mechanics  6 CR  Konyukhov

Competence Certificate
- ‘Teilleistung’ T-BGU-103223 with oral examination according to § 4 Par. 2 No. 2
  details about the learning control see at the 'Teilleistung'

Competence Goal
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.

Module grade calculation
grade of the module is grade of the exam

Prerequisites
none

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.

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

Annotation
none
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

Literature
M 5.37 Module: Contact Mechanics (bauiM1S41-KONTMECH) [M-BGU-104916]

Responsible: Marlon Franke
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of:
- Study Focus I / Structural Engineering (Wahlpflichtmodule) (Usage from 4/1/2019)
- Subject-Specific Supplements (Usage from 4/1/2019)
- Study Focus II / Structural Engineering (Wahlpflichtmodule) (Usage from 4/1/2019)

Credits 6
Recurrence Each summer term
Language German
Level 4
Version 1

Mandatory
T-BGU-109947 Contact Mechanics 6 CR Franke

Competence Certificate
- 'Teilleistung' T-BGU-109947 with oral examination according to § 4 Par. 2 No. 2

details about the learning control see at the 'Teilleistung'

Competence Goal
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.

Module grade calculation
grade of the module is grade of the exam

Prerequisites
none

Modeled Conditions
The following conditions have to be fulfilled:

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.

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.

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

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

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
Literature
[1] Laursen: Computational Contact and Impact Mechanics
Module: Digital Planning and Building Information Modeling (bauM1S42-DIGIPLAN) [M-BGU-105135]

**Responsible:** Dr.-Ing. Tim Zinke

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:**
- Study Focus I / Structural Engineering (Wahlpflichtmodule) (Usage from 10/1/2019)
- Subject-Specific Supplements (Usage from 10/1/2019)
- Study Focus II / Structural Engineering (Wahlpflichtmodule) (Usage from 10/1/2019)

**Credits:** 6

**Recurrence:** Each winter term

**Language:** German

**Level:** 4

**Version:** 1

**Mandatory**

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**Competence Certificate**

- 'Teilleistung' T-BGU-110382 with examination of other type according to § 4 Par. 2 No. 3

details about the learning control see at the 'Teilleistung'

**Competence Goal**

see German version

**Module grade calculation**

grade of the module is grade of the exam

**Prerequisites**

none

**Content**

see German version

**Recommendation**

course Computer Aided Design (CAD) (6200520)
course Steel and Composite Structures (6212801 und 6212802)

**Annotation**

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

further information see German version

**Workload**

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

- lecture, exercise: 60 h

independent study:

- preparation and follow-up lectures/exercises, tutorials: 40 h
- project work, modeling, preparation of BIM flat pattern plan and report with presentation: 80 h

total: 180 h

**Literature**

5.39 Module: Urban Water Infrastructure and Management (bauIM2P10-URBIM) [M-BGU-103358]

Responsibility: Dr.-Ing. Stephan Fuchs
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences

Part of:
- Study Focus I / Water and Environment (Pflichtmodule)
- Study Focus I / Water and Environment (Wahlpflichtmodule)
- Subject-Specific Supplements
- Study Focus II / Water and Environment (Pflichtmodule)
- Study Focus II / Water and Environment (Wahlpflichtmodule)

Credits 6
Recurrence Each winter term
Language English
Level 4
Version 2

Mandatory
T-BGU-106600 Urban Water Infrastructure and Management 6 CR Fuchs

Competence Certificate
- 'Teilleistung' T-BGU-106600 with written examination according to § 4 Par. 2 No. 1
details about the learning control see at the 'Teilleistung'

Competence Goal
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.

Module grade calculation
grade of the module is grade of the exam

Prerequisites
none

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.

Recommendation
course Sanitary Environmental Engineering (6200603)

Annotation
keine

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
Literature
**Module: Numerical Fluid Mechanics (bauiM2P5-NUMFLMECH) [M-BGU-103375]**

**Responsible:** Prof. Dr.-Ing. Markus Uhlmann  
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:**  
- Study Focus I / Water and Environment (Pflichtmodule)  
- Study Focus I / Water and Environment (Wahlpflichtmodule)  
- Subject-Specific Supplements  
- Study Focus II / Water and Environment (Pflichtmodule)  
- Study Focus II / Water and Environment (Wahlpflichtmodule)

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**Mandatory**

| T-BGU-106758 | Numerical Fluid Mechanics | 6 CR | Uhlmann |

**Competence Certificate**  
- 'Teilleistung' T-BGU-106758 with written examination according to § 4 Par. 2 No. 1  
details about the learning control see at the 'Teilleistung'

**Competence Goal**  
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.

**Module grade calculation**  
grade of the module is grade of the exam

**Prerequisites**  
none

**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

**Recommendation**  
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)

**Annotation**  
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
Module: Hydraulic Engineering (bauIM2P6-ADVHYENG) [M-BGU-103376]

**Responsible:** Prof. Dr. Franz Nestmann

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:**
- Study Focus I / Water and Environment (Pflichtmodule)
- Study Focus I / Water and Environment (Wahlpflichtmodule)
- Subject-Specific Supplements
- Study Focus II / Water and Environment (Pflichtmodule)
- Study Focus II / Water and Environment (Wahlpflichtmodule)

**Credits:** 6

**Recurrence:** Each summer term

**Language:** English

**Level:** 4

**Version:** 1

**Mandatory**

| T-BGU-106759 | Hydraulic Engineering | 6 CR | Nestmann |

**Competence Certificate**

- "Teilleistung" T-BGU-106759 with written examination according to § 4 Par. 2 No. 1

details about the learning control see at the 'Teilleistung'

**Competence Goal**

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.

**Module grade calculation**

grade of the module is grade of the exam

**Prerequisites**

none

**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.

**Recommendation**

none

**Annotation**

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
5.42 Module: Water and Energy Cycles (bauiM2P8-WATENCYC) [M-BGU-103360]

Responsible: Prof. Dr.-Ing. Erwin Zehe
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences

Part of:
- Study Focus I / Water and Environment (Pflichtmodule)
- Study Focus I / Water and Environment (Wahlpflichtmodule)
- Subject-Specific Supplements
- Study Focus II / Water and Environment (Pflichtmodule)
- Study Focus II / Water and Environment (Wahlpflichtmodule)

Credits: 6
Recurrence: Each winter term
Language: English
Level: 4
Version: 1

Mandatory

| T-BGU-106596 | Water and Energy Cycles | 6 CR | Zehe |

Competence Certificate
- "Teilleistung" T-BGU-106596 with oral examination according to § 4 Par. 2 No. 2
- details about the learning control see at the 'Teilleistung'

Competence Goal
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.

Module grade calculation
grade of the module is grade of the exam

Prerequisites
none

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

Recommendation
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

Annotation
none
**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

**Literature**
Module: Advanced Fluid Mechanics (bauIM2P9-ADVFM) [M-BGU-103359]

Responsible: Prof. Dr. Olivier Eiff
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of:
- Study Focus I / Water and Environment (Pflichtmodule)
- Study Focus I / Water and Environment (Wahlpflichtmodule)
- Subject-Specific Supplements
- Study Focus II / Water and Environment (Pflichtmodule)
- Study Focus II / Water and Environment (Wahlpflichtmodule)

Credits: 6
Recurrence: Each summer term
Language: English
Level: 4
Version: 1

### Mandatory

| T-BGU-106612 | Advanced Fluid Mechanics | 6 CR | Eff |

### Competence Certificate
- ‘Teilleistung’ T-BGU-106612 with written examination according to § 4 Par. 2 No. 1
- details about the learning control see at the 'Teilleistung'

### Competence Goal
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.

### Module grade calculation
- grade of the module is grade of the exam

### Prerequisites
- none

### 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.

### Recommendation
- 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)

### Annotation
- none
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

Literature
5.44 Module: Management of Water Resources and River Basins (bauiM2S01-HY1) [M-BGU-103364]

Responsible: Dr.-Ing. Uwe Ehret
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: Study Focus I / Water and Environment (Wahlpflichtmodule)
Subject-Specific Supplements
Study Focus II / Water and Environment (Wahlpflichtmodule)

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Mandatory
T-BGU-106597 Management of Water Resources and River Basins 6 CR Ehret

Competence Certificate
- ‘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’

Competence Goal
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.

Module grade calculation
grade of the module is grade of the exam

Prerequisites
none

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.

Recommendation
courses Hydrology (6200513), Water Resources Management and Engineering Hydrology (6200617)

Annotation
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
Module: Subsurface Flow and Contaminant Transport (bauiM2S03-HY3) [M-BGU-103872]

**Responsible:** Prof. Dr.-Ing. Erwin Zehe

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:** Study Focus I / Water and Environment (Wahlpflichtmodule)
Subject-Specific Supplements
Study Focus II / Water and Environment (Wahlpflichtmodule)

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**Mandatory**

| T-BGU-106598 | Transport and Transformation of Contaminants in Hydrological Systems | 6 CR | Zehe |

**Competence Certificate**

- 'Teilleistung' T-BGU-106598 with oral examination according to § 4 Par. 2 No. 2
- details about the learning control see at the 'Teilleistung'

**Competence Goal**

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.

**Module grade calculation**

grade of the module is grade of the exam

**Prerequisites**

none

**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

**Recommendation**

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)

**Annotation**

This module is offered newly as from summer term 2018.
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

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

**Responsible:** Prof. Dr.-Ing. Erwin Zehe

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:**
- Study Focus I / Water and Environment (Wahlpflichtmodule)
- Subject-Specific Supplements
- Study Focus II / Water and Environment (Wahlpflichtmodule)

**Credits:** 6

**Recurrence:** Each summer term

**Language:** English

**Level:** 4

**Version:** 1

**Mandatory**

T-BGU-106605 Geostatistics

**Competence Certificate**
- 'Teilleistung' T-BGU-106605 with oral examination according to § 4 Par. 2 No. 2
- details about the learning control see at the 'Teilleistung'

**Competence Goal**

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.

**Module grade calculation**

grade of the module is grade of the exam

**Prerequisites**

none

**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

**Recommendation**

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)

**Annotation**

This module is offered newly as from summer term 2018.

**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
**Literature**

Module: Hydrological Measurements in Environmental Systems (bauiM2S05-HY5) [M-BGU-103763]

Responsible: Dr. Jan Wienhöfer
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: Study Focus I / Water and Environment (Wahlpflichtmodule)
Subject-Specific Supplements Study Focus II / Water and Environment (Wahlpflichtmodule)

Credits: 6
Recurrence: Each summer term
Language: English
Level: 4
Version: 1

Competence Certificate
- ‘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'

Competence Goal
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.

Module grade calculation
grade of the module is grade of the exam

Prerequisites
none

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

Recommendation
knowledge in hydrology

Annotation
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 Geocology.

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
Literature notes for field exercises
5.48 Module: Aquatic Ecosystems (bauiM2S06-HY6) [M-BGU-103400]

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Competence Certificate
- ‘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’

Competence Goal
see German version

Module grade calculation
grade of the module is grade of the exam

Prerequisites
none

Content
see German version

Recommendation
none

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

Responsible: Dr. Charlotte Kämpf
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: Study Focus I / Water and Environment (Wahlpflichtmodule)
Subject-Specific Supplements
Study Focus II / Water and Environment (Wahlpflichtmodule)

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Competence Certificate

- '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'

Competence Goal
(see German version)

Module grade calculation
grade of the module is grade of the exam

Prerequisites
none

Content
(see German version)

Recommendation
none

Annotation
IMPORTANT:
The module will be still offered in winter term 2019/20.

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

Literature
(see German version)
## 5.50 Module: Groundwater Management (bauiM2S08-HY8) [M-BGU-100340]

### Responsible: Dr. Ulf Mohrlok

### Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences

### Part of:
- Study Focus I / Water and Environment (Wahlpflichtmodule)
- Subject-Specific Supplements
- Study Focus II / Water and Environment (Wahlpflichtmodule)

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<td>T-BGU-100625</td>
<td>Numerical Groundwater Modeling</td>
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### Competence Certificate
- '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

### Competence Goal
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.

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

### Prerequisites
None

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

### Recommendation
Basic knowledge in fluid mechanics, hydrology, solute transport and numerical methods.

### Annotation
None

### 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
**Literature**


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

**Responsible:** Dr.-Ing. Peter Oberle

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:**
- Study Focus I / Water and Environment (Wahlpflichtmodule)
- Subject-Specific Supplements
- Study Focus II / Water and Environment (Wahlpflichtmodule)

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**Competence Certificate**
- 'Teilleistung' T-BGU-100139 with oral examination according to § 4 Par. 2 No. 2
details about the learning control see at the 'Teilleistung'

**Competence Goal**
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.

**Module grade calculation**
grade of the module is grade of the exam

**Prerequisites**
none

**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.

**Recommendation**
course Hydraulic Engineering and Water Management (6200511)

**Annotation**
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

**Literature**
Folienumdrucke;
# Module: Waterway Engineering (bauiM2S12-WB4) [M-BGU-103392]

**Responsible:** Dr.-Ing. Andreas Kron  
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:**  
- Study Focus I / Water and Environment (Wahlpflichtmodule)  
- Subject-Specific Supplements  
- Study Focus II / Water and Environment (Wahlpflichtmodule)

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## Competence Certificate

- ’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’

## Competence Goal

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.

## Module grade calculation

grade of the module is grade of the exam

## Prerequisites

none

## 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

## Recommendation

course Hydraulic Engineering and Water Management (6200511)

## Annotation

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
Module: Interaction Flow - Building Structure (bauiM2S16-SM2) [M-BGU-103897]

**Responsibility:** Prof. Dr. Olivier Eiff

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:**
- Study Focus I / Water and Environment (Wahlpflichtmodule)
- Subject-Specific Supplements
- Study Focus II / Water and Environment (Wahlpflichtmodule)

**Credits:** 6

**Recurrence:** Each winter term

**Language:** German/English

**Level:** 4

**Version:** 2

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**T-BGU-110404** Interaction Flow - Hydraulic Structures 3 CR Gebhardt

**T-BGU-103563** Building and Environmental Aerodynamics 3 CR Gromke

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**Competence Certificate**

- 'Teilleistung' T-BGU-110404 with written examination according to § 4 Par. 2 No. 1
- 'Teilleistung' T-BGU-103563 with oral examination according to § 4 Par. 2 No. 2

Details about the learning controls see at the respective 'Teilleistung'.

**Competence Goal**

The students have the competence to analyze 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.

**Module grade calculation**

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 have to be fulfilled:

1. The module **M-BGU-103389 - Hydraulic Structures** must not have been started.

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**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.

**Recommendation**

Course Hydromechanics (6200304), modules Advanced Fluid Mechanics [bauiM2P9-ADVFM], Technical Hydraulics [bauiM2S17-SM3]

**Annotation**

As of the winter term 2019/20 the course Interaction Flow - Hydraulic Structures will be offered in English with a written examination.
Workload
contact hours (1 HpW = 1 h x 15 weeks):

- Interaction Flow - Hydraulic Structure lecture/exercise: 30 h
- Building and Environmental Aerodynamics lecture, exercise: 30 h

independent study:

- preparation and follow-up lecture/exercises Interaction Flow - Hydraulic Structure: 30 h
- examination preparation Interaction Flow - Hydraulic 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

Literature

Schmaußer, G., Nölke, H., Herz, E., 2000, Stahlwasserbauten - Kommentar zur DIN 19704, Ernst und Sohn Verlag, Berlin
5.54 Module: Technical Hydraulics (bauiM2S17-SM3) [M-BGU-103385]

**Responsible:** Prof. Dr. Olivier Eiff

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:** Study Focus I / Water and Environment (Wahlpflichtmodule)

**Subject-Specific Supplements**

**Credits** 6

**Recurrence** Each summer term

**Language** German

**Level** 4

**Version** 1

**Mandatory**

| T-BGU-106770 | Technical Hydraulics | 6 CR | Eiff |

**Competence Certificate**
- *Teilleistung* T-BGU-106770 with written examination according to § 4 Par. 2 No. 1

Details about the learning control see at the 'Teilleistung'

**Competence Goal**
- see German version

**Module grade calculation**
- grade of the module is grade of the exam

**Prerequisites**
- none

**Content**
- see German version

**Recommendation**
- module Advanced Fluid Mechanics [bauiM2P9-ADVFM]

**Annotation**
- IMPORTANT:
  - The module will not be offered in summer term 2019.

**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

**Literature**
- Vorlesungsskript Rohrhydraulik, 2009
- Lang, C., Jirka, G., 2009, Einführung in die Gerinnehydraulik, Universitätsverlag Karlsruhe
Module: Environmental Fluid Mechanics (bauiM2S19-SM5) [M-BGU-103383]

**Responsible:** Prof. Dr. Olivier Eiff

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:**
- Study Focus I / Water and Environment (Wahlpflichtmodule)
- Subject-Specific Supplements
- Study Focus II / Water and Environment (Wahlpflichtmodule)

**Credits:** 6

**Recurrence:** Each winter term

**Language:** English

**Level:** 4

**Version:** 1

### Competence Certificate
- ‘Teilleistung’ T-BGU-106767 with written examination according to § 4 Par. 2 No. 1
- Details about the learning control see at the ‘Teilleistung’

### Competence Goal
- 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.

### Module grade calculation
- Grade of the module is grade of the exam

### Prerequisites
- None

### 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.

### Recommendation

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

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

**Responsible:** Prof. Dr.-Ing. Markus Uhlmann  
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:** Study Focus I / Water and Environment (Wahlpflichtmodule)  
Subject-Specific Supplements  
Study Focus II / Water and Environment (Wahlpflichtmodule)

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**Competence Certificate**
- 'Teilleistung' T-BGU-106769 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'

**Competence Goal**
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.

**Module grade calculation**
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 have to be fulfilled:

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

**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 Programming 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.

**Recommendation**
Programming skills in at least one compiler language (C,C++, FORTRAN or equivalent)

**Annotation**
none
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

Literature
T.G. Mattson, B.A. Sanders, B.L. Massingill "Patterns for Parallel Programming" Addison-Wesley, 2004.
Module: Industrial Water Management (bauiM2S29-SW6) [M-BGU-104073]

**Responsible:** Dr.-Ing. Tobias Morck

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:**
- Study Focus I / Water and Environment (Wahlpflichtmodule) (Usage from 4/1/2018)
- Subject-Specific Supplements (Usage from 4/1/2018)
- Study Focus II / Water and Environment (Wahlpflichtmodule) (Usage from 4/1/2018)

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**Competence Certificate**

- ‘Teilleistung’ T-BGU-109980 with not graded accomplishment 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’

**Competence Goal**

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.

**Module grade calculation**
grade of the module is grade of the exam

**Prerequisites**
none

**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.

**Recommendation**
course Sanitation and Environmental Engineering (6200603)

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

**Responsibility:** Prof. Dr.-Ing. Markus Uhlmann

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:** Study Focus I / Water and Environment (Wahlpflichtmodule)

Subject-Specific Supplements

- Study Focus II / Water and Environment (Wahlpflichtmodule)

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**Mandatory**

| T-BGU-103561 | Analysis of Turbulent Flows | 6 CR | Uhlmann |

**Competence Certificate**

- "Teilleistung" T-BGU-103561 with oral examination according to § 4 Par. 2 No. 2

**Details about the learning control see at the 'Teilleistung'**

**Competence Goal**

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 pros and 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.

**Module grade calculation**

Grade of the module is grade of the exam

**Prerequisites**

None

**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.

**Recommendation**

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'.

**Annotation**

**IMPORTANT:**

The module will not be offered anymore in this form as from summer term 2020. It will be replaced by a new module offer.
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
### 5.59 Module: Project Studies in Water Resources Management (bauiM2S33-WB6) [M-BGU-103394]

**Responsible:** Dr.-Ing. Frank Seidel  
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:**  
- Study Focus I / Water and Environment (Wahlpflichtmodule)  
- Subject-Specific Supplements  
- Study Focus II / Water and Environment (Wahlpflichtmodule)

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**Competence Certificate**  
- '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'

**Competence Goal**  
see German version

**Module grade calculation**  
grade of the module is grade of the exam

**Prerequisites**  
none

**Content**  
see German version

**Recommendation**  
module Flow and Sediment Dynamics in Rivers [bauiM2S35-WB8]

**Annotation**  
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
5.60 Module: Numerical Flow Modeling in Hydraulic Engineering (bauIM2S34-WB7) [M-BGU-103390]

Responsible: Dr.-Ing. Peter Oberle
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: Study Focus I / Water and Environment (Wahlpflichtmodule)
Subject-Specific Supplements
Study Focus II / Water and Environment (Wahlpflichtmodule)

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T-BGU-106776 Numerical Flow Modeling in Hydraulic Engineering 6 CR Oberle

Competence Certificate
- ‘Teilleistung’ T-BGU-106776 with oral examination according to § 4 Par. 2 No. 2
details about the learning control see at the ‘Teilleistung’

Competence Goal
see German version

Module grade calculation
grade of the module is grade of the exam

Prerequisites
none

Content
see German version

Recommendation
basic knowledge of hydrology, hydraulic engineering and water management as well as open channel hydraulics

Annotation
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

Literature
lecture notes
Module: Flow and Sediment Dynamics in Rivers (bauIM2S35-WB8) [M-BGU-103393]

Responsible: Prof. Dr. Franz Nestmann
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: Study Focus II / Water and Environment (Wahlpflichtmodule)

Credits: 6
Recurrence: Each summer term
Language: German/English
Level: 4
Version: 1

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Competence Certificate
- 'Teilleistung' T-BGU-106781 with not graded accomplishment according to § 4 Par. 3 as examination prerequisite
- 'Teilleistung' T-BGU-106782 with oral examination according to § 4 Par. 2 No. 2

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

Competence Goal
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.

Module grade calculation
grade of the module is grade of the exam

Prerequisites
none

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

Recommendation
module Hydraulic Engineering [bauIM2P6-ADVHYENG]

Annotation
This module (in German) is not offered anymore as from summer term 2018. It is replaced by the module M-BGU-104083 Flow and Sediment Dynamics in Rivers (in English).

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
5.62 Module: Flow and Sediment Dynamics in Rivers (bauIM2S35-WB8) [M-BGU-104083]

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**Responsible:** Prof. Dr. Franz Nestmann

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:**
- Study Focus I / Water and Environment (Wahlpflichtmodule) (Usage from 4/1/2018)
- Subject-Specific Supplements (Usage from 4/1/2018)
- Study Focus II / Water and Environment (Wahlpflichtmodule) (Usage from 4/1/2018)

**Mandatory**

| T-BGU-108467 | Flow and Sediment Dynamics in Rivers | 4 CR | Nestmann |

**Competence Certificate**
- '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'

**Competence Goal**
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.

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

**Prerequisites**
one

**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

**Recommendation**
basics in fluid mechanics, module Hydraulic Engineering [bauIM2P6-ADVHYENG]

**Annotation**
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
Module: Hydraulic Structures (bauIM2S36-WB9) [M-BGU-103389]

Responsible: Prof. Dr. Olivier Eiff
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: Study Focus I / Water and Environment (Wahlpflichtmodule)
Subject-Specific Supplements
Study Focus II / Water and Environment (Wahlpflichtmodule)

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<td>T-BGU-110404</td>
<td>Interaction Flow - Hydraulic Structures</td>
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Competence Certificate
- 'Teilleistung' T-BGU-106774 with oral examination according to § 4 Par. 2 No. 2
- 'Teilleistung' T-BGU-110404 with written examination according to § 4 Par. 2 No. 1
details about the learning controls see at the respective 'Teilleistung'

Competence Goal
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.

Module grade calculation
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 have to be fulfilled:

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

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

Recommendation
none

Annotation
As of the winter term 2019/20 the course Interaction Flow - Hydraulic Structures will be offered in English with a written examination.
**Workload**

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

- Groundwater Flow around Structures lecture/exercise: 30 h
- Interaction Flow - Hydraulic Structures 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 Interaction Flow - Hydraulic Structures: 30 h
- examination preparation Interaction Flow - Hydraulic Structures (partial exam): 30 h

total: 180 h

**Literature**


Naudascher; E, 1991, Hydrodynamic Forces, Balkema Pub., Rotterdam

C. Lang, Skript Interaktion Strömung - Wasserbauwerk
Module: Experimental Hydraulics and Measuring Techniques (bauiM2S37-WB10) [M-BGU-103388]

Responsible: Dr.-Ing. Frank Seidel
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: Study Focus I / Water and Environment (Wahlpflichtmodule)
Subject-Specific Supplements
Study Focus II / Water and Environment (Wahlpflichtmodule)

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<td>T-BGU-110411</td>
<td>Flow Measurement Techniques</td>
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Competence Certificate
- 'Teilleistung' T-BGU-106773 with examination of other type according to § 4 Par. 2 No. 3
- 'Teilleistung' T-BGU-110411 with oral examination according to § 4 Par. 2 No. 2
details about the learning controls see at the respective 'Teilleistung'

Competence Goal
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.

Module grade calculation
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 have to be fulfilled:

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

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)

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

Annotation
As of the winter term 2019/20 the course Flow Measurement Techniques will be offered in English.
Workload
contact hours (1 HpW = 1 h x 15 weeks):

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

independent study:

- preparation and follow-up lecture/exercises Flow Measurement Techniques: 30 h
- examination preparation Flow Measurement 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 5.65 Module: Water Distribution Systems (bauIM2S38-WB11) [M-BGU-104100]

**Responsible:** Prof. Dr. Franz Nestmann

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:**
- Study Focus I / Water and Environment (Wahlpflichtmodule) (Usage from 4/1/2018)
- Subject-Specific Supplements (Usage from 4/1/2018)
- Study Focus II / Water and Environment (Wahlpflichtmodule) (Usage from 4/1/2018)

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**Competence Certificate**
- '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'

**Competence Goal**
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.

**Module grade calculation**
grade of the module is grade of the exam

**Prerequisites**
none

**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.

**Recommendation**
hydromechanics (specifically pipe hydraulics)

**Annotation**
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).
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

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

**Responsible:** Prof. Dr. Olivier Eiff

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:**
- Study Focus I / Water and Environment (Wahlpflichtmodule)
- Subject-Specific Supplements
- Study Focus II / Water and Environment (Wahlpflichtmodule)

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**Competence Certificate**
- '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'

**Competence Goal**

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.

**Module grade calculation**
grade of the module is grade of the exam

**Prerequisites**
none

**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

**Recommendation**
module Advanced Fluid Mechanics (bauiM2P9)

**Annotation**
none
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

Literature
Tropea, C. et.al., 2007, Springer Handbook of Experimental Fluid Mechanics, Springer Verlag Berlin
Module: Wastewater and Storm Water Treatment Facilities (bauIM2S40-SW7) [M-BGU-104898]

Responsible: Dr.-Ing. Stephan Fuchs
Dr.-Ing. Tobias Morck

Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences

Part of: Study Focus I / Water and Environment (Wahlpflichtmodule) (Usage from 4/1/2019)
Subject-Specific Supplements (Usage from 4/1/2019)
Study Focus II / Water and Environment (Wahlpflichtmodule) (Usage from 4/1/2019)

Credits 6
Recurrence Each summer term
Language English
Level 4
Version 1

Mandatory T-BGU-109934 Wastewater and Storm Water Treatment Facilities 6 CR Fuchs, Morck

Competence Certificate
- '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'

Competence Goal
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.

Module grade calculation
grade of the module is grade of the exam

Prerequisites
none

Modeled Conditions
The following conditions have to be fulfilled:

1. The module M-BGU-103362 - Wastewater and Storm Water Treatment must not have been started.

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.

Recommendation
module 'Urban Water Infrastructure and Management' [bauIM2P10-URBIM]

Annotation
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 Geocology 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.
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

Literature
5.68 Module: Freshwater Ecology (bauIM2S41-SW8) [M-BGU-104922]

Responsible: Dr.-Ing. Stephan Fuchs
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: Study Focus I / Water and Environment (Wahlpflichtmodule) (Usage from 4/1/2019)
Subject-Specific Supplements (Usage from 4/1/2019)
Study Focus II / Water and Environment (Wahlpflichtmodule) (Usage from 4/1/2019)

Credits 6
Recurrence Each summer term
Language English
Level 4
Version 1

Mandatory
T-BGU-109956 Applied Ecology and Water Quality 3 CR Fuchs, Hilgert
T-BGU-109957 Field Training Water Quality 3 CR Fuchs, Hilgert

Competence Certificate
- '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'

Competence Goal
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.

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

Prerequisites
none

Modeled Conditions
The following conditions have to be fulfilled:

1. The module M-BGU-103361 - Water Ecology must not have been started.

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.

Recommendation
none
Annotation
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.

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

Literature
Jürgen Schwörbel, Methoden der Hydrobiologie, UTB für Wissenschaft 1999
kursbegleitende Materialien
### Module: River Basin Modeling (bauiM2S42-SW9) [M-BGU-103373]

**Responsible:** Dr.-Ing. Stephan Fuchs  
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:**  
- Study Focus I / Water and Environment (Wahlpflichtmodule)  
- Subject-Specific Supplements  
- Study Focus II / Water and Environment (Wahlpflichtmodule)

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**Competence Certificate**

- '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'

**Competence Goal**

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.

**Module grade calculation**

grade of the module is grade of the exam

**Prerequisites**

none

**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.

**Recommendation**

modules Urban Water Infrastructure and Management [bauiM2P10-URBIM], Water Ecology [bauiM2S41-SW8]

**Annotation**

none

**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

**Literature**

Module: Wastewater Treatment Technologies (bauIM2S43-SW10) [M-BGU-104917]

Responsible: Dr.-Ing. Tobias Morck
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of:
- Study Focus I / Water and Environment (Wahlpflichtmodule) (Usage from 4/1/2019)
- Subject-Specific Supplements (Usage from 4/1/2019)
- Study Focus II / Water and Environment (Wahlpflichtmodule) (Usage from 4/1/2019)

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<td>Term Paper 'International Sanitary Engineering'</td>
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<td>T-BGU-109948</td>
<td>Wastewater Treatment Technologies</td>
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**Competence Certificate**

- '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'

**Competence Goal**

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.

**Module grade calculation**

grade of the module is grade of the exam

**Prerequisites**

none

**Modeled Conditions**

The following conditions have to be fulfilled:

1. The module M-BGU-103399 - Process Engineering in Wastewater Treatment must not have been started.
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 methods 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

Recommendation
module Urban Water Infrastructure and Management [bauiM2S43-SW10]

Annotation
The module is offered newly as from summer term 2019 and replaces the module Water Treatment Technologies.

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

Literature
ATV-DVWK(1997) Handbuch der Abwassertechnik: Mechanische Abwasserreinigung, Band 6, Verlag Ernst & Sohn, Berlin
Module: Introduction to Environmental Data Analysis and Statistical Learning (bauiM2S44-ENVDAT) [M-BGU-104880]

Responsible: Dr.-Ing. Uwe Ehret
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: Study Focus I / Water and Environment (Wahlpflichtmodule) (Usage from 4/1/2019)
Subject-Specific Supplements (Usage from 4/1/2019)
Study Focus II / Water and Environment (Wahlpflichtmodule) (Usage from 4/1/2019)

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Competence Certificate
- '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'

Competence Goal
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.

Module grade calculation
grade of the module is grade of the exam

Prerequisites
none

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

Recommendation
preliminary knowledge in statistics, e.g. successful completion of Probability and Statistics (WSEM-CC911), and Matlab programming skills, e.g. successful completion of Introduction to Matlab (WSEM-CC772)

Annotation
The module is offered newly as from summer term 2019.
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

Literature
5.72 Module: Urban and Regional Planning (bauIM3P1-PLSTAREG) [M-BGU-100007]

**Responsible:** Prof. Dr.-Ing. Peter Vortisch

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:**
- Study Focus I / Mobility and Infrastructure (Pflichtmodule)
- Study Focus I / Mobility and Infrastructure (Wahlpflichtmodule)
- Subject-Specific Supplements
- Study Focus II / Mobility and Infrastructure (Pflichtmodule)
- Study Focus II / Mobility and Infrastructure (Wahlpflichtmodule)

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**Competence Certificate**

- "Teilleistung" T-BGU-100050 with oral examination according to § 4 Par. 2 No. 2

**Competence Goal**

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.

**Module grade calculation**

grade of the module is grade of the exam

**Prerequisites**

none

**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.

**Recommendation**

module Mobility and Infrastructure [bauIBFP5-MOBIN]

**Annotation**

none

**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

**Literature**

list of literature to module
Module: Models and Methods in Traffic Engineering and Transportation Planning (bauiM3P2-VERMODELL) [M-BGU-100008]

Responsible: Prof. Dr.-Ing. Peter Vortisch
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of:
- Study Focus I / Mobility and Infrastructure (Pflichtmodule)
- Study Focus I / Mobility and Infrastructure (Wahlpflichtmodule)
- Subject-Specific Supplements
- Study Focus II / Mobility and Infrastructure (Pflichtmodule)
- Study Focus II / Mobility and Infrastructure (Wahlpflichtmodule)

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Competence Certificate
- 'Teilleistung' T-BGU-100012 with oral examination according to § 4 Par. 2 No. 2
details about the learning control see at the 'Teilleistung'

Competence Goal
see German version

Module grade calculation
grade of the module is grade of the exam

Prerequisites
none

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

Recommendation
none

Annotation
none
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

Literature
lecture notes with additional references / exercises
5.74 Module: Infrastructure Management (bauiM3P3-STRINFRA) [M-BGU-100009]

Responsible: Prof. Dr.-Ing. Ralf Roos
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of:
- Study Focus I / Mobility and Infrastructure (Pflichtmodule)
- Study Focus I / Mobility and Infrastructure (Wahlpflichtmodule)
- Subject-Specific Supplements
- Study Focus II / Mobility and Infrastructure (Pflichtmodule)
- Study Focus II / Mobility and Infrastructure (Wahlpflichtmodule)

Credits: 6
Recurrence: Each summer term
Duration: 1 term
Language: German
Level: 4
Version: 2

Mandatory
T-BGU-106300 Infrastructure Management 6 CR Roos

Competence Certificate
- "Teilleistung" T-BGU-106300 with written examination according to § 4 Par. 2 No. 1
details about the learning control see at the respective "Teilleistung"

Competence Goal
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.

Module grade calculation
grade of the module is grade of the exam

Prerequisites
none

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.

Recommendation
none

Annotation
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
Module: Laws and Proceedings Concerning Traffic and Roads (bauiM3P5-VERFRECHT) [M-BGU-100011]

**Responsible:** Prof. Dr.-Ing. Ralf Roos

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:**
- Study Focus I / Mobility and Infrastructure (Pflichtmodule)
- Study Focus I / Mobility and Infrastructure (Wahlpflichtmodule)
- Subject-Specific Supplements
- Study Focus II / Mobility and Infrastructure (Pflichtmodule)
- Study Focus II / Mobility and Infrastructure (Wahlpflichtmodule)

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<td>Laws and Proceedings concerning Traffic and Roads</td>
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**Competence Certificate**

- "Teilleistung" T-BGU-100050 with written examination according to § 4 Par. 2 No. 1

**Competence Goal**

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.

**Module grade calculation**

grade of the module is grade of the exam

**Prerequisites**

none

**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 Analysis etc.) in transport planning

**Recommendation**

none

**Annotation**

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
Module: Urban Renewal (bauiM3S01-PLSTUMB) [M-BGU-100013]

**Responsibility:** Prof. Dr.-Ing. Peter Vortisch

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:**
- Study Focus I / Mobility and Infrastructure (Wahlpflichtmodule)
- Subject-Specific Supplements
- Study Focus II / Mobility and Infrastructure (Wahlpflichtmodule)

**Credits:** 6

**Recurrence:** Each summer term

**Duration:** 1 term

**Language:** German

**Level:** 4

**Version:** 2

**Mandatory**

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<td>History of Urban Planning</td>
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<td>T-BGU-108442</td>
<td>Urban Management</td>
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**Competence Certificate**

- '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'

**Competence Goal**

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.

**Module grade calculation**

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

**Prerequisites**

None

**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.

**Recommendation**

None

**Annotation**

None
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

Literature
list of literature to module
5.77 Module: Space and Infrastructure (bauIM3S02-PLRAUMINF) [M-BGU-100014]

Responsible: Dr.-Ing. Martin Kagerbauer
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: Study Focus I / Mobility and Infrastructure (Wahlpflichtmodule)
Subject-Specific Supplements
Study Focus II / Mobility and Infrastructure (Wahlpflichtmodule)

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T-BGU-100056 Space and Infrastructure

Competence Certificate
- 'Teilleistung' T-BGU-100056 with oral examination according to § 4 Par. 2 No. 2
details about the learning control see at the 'Teilleistung'

Competence Goal
see German version

Module grade calculation
grade of the module is grade of the exam

Prerequisites
none

Content
see German version

Recommendation
none

Annotation
none

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

Literature
list of literature to module
Module: Traffic Management und Simulation Methods (bauiM3S03-VERMANAGE) [M-BGU-100015]

Responsible: Prof. Dr.-Ing. Peter Vortisch
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of:
- Study Focus I / Mobility and Infrastructure (Wahlpflichtmodule)
- Subject-Specific Supplements
- Study Focus II / Mobility and Infrastructure (Wahlpflichtmodule)

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Competence Certificate

- ‘Teilleistung’ T-BGU-100008 with oral examination according to § 4 Par. 2 No. 2
- details about the learning control see at the ‘Teilleistung’

Competence Goal

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.

Module grade calculation

grade of the module is grade of the exam

Prerequisites

none

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.

Recommendation

none

Annotation

none

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 h
- examination preparation: 60 h

total: 180 h

Literature

lecture notes
guidelines ('Handbuch zur Bemessung von Straßen', 'Richtlinien für Lichtsignalanlagen'),
software documentations
5.79 Module: Planning of Transportation Systems (bauiM3S04-VERPLAN) [M-BGU-100016]

**Responsible:** Prof. Dr.-Ing. Peter Vortisch

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:**
- Study Focus I / Mobility and Infrastructure (Wahlpflichtmodule)
- Subject-Specific Supplements
- Study Focus II / Mobility and Infrastructure (Wahlpflichtmodule)

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**Mandatory**

| T-BGU-100013 | Planning of Transportation Systems | 6 CR | Vortisch |

**Competence Certificate**
- "Teilleistung" T-BGU-100013 with oral examination according to § 4 Par. 2 No. 2
- details about the learning control see at the 'Teilleistung'

**Competence Goal**
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.

**Module grade calculation**
grade of the module is grade of the exam

**Prerequisites**
none

**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

**Recommendation**
course Transportation (6200406)

**Annotation**
none
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

Literature
lecture notes and materials are available for downloading
5.80 Module: Highway Design (bauiM3S05-STRENTW) [M-BGU-100017]

**Responsible:** Dr.-Ing. Matthias Zimmermann

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:**
- Study Focus I / Mobility and Infrastructure (Wahlpflichtmodule)
- Subject-Specific Supplements
- Study Focus II / Mobility and Infrastructure (Wahlpflichtmodule)

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**Mandatory**

- T-BGU-109917 **Study project Design of a Rural Road**
  - 2 CR  Roos, Zimmermann
- T-BGU-100057 **Highway Design**
  - 4 CR  Roos, Zimmermann

**Competence Certificate**
- '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'

**Competence Goal**
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.

**Module grade calculation**
grade of the module is grade of the exam

**Prerequisites**
none

**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.

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

**Annotation**
one
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
Module: Road Construction (bauM3S06-STRBAUT) [M-BGU-100006]

**Responsible:** Prof. Dr.-Ing. Ralf Roos

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:**
- Study Focus I / Mobility and Infrastructure (Wahlpflichtmodule)
- Subject-Specific Supplements
- Study Focus II / Mobility and Infrastructure (Wahlpflichtmodule)

**Credits:** 6

**Recurrence:** Each winter term

**Duration:** 1 term

**Language:** German

**Level:** 4

**Version:** 1

**Mandatory**

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**Competence Certificate**

- “Teilleistung” T-BGU-100058 with oral examination according to § 4 Par. 2 No. 2 details about the learning control see at the "Teilleistung"

**Competence Goal**

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.

**Module grade calculation**

grade of the module is grade of the exam

**Prerequisites**

none

**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.

**Recommendation**

preliminary attendance of the compulsory module Infrastructure Management [mobiM301-STRINFRA]

**Annotation**

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
5.82 Module: Project Integrated Planning (bauM3S09-PROJEKTIP) [M-BGU-100018]

Responsible: Prof. Dr.-Ing. Ralf Roos
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: Study Focus I / Mobility and Infrastructure (Wahlpflichtmodule)
Subject-Specific Supplements
Study Focus II / Mobility and Infrastructure (Wahlpflichtmodule)

Credits: 6
Recurrence: Each winter term
Duration: 1 term
Language: German
Level: 4
Version: 2

Mandatory
T-BGU-109916 Group exercise Project Integrated Planning 5 CR Roos
T-BGU-100061 Project Integrated Planning 1 CR Roos

Competence Certificate
- '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'

Competence Goal
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.

Module grade calculation
grade of the module is grade of the exam

Prerequisites
none

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.

Recommendation
preliminary attendance of at least 2 compulsory modules in the study focus Mobility and Infrastructure

Annotation
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
5.83 Module: Intermodality in Freight, Long-Distance and Air Transport (bauIM3S11-VERINTER) [M-BGU-100020]

Responsible: Bastian Chlond
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: Study Focus I / Mobility and Infrastructure (Wahlpflichtmodule)
Subject-Specific Supplements
Study Focus II / Mobility and Infrastructure (Wahlpflichtmodule)

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<td>T-BGU-106301</td>
<td>Long-Distance and Air Traffic</td>
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Competence Certificate
- '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'

Competence Goal
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.

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

Prerequisites
none

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

Recommendation
none

Annotation
none

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
Literature
lecture accompanying documents
**Module: Road Safety (bauiM3S12-STRVSICH) [M-BGU-100021]**

**Responsible:** Dr.-Ing. Matthias Zimmermann

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:**
- Study Focus I / Mobility and Infrastructure (Wahlpflichtmodule)
- Subject-Specific Supplements
- Study Focus II / Mobility and Infrastructure (Wahlpflichtmodule)

**Credits** 6

**Recurrence** Each winter term

**Duration** 1 term

**Language** German

**Level** 4

**Version** 2

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**Competence Certificate**
- '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'

**Competence Goal**
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.

**Module grade calculation**
grade of the module is grade of the exam

**Prerequisites**
none

**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.

**Recommendation**
none

**Annotation**
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
5.85 Module: Special Topics in Highway Engineering (bauiM3S13-STRSPEZ) [M-BGU-100022]

Responsible: Prof. Dr.-Ing. Ralf Roos
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: Study Focus I / Mobility and Infrastructure (Wahlpflichtmodule)
Subject-Specific Supplements
Study Focus II / Mobility and Infrastructure (Wahlpflichtmodule)

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Mandatory

T-BGU-106734 Special Topics in Highway Engineering 6 CR Hess, Roos

Competence Certificate
- ‘Teilleistung’ T-BGU-106734 with oral examination according to § 4 Par. 2 No. 2

details about the learning control see at the 'Teilleistung'

Competence Goal
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.

Module grade calculation
grade of the module is grade of the exam

Prerequisites
none

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).

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

Annotation
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
Module: City Transport Facilities (bauIM3S17-STRIVA) [M-BGU-100026]

Responsible: Prof. Dr.-Ing. Ralf Roos
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences

Part of:
- Study Focus I / Mobility and Infrastructure (Pflichtmodule) (Usage from 10/1/2018)
- Study Focus I / Mobility and Infrastructure (Wahlpflichtmodule)
- Subject-Specific Supplements
- Study Focus II / Mobility and Infrastructure (Pflichtmodule) (Usage from 10/1/2018)
- Study Focus II / Mobility and Infrastructure (Wahlpflichtmodule)

Credits: 6
Recurrence: Each winter term
Duration: 1 term
Language: German
Level: 4
Version: 2

Mandatory
T-BGU-109912 Exercises and student research project City Transport Facilities 2 CR Roos
T-BGU-100083 City Transport Facilities 4 CR Roos

Competence Certificate
- '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'

Competence Goal
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.

Module grade calculation
grade of the module is grade of the exam

Prerequisites
none

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.

Recommendation
none

Annotation
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
Module: Track Guided Transport Systems - Operation and Capacity (bauiM3S18-EBBETRKAP) [M-BGU-100581]

Responsible: Jan Tzschaschel
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of:
- Study Focus I / Mobility and Infrastructure (Wahlpflichtmodule)
- Subject-Specific Supplements
- Study Focus II / Mobility and Infrastructure (Wahlpflichtmodule)

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Competence Certificate
- "Teilleistung" T-BGU-101002 with oral examination according to § 4 Par. 2 No. 2
  details about the learning control see at the 'Teilleistung'

Competence Goal
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.

Module grade calculation
grade of the module is grade of the exam

Prerequisites
none

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

Recommendation
preliminary attendance of compulsory module Track Guided Transport Systems - Technical Design and Components [bauiM3P4-EBTECHNIK]

Annotation
IMPORTANT:
The module will be offered further on as from summer term 2019.

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
Literature
Fiedler, Grundlagen der Bahntechnik, Werner-Verlag, Düsseldorf
Hausmann, Enders, Grundlagen des Bahnbetriebs, Bahn-Fachverlag, Heidelberg
Pachl, Systemtechnik des Schienenverkehrs, Teubner-Verlag, Stuttgart
Module: Analysis and Evolution of Mobility (bauM3S20-VERANAMOB) [M-BGU-100583]

Responsible: Dr.-Ing. Martin Kagerbauer
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: Study Focus I / Mobility and Infrastructure (Wahlpflichtmodule)
          Subject-Specific Supplements
          Study Focus II / Mobility and Infrastructure (Wahlpflichtmodule)

Credits: 6
Recurrence: Each term
Language: German
Level: 4
Version: 2

Mandatory
T-BGU-101004  Analysis and Evolution of Mobility  6 CR  Kagerbauer

Competence Certificate
- "Teilleistung" T-BGU-101004 with oral examination according to § 4 Par. 2 No. 2
details about the learning control see at the 'Teilleistung'

Competence Goal
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.

Module grade calculation
grade of the module is grade of the exam

Prerequisites
none

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

Recommendation
course Transportation (6200406)

Annotation
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
Module: Special Issues of Public Transport (bauiM3S22-VERSPEZOEV) [M-BGU-103357]

Responsible: Prof. Dr.-Ing. Peter Vortisch
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of:
- Study Focus I / Mobility and Infrastructure (Wahlpflichtmodule)
- Subject-Specific Supplements
- Study Focus II / Mobility and Infrastructure (Wahlpflichtmodule)

Election block: Wahlpflicht (2 items as well as 6 credits)

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| T-BGU-101005 | Tendering, Planning and Financing in Public Transport | 3 CR | Vortisch |
| T-BGU-100014 | Seminar in Transportation | 3 CR | Chlond, Vortisch |
| T-BGU-106608 | Information Management for Public Mobility Services | 3 CR | Vortisch |

Competence Certificate

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'

Competence Goal

see German version

Module grade calculation

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

Prerequisites

none

Content

see German version

Recommendation

course Transportation (6200406)

Annotation

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
Module: Economics and Management in Construction (bauim4p3-) [M-BGU-100102]

**Responsible:** Prof. Dr.-Ing. Shervin Haghsheno

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:**
- Study Focus I / Technology and Management in Construction (Pflichtmodule)
- Subject-Specific Supplements
- Study Focus II / Technology and Management in Construction (Pflichtmodule)

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<tr>
<td>T-BGU-108010</td>
<td>Student Research Project 'Cost Estimation in Structural Engineering and Earthworks'</td>
<td>1 CR</td>
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**Competence Certificate**

- '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'

**Competence Goal**

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.

**Module grade calculation**

grade of the module is grade of the exam

**Prerequisites**

none

**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 controlling • forms of organisation

**Recommendation**

none

**Annotation**

none
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

Literature
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 Pörschel, 6. Auflage, 2007
Module: Sustainability in Real Estate Management (bauiM4P4-) [M-BGU-100112]

Responsible: Prof. Dr.-Ing. Kunibert Lennerts
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: Study Focus I / Technology and Management in Construction (Pflichtmodule)
Subject-Specific Supplements
Study Focus II / Technology and Management in Construction (Pflichtmodule)

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Competence Certificate
- ‘Teilleistung’ T-BGU-100149 with written examination according to § 4 Par. 2 No. 1
details about the learning control see at the 'Teilleistung'

Competence Goal
see German version

Module grade calculation
grade of the module is grade of the exam

Prerequisites
none

Content
see German version

Recommendation
courses Facility und Real Estate Management I (6200414), Life Cycle Management (6200615)

Annotation
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
Module: Project Management in Construction and Real Estate Industry (bauiM4P5-) [M-BGU-100338]

**Responsible:** Prof. Dr.-Ing. Shervin Haghsheno

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:**
- Study Focus I / Technology and Management in Construction (Pflichtmodule)
- Subject-Specific Supplements
- Study Focus II / Technology and Management in Construction (Pflichtmodule)

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**Mandatory**

| T-BGU-101006 | Group Exercise Project Management in Construction and Real Estate Industry | 1 CR | Haghsheno |
| T-BGU-100622 | Project Management in Construction and Real Estate Industry | 4 CR | Haghsheno |
| T-BGU-108011 | Student Research Project 'Scheduling and Building Site Facilities' | 1 CR | Schneider |

**Competence Certificate**
- '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'**

**Competence Goal**
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.

**Module grade calculation**
grade of the module is grade of the exam

**Prerequisites**
none

**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.

**Recommendation**
none

**Annotation**
none
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

Literature
DIETHELM, G.: Projektmanagement, Band 1: Grundlagen, Verlag Neue Wirtschafts-Briefe, Herne, 2000
ESCHENBRUCH, K.: Recht der Projektsteuerung, Werner Verlag, München, 2003
VOLKMANN, W.: Projektabwicklung, Verlag für Wirtschaft und Verwaltung Hubert Wingen, Essen, 2002
5.93 Module: Machinery and Process Engineering (bauIM4P6-) [M-BGU-100339]

Responsible: Prof. Dr.-Ing. Sascha Gentes
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: Study Focus I / Technology and Management in Construction (Pflichtmodule)
Subject-Specific Supplements
Study Focus II / Technology and Management in Construction (Pflichtmodule)

Credits 6
Recurrence Each winter term
Language German
Level 4
Version 2

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Competence Certificate
- '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'

Competence Goal
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.

Module grade calculation
grade of the module is grade of the exam

Prerequisites
none

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.

Recommendation
none

Annotation
none
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

Literature
1) Baugeräteliste, aktuelle Fassung
Module: Business and Human Resource Management (bauiM4S01-) [M-BGU-100111]

Responsible: Prof. Dr.-Ing. Shervin Haghsheno
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: Study Focus I / Technology and Management in Construction (Wahlpflichtmodule)
Subject-Specific Supplements
Study Focus II / Technology and Management in Construction (Wahlpflichtmodule)

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Competence Certificate
- "Teilleistung" T-BGU-108002 with written examination according to § 4 Par. 2 No. 1

details about the learning control see at the 'Teilleistung'

Competence Goal
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.

Module grade calculation
grade of the module is grade of the exam

Prerequisites
none

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.

Recommendation
none

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

Responsible: Prof. Dr.-Ing. Sascha Gentes
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: Study Focus I / Technology and Management in Construction (Wahlpflichtmodule)
Subject-Specific Supplements
Study Focus II / Technology and Management in Construction (Wahlpflichtmodule)

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Mandatory

T-BGU-100146 Environmentally-Friendly Recycling and Disassembly of Buildings 6 CR Gentes

Competence Certificate
- "Teilleistung" T-BGU-100146 with oral examination according to § 4 Par. 2 No. 2
details about the learning control see at the 'Teilleistung'

Competence Goal
see German version

Module grade calculation
grade of the module is grade of the exam

Prerequisites
none

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.

Recommendation
none

Annotation
none

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
Literature
Module: Upgrading of Existing Buildings and Energetic Refurbishment (bauiM4S07-) [M-BGU-100108]

Responsible: Prof. Dr.-Ing. Kunibert Lennerts
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of:
- Study Focus I / Technology and Management in Construction (Wahlpflichtmodule)
- Subject-Specific Supplements
- Study Focus II / Technology and Management in Construction (Wahlpflichtmodule)

Credits: 6
Recurrence: Each winter term
Language: German
Level: 4
Version: 3

Mandatory

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<td>1.5 CR</td>
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<td>Upgrading of Existing Buildings and Energetic Refurbishment</td>
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Competence Certificate
- 'Teilleistung' T-BGU-100621 with examination of other 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'

Competence Goal
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.

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

Prerequisites
none

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

Recommendation
none

Annotation
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
### 5.97 Module: Real Estate Management (bauIM4S08-) [M-BGU-100346]

**Responsible:** Prof. Dr.-Ing. Kunibert Lennerts  
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:**  
- Study Focus I / Technology and Management in Construction (Wahlpflichtmodule)  
- Subject-Specific Supplements  
- Study Focus II / Technology and Management in Construction (Wahlpflichtmodule)

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**Competence Certificate**  
- 'Teilleistung' T-BGU-100629 with oral examination according to § 4 Par. 2 No. 2  
- details about the learning control see at the 'Teilleistung'

**Competence Goal**  
see German version

**Module grade calculation**  
grade of the module is grade of the exam

**Prerequisites**  
none

**Content**  
see German version

**Recommendation**  
none

**Annotation**  
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
Module: Lean Construction (bauM4S09-) [M-BGU-100104]

Responsible: Prof. Dr.-Ing. Shervin Haghsheno

Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences

Part of: Study Focus I / Technology and Management in Construction (Wahlpflichtmodule) Subject-Specific Supplements

Study Focus II / Technology and Management in Construction (Wahlpflichtmodule)

Credits 6
Recurrence Each winter term
Duration 1 term
Language German
Level 4
Version 3

Mandatory

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<td>Project Paper Lean Construction</td>
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Competence Certificate
- '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'

Competence Goal
see German version

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

Prerequisites
none

Content
see German version

Recommendation
none

Annotation
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 project with report (partial exam): 40 h
- examination preparation (partial exam): 50 h

total: 180 h

Literature


**5.99 Module: Advanced Studies in Construction Engineering (bauIM4S10-) [M-BGU-100344]**

**Responsible:** Prof. Dr.-Ing. Shervin Haghsheno  
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:** Study Focus I / Technology and Management in Construction (Wahlpflichtmodule)  
Subject-Specific Supplements  
Study Focus II / Technology and Management in Construction (Wahlpflichtmodule)

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**Competence Certificate**
- "Teilleistung" T-BGU-108003 with written examination according to § 4 Par. 2 No. 1

**Competence Goal**
see German version

**Module grade calculation**
grade of the module is grade of the exam

**Prerequisites**
none

**Content**
see German version

**Recommendation**
none

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

**Responsible:** Prof. Dr.-Ing. Sascha Gentes

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:**
- Study Focus I / Technology and Management in Construction (Wahlpflichtmodule)
- Subject-Specific Supplements
- Study Focus II / Technology and Management in Construction (Wahlpflichtmodule)

**Credits:** 6

**Recurrence:** Each winter term

**Language:** German

**Level:** 4

**Version:** 1

**Mandatory**

| T-BGU-100627 | Decommissioning of Nuclear Facilities | 6 CR | Gentes |

**Competence Certificate**

- ‘Teilleistung’ T-BGU-100627 with oral examination according to § 4 Par. 2 No. 2
details about the learning control see at the ‘Teilleistung’

**Competence Goal**
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 decommissioning and 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 considering the respective laws.

**Module grade calculation**
grade of the module is grade of the exam

**Prerequisites**
none

**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.

**Recommendation**
none

**Annotation**
none
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

Literature
1) Kohli, Rajiv [Hrsg.]: Developments in surface contamination and cleaning - fundamentals and applied aspects, Knovel library, USA, 2008.
5) Fortschrittsbericht über den Stand der BMBF – Stilllegungsprojekte und der vom BMBF geförderten FuE-Arbeiten zu 'Stilllegung / Rückbau kerntechnischer Anlagen'
Module: Facility Management in Hospitals and Hospital Management (bauiM4S13-) [M-BGU-100347]

Responsible: Prof. Dr.-Ing. Kunibert Lennerts
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: Study Focus I / Technology and Management in Construction (Wahlpflichtmodule)
Subject-Specific Supplements
Study Focus II / Technology and Management in Construction (Wahlpflichtmodule)

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Competence Certificate
- ‘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’

Competence Goal
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.

Module grade calculation
grade of the module is grade of the exam

Prerequisites
none

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

Recommendation
course Facility and Real Estate Management (6200414)

Annotation
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 Hospital Management: 75 h

total: 180 h
Module: Turnkey Construction (bauIM4S15-) [M-BGU-100676]

Responsible: Prof. Dr.-Ing. Shervin Hagsheno
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: Study Focus I / Technology and Management in Construction (Wahlpflichtmodule)
Subject-Specific Supplements
Study Focus II / Technology and Management in Construction (Wahlpflichtmodule)

Credits: 6
Recurrence: Each summer term
Language: German
Level: 4
Version: 1

Competence Certificate
- 'Teilleistung' T-BGU-101208 with written examination according to § 4 Par. 2 No. 1
details about the learning control see at the 'Teilleistung'

Competence Goal
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 create, examine and avoid claims.

Module grade calculation
grade of the module is grade of the exam

Prerequisites
none

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.

Recommendation
none

Annotation
none

Workload
contact hours (1 HpW = 1 h x 15 weeks):
- Turnkey 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
Literatur
5.103 Module: Building Information Modeling (BIM) (bauiM4S16-) [M-BGU-103916]

M Mandatory

T-BGU-108007 Building Information Modeling (BIM) 6 CR Haghsheno

Competence Certificate
- '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'

Competence Goal
see German version

Module grade calculation
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

Content
see German version

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

Annotation
registration procedure: see German version

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

Literature
Module: Research Seminar Construction Management (bauiM4S17-) [M-BGU-103917]

**Responsible:** Prof. Dr.-Ing. Shervin Haghsheno

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:**
- Study Focus I / Technology and Management in Construction (Wahlpflichtmodule)
- Subject-Specific Supplements
- Study Focus II / Technology and Management in Construction (Wahlpflichtmodule)

**Mandatory**

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**Competence Certificate**

- "Teilleistung" T-BGU-108008 with examination of other type according to § 4 Par. 2 No. 3

**Competence Goal**
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.

**Module grade calculation**
grade of the module is grade of the exam

**Prerequisites**
none

**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

**Recommendation**
none

**Annotation**
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
5.105 Module: Equipment and special Construction Techniques in Building Practice (bauM4S18-) [M-BGU-103918]

Responsible: Prof. Dr.-Ing. Sascha Gentes

Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences

Part of:
- Study Focus I / Technology and Management in Construction (Wahlpflichtmodule)
- Subject-Specific Supplements
- Study Focus II / Technology and Management in Construction (Wahlpflichtmodule)

Credits: 6

Recurrence: Each term

Language: German

Level: 4

Version: 1

### Mandatory

| T-BGU-108009 | Equipment and special Construction Techniques in Building Practice | 6 CR | Gentes |

Competence Certificate

- 'Teilleistung' T-BGU-108009 with oral examination according to § 4 Par. 2 No. 2
details about the learning control see at the 'Teilleistung'

Competence Goal

see German version

Module grade calculation

grade of the module is grade of the exam

Prerequisites

none

Content

see German version

Recommendation

none

Annotation

This module will be offered 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
Module: Digitalization in Facility and Real Estate Management (bauiM4S19-) [M-BGU-104348]

**Responsible:** Prof. Dr.-Ing. Kunibert Lennerts

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:**
- Study Focus I / Technology and Management in Construction (Wahlpflichtmodule)
- Subject-Specific Supplements
- Study Focus II / Technology and Management in Construction (Wahlpflichtmodule)

**Credits:** 6

**Recurrence:** Each winter term

**Language:** German

**Level:** 4

**Version:** 1

### Competence Certificate

- 'Teilleistung' T-BGU-108941 with examination of other type according to § 4 Par. 2 No. 3

### Competence Goal

Students will acquire basic knowledge of sensor networks, building automation and the application of the 'Internet of Things' (IoT) in facility and real estate management. They will be able to take a critical look of the technologies of digitization (including network structures, cloud storage, sensor distribution, information privacy, augmented reality) and evaluate them according to the requirements of facility and real estate management. In addition, students will be able to implement simple sensor networks and the basics of 'augmented reality' by using a HoloLens.

### Module grade calculation

grade of the module is grade of the exam

### Prerequisites

none

### Content

- Basic information of concepts of digitalization
- Execute Internet of Things in building automation
- Integration of sensor signals in FM processes
- Visualize of maintenance and inspection work through 'augmented reality' (HoloLens)
- Producing project work during the semester colloquium

### Recommendation

none

### Annotation

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
5.107 Module: Theoretical Soil Mechanics (bauiM5P1-THEOBM) [M-BGU-100067]

Responsible: N.N.
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of:
  - Study Focus I / Geotechnical Engineering (Pflichtmodule)
  - Subject-Specific Supplements
  - Study Focus II / Geotechnical Engineering (Pflichtmodule)

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<td>1 term</td>
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Mandatory

T-BGU-100067  
Theoretical Soil Mechanics  
6 CR  
N.N.

Competence Certificate

- 'Teilleistung' T-BGU-100067 with written examination according to § 4 Par. 2 No. 1

details about the learning control see at the 'Teilleistung'

Competence Goal

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.

Module grade calculation

grade of the module is grade of the exam

Prerequisites

none

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

Recommendation

fundamentals in soil mechanics and continuum mechanics, module Basics of Numerical Modelling [bauiM5P4-NUMGRUND]

Annotation

none
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

Literature
Niemunis (2009): Über die Anwendung der Kontinuumstheorie auf bodenmechanische Probleme (download)
5.108 Module: Earthworks and Foundation Engineering (bauIM5P2-ERDGB) [M-BGU-100068]

Responsible: N.N.
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of:
- Study Focus I / Geotechnical Engineering (Pflichtmodule)
- Subject-Specific Supplements
- Study Focus II / Geotechnical Engineering (Pflichtmodule)

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Mandatory

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<td>4 CR</td>
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<td>T-BGU-100178</td>
<td>Student Research Project 'Earthworks and Foundation Engineering'</td>
<td>2 CR</td>
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Competence Certificate
- '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'

Competence Goal
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.

Module grade calculation
grade of the module is grade of the exam

Prerequisites
none

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.

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

Annotation
none
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

Literature
[1] Witt. K.J. (2008), Grundbau-Taschenbuch, Teil 1,
5.109 Module: Rock Mechanics and Tunneling (bauiM5P3-FMTUB) [M-BGU-100069]

Responsible: N.N.
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: Study Focus I / Geotechnical Engineering (Pflichtmodule) Subject-Specific Supplements
Study Focus II / Geotechnical Engineering (Pflichtmodule)

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<td>Rock Mechanics and Tunneling</td>
<td>5 CR</td>
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<td>T-BGU-100179</td>
<td>Student Research Project 'Rock Mechanics and Tunneling'</td>
<td>1 CR</td>
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Competence Certificate
- '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'

Competence Goal
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.

Module grade calculation
grade of the module is grade of the exam

Prerequisites
none

Content
see German version

Recommendation
basic knowledge of Engineering Geology;

compilation and submission of student research project as examination preparation until examination date

Annotation
none

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
Literature
[8] Müller, L. 1978: Der Felsbau, Bd. 3 Tunnelbau
Module: Basics of Numeric Modeling (bauIM5P4-NUMGRUND) [M-BGU-100070]

Responsible: N.N.
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences

Part of:
- Study Focus I / Geotechnical Engineering (Pflichtmodule)
- Subject-Specific Supplements
- Study Focus II / Geotechnical Engineering (Pflichtmodule)

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Mandatory
- T-BGU-106196 Continuum Mechanics 3 CR Franke
- T-BGU-106197 Numerics in Geotechnics 3 CR Niemunis

Competence Certificate
- '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'

Competence Goal
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.

Module grade calculation
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 have to be fulfilled:

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

Content
see German version

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

Annotation
none
**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

**Literature**

### 5.111 Module: Special Issues of Soil Mechanics (bauiM5S01-SPEZBM) [M-BGU-100005]

**Responsible:** N.N.  
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:** Subject-Specific Supplements

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**Competence Certificate**  
- 'Teilleistung' T-BGU-100071 with oral examination according to § 4 Par. 2 No. 2  
details about the learning control see at the 'Teilleistung'

**Competence Goal**  
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.

**Module grade calculation**  
grade of the module is grade of the exams

**Prerequisites**  
none

**Content**  
see German version

**Recommendation**  
module Theoretical Soil Mechanics [bauiM5P1-THEOBM]

**Annotation**  
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 Soil Dynamics: 15 h
- exercises with available software: 30 h
- examination preparation: 60 h

total: 180 h
Module: Ground Investigation (bauiM5S02-BERKUND) [M-BGU-100071]

**M** 5.112 Module: Ground Investigation (bauiM5S02-BERKUND) [M-BGU-100071]

**Responsible:** N.N.

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:** Study Focus I / Geotechnical Engineering (Wahlpflichtmodule)
Subject-Specific Supplements
Study Focus II / Geotechnical Engineering (Wahlpflichtmodule)

**Credits** 6

**Recurrence** Each summer term

**Duration** 1 term

**Language** German

**Level** 4

**Version** 1

### Mandatory

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<tr>
<th>T-BGU-100072</th>
<th>Ground Investigation</th>
<th>6 CR</th>
<th>N.N.</th>
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**Competence Certificate**
- 'Teilleistung' T-BGU-100072 with oral examination according to § 4 Par. 2 No. 2

details about the learning control see at the 'Teilleistung'

**Competence Goal**
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.

**Module grade calculation**
grade of the module is grade of the exam

**Prerequisites**
none

**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.

**Recommendation**
none

**Annotation**
none

**Workload**
contact hours \((1 \text{ HpW} = 1 \text{ h} \times 15 \text{ weeks})\):
- 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
Module: Applied Geotechnics (bauiM5S03-ANGEOTEC) [M-BGU-100072]

Responsible: N.N.
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: Study Focus I / Geotechnical Engineering (Wahlpflichtmodule)
                      Subject-Specific Supplements
                      Study Focus II / Geotechnical Engineering (Wahlpflichtmodule)

Credits 6
Recurrence Each summer term
Duration 1 term
Language German
Level 4
Version 2

M Mandatory
T-BGU-100073 Applied Geotechnics 6 CR Kudella

Competence Certificate
- ‘Teilleistung’ T-BGU-100073 with written examination according to § 4 Par. 2 No. 1
details about the learning control see at the ‘Teilleistung’

Competence Goal
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.

Module grade calculation
grade of the module is grade of the exam

Prerequisites
none

Content
see German version

Recommendation
module Earthworks and Foundation Engineering [bauiM5P2-ERDGB]

Annotation
none

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
Literature
5.114 Module: Ground Water and Earth Dams (bauIM5S04-GWDAMM) [M-BGU-100073]

Responsible: N.N.
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: Subject-Specific Supplements

Credits  Recurrence  Duration  Language  Level  Version
6           Each summer term  1 term           German  4       1

Mandatory

T-BGU-100091  Ground Water and Earth Dams  6 CR  Bieberstein

Competence Certificate
- 'Teilleistung' T-BGU-100091 with oral examination according to § 4 Par. 2 No. 2
details about the learning control see at the 'Teilleistung'

Competence Goal
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.

Module grade calculation
grade of the module is grade of the exam

Prerequisites
none

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.

Recommendation
module Earthworks and Foundation Engineering [bauIM5P2-ERDGB]

Annotation
none

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

Literature
5.115 Module: Rock Engineering and Underground Construction (bauiM5S05-FELSHOHL) [M-BGU-100074]

Responsible: N.N.
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: Subject-Specific Supplements

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Mandatory

T-BGU-100074 | Rock Engineering and Underground Construction | 6 CR | Kudella

Competence Certificate
- ‘Teilleistung’ T-BGU-100074 with written examination according to § 4 Par. 2 No. 1
  details about the learning control see at the 'Teilleistung'

Competence Goal
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.

Module grade calculation
grade of the module is grade of the exam

Prerequisites
none

Content
see German version

Recommendation
module Rock Engineering and Tunneling [bauiM5P3-FMTUB]

Annotation
none

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

Literature

Module: Numerical Modelling in Geotechnics (bauiM5S06-NUMMOD) [M-BGU-100075]

Responsible: N.N.
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: Subject-Specific Supplements

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Mandatory

| T-BGU-100107 | Numerical Modelling in Geotechnics | 6 CR | Niemunis |

Competence Certificate
- „Teilleistung“ T-BGU-100107 with oral examination according to § 4 Par. 2 No. 2
- details about the learning control see at the ‘Teilleistung’

Competence Goal
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.

Module grade calculation
grade of the module is grade of the exam

Prerequisites
none

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

Recommendation
module Basics of Numeric Modelling [bauiM5P4-NUMGRUND]

Annotation
none
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

Literature

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

Responsible: N.N.
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: Subject-Specific Supplements

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Mandatory

| T-BGU-100075 | Geotechnical Testing and Measuring Technology | 6 CR | N.N. |

Competence Certificate
- 'Teilleistung' T-BGU-100075 with oral examination according to § 4 Par. 2 No. 2

details about the learning control see at the 'Teilleistung'

Competence Goal
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.

Module grade calculation
none

Prerequisites
none

Content
The module deepens aspects of geotechnical experiments. Specific experiments from rock mechanics and dam and embankment 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.

Recommendation
none

Annotation
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 repeating 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
## Module: Special Underground Engineering (baurM5S08-SPEZTIEF) [M-BGU-100078]

**Responsible:** N.N.  
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:** Subject-Specific Supplements

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<td>Ground Improvement, Grouting and Soil Freezing</td>
<td>3 CR</td>
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<td>3 CR</td>
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### Competence Certificate

- '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'.

### Competence Goal

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.

### Module grade calculation

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

### Prerequisites

None

### 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 equipment, execution controls and advice for avoiding errors and minimizing 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

### Recommendation

None

### Annotation

None
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

Literature
[1] Triantafyllidis, Th. (1990), Planung und Bauausführung im Spezialtiefbau, Teil 1, Ernst & S.
Module: Environmental Geotechnics (bauIM5S09-UMGEOTEC) [M-BGU-100079]

Responsible: N.N.
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: Subject-Specific Supplements

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<td>Landfills</td>
<td>3 CR</td>
<td>Bieberstein</td>
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<tr>
<td>T-BGU-100089</td>
<td>Brownfield Sites - Investigation, Evaluation, Rehabilitation</td>
<td>3 CR</td>
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Competence Certificate
- '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'

Competence Goal
The students can describe the legal guidelines regarding the disposal of wastes and the permitted threshold value for brownfields. They can outline the geotechnical concerns in the construction of landfill sites depending on the particular landfill classification, landfill elements, their relevant requirements and necessary certifications. They are able to interlink interdisciplinarily 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.

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

Prerequisites
none

Content
The module covers geotechnical techniques in dealing with waste and brownfields. The environmental engineering, scientific and legal basics are discussed. Working steps of project planning, building materials, ways of construction and proofs are presented. Techniques for burning and immobilisation are explained as well as different microbiological, electrokinetic, hydraulic and pneumatic soil remediation methods.

Recommendation
none

Annotation
none

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

Responsible: N.N.
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: Subject-Specific Supplements

M Mandatory

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T-BGU-100085 Coupled Geomechanic Processes

Competence Certificate
- "Teilleistung" T-BGU-100085 with oral examination according to § 4 Par. 2 No. 2
details about the learning control see at the 'Teilleistung'

Competence Goal
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.

Module grade calculation
grade of the module is grade of the exam

Prerequisites
none

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.

Recommendation
module Rock Engineering and Tunneling [bauiM5P3-FMTUB]

Annotation
IMPORTANT:
The module will not be offered in winter term 2019/20.

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
Literature
5.121 Module: Module Master Thesis (bauiMSC-THESIS) [M-BGU-104996]

Responsible: Prof. Dr.-Ing. Peter Vortisch  
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences  
Part of: Master Thesis (Usage from 7/1/2019)

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<td>Master Thesis</td>
<td>30 CR</td>
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Competence Certificate  
thesis and final presentation according to § 14 ER/SPO

Competence Goal  
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.

Module grade calculation  
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 Interdisciplinary Qualifications [bauiMW0-UEQUAL] cannot be counted for this purpose.

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.

Recommendation  
All technical skills and soft skills required for working on the selected topic and the preparation of the thesis should be attained.

Annotation  
Information about the procedure regarding admission and registration of the Master Thesis see chap. 2.8.

Workload  
- working on thesis project: 720 h  
- thesis writing: 150 h.  
- preparation of presentation: 30 h  

total: 900 h
5.122 Module: Module Master Thesis (bauiMSC-THESIS) [M-BGU-103953]

Responsible: Prof. Dr.-Ing. Peter Vortisch
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: Master Thesis (Usage until 6/30/2019)

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Mandatory

| T-BGU-108097 | Master Thesis | 30 CR | Vortisch |

Competence Certificate

thesis and final presentation according to § 14 ER/SPO

Competence Goal

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.

Module grade calculation

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.

Modeled Conditions

The following conditions have to be fulfilled:

1. The module M-BGU-103926 - Prerequisite Thesis must have been passed.

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.

Recommendation

All technical skills and soft skills required for working on the selected topic and the preparation of the thesis should be attained.

Annotation

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
5.123 Module: Interdisciplinary Qualifications (bauiMW0-UEQUAL) [M-BGU-103927]

Responsible: Prof. Dr.-Ing. Peter Vortisch
Organisation: University
Part of: Interdisciplinary Qualifications

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Election block: Überfachliche Qualifikationen (at least 6 credits)

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<tr>
<th>T-BGU-106765</th>
<th>Introduction to Matlab</th>
<th>3 CR</th>
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Competence Certificate
according to elected courses, freely be chosen from the course catalogue for Interdisciplinary Qualifications of HoC and ZAK

Competence Goal
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.

Module grade calculation
not graded

Prerequisites
none

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).

Recommendation
none

Annotation
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. If the Examination Committee accepted the recognition of a course in principle, online registration to the respective examination is possible. Language courses of the 'Sprachenzentrum' (SpZ) are usually recognized. Further information about the Interdisciplinary Qualifications see Sect. 2.3.
Workload
see course description of HoC, and lecture descriptions of ZAK
6 Courses

6.1 Course: Advanced Fluid Mechanics [T-BGU-106612]

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Responsible: Prof. Dr. Olivier Eiff
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: M-BGU-103359 - Advanced Fluid Mechanics

Events

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<td>Advanced Fluid Mechanics</td>
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Competence Certificate
written exam, 90 min.

Prerequisites
none

Recommendation
none

Annotation
none
6.2 Course: Advanced Studies in Construction Engineering [T-BGU-108003]

**Responsible:** Prof. Dr.-Ing. Shervin Haghsheno

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:** M-BGU-100344 - Advanced Studies in Construction Engineering

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<td>Haghsheno, Scheuble, Matz</td>
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<td>Lecture (V)</td>
<td>Haghsheno, Schneider</td>
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<td>WS 19/20</td>
<td>6241905</td>
<td>Erdbau</td>
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<td>Lecture (V)</td>
<td>Haghsheno, Mitarbeiter/innen</td>
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**Competence Certificate**

written exam, 90 min.

**Prerequisites**

none

**Recommendation**

none

**Annotation**

none
6.3 Course: Analysis and Evolution of Mobility [T-BGU-101004]

Responsible: Dr.-Ing. Martin Kagerbauer
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: M-BGU-100583 - Analysis and Evolution of Mobility

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**Competence Certificate**
oral exam, appr. 30 min.

**Prerequisites**

none

**Recommendation**

none

**Annotation**

none
## 6.4 Course: Analysis of Turbulent Flows [T-BGU-103561]

### Responsible:
Prof. Dr.-Ing. Markus Uhlmann

### Organisation:
KIT Department of Civil Engineering, Geo- and Environmental Sciences

### Part of:
M-BGU-103363 - Analysis of Turbulent Flows

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<td>Uhlmann</td>
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<td>6221911</td>
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<td>Lecture (V)</td>
<td>Uhlmann</td>
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**Competence Certificate**
oral exam, appr. 45 min.

**Prerequisites**
none

**Recommendation**
none

**Annotation**
none
6.5 Course: Anchorage in Concrete [T-BGU-100022]

**Responsible:** Prof. Dr.-Ing. Lothar Stempniewski

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:** M-BGU-100001 - Anchorage in Concrete

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<td>Übungen zu Befestigungstechnik I</td>
<td>1 SWS</td>
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<td>Befestigungstechnik II</td>
<td>1 SWS</td>
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<td>1 SWS</td>
<td>Practice (Ü)</td>
<td>Fuchs, Rizzo</td>
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**Competence Certificate**

oral exam, appr. 20 min.

**Prerequisites**

none

**Recommendation**

none

**Annotation**

none
6.6 Course: Anchoring, Piling and Slurry Wall Technology [T-BGU-100079]

Responsible: N.N.
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: M-BGU-100078 - Special Underground Engineering

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Events

| SS 2019 | 6251822 | Anchoring, Piling and Slurry Wall Technology | 2 SWS | Lecture / Practice (VÜ) | Triantafyllidis |

Competence Certificate
oral exam, appr. 20 min.

Prerequisites
none

Recommendation
none

Annotation
none

Below you will find excerpts from events related to this course:

Anchoring, Piling and Slurry Wall Technology
6251822, SS 2019, 2 SWS, Language: German, Open in study portal

Learning Content

- Slurry walls: Application range 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.
6.7 Course: Applied Building Physics [T-BGU-100039]

Responsible: Dr.-Ing. Engin Kotan
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: M-BGU-103950 - Building Physics I

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Competence Certificate
oral exam, appr. 20 min.

Prerequisites
none

Recommendation
none

Annotation
none
6.8 Course: Applied Dynamics of Structures [T-BGU-100021]

**Responsible:** Prof. Dr.-Ing. Lothar Stempniewski

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:** M-BGU-100038 - Applied Dynamics of Structures

**Type**
- Oral examination

**Credits**
- 6

**Recurrence**
- Each term

**Version**
- 1

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**Competence Certificate**
oral exam, appr. 30 min.

**Prerequisites**
none

**Recommendation**
none

**Annotation**
none
## 6.9 Course: Applied Ecology and Water Quality [T-BGU-109956]

**Responsible:** Dr.-Ing. Stephan Fuchs  
Dr.-Ing. Stephan Hilgert  

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:** M-BGU-104922 - Freshwater Ecology

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### Events

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### Competence Certificate

term paper, appr. 8-15 pages, and presentation, appr. 15 min.

### Prerequisites

none

### Recommendation

none

### Annotation

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.
### Course: Applied Geotechnics [T-BGU-100073]

**Responsible:** Dr.-Ing. Peter Kudella

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:** M-BGU-100072 - Applied Geotechnics

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#### Events

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<th>Lecture / Practice (VÜ)</th>
<th>Kudella</th>
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<tbody>
<tr>
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<td>6251812</td>
<td>Special Foundation Engineering and Design</td>
<td>2 SWS</td>
<td>Lecture / Practice (VÜ)</td>
<td>Kudella</td>
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**Competence Certificate**

class= handwritten exam, 90 min.

**Prerequisites**

none

**Recommendation**

none

**Annotation**

none

Below you will find excerpts from events related to this course:

#### Foundations and Retaining Structures

6251810, SS 2019, 2 SWS, Language: German, [Open in study portal](#)

**Lecture / Practice (VÜ)**

**Learning 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


Special Foundation Engineering and Design
6251812, SS 2019, 2 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)

Learning 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.
6.11 Course: Aquatic Ecosystems [T-BGU-106789]

**Responsible:** Dr. Charlotte Kämpf

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:** M-BGU-103400 - Aquatic Ecosystems

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**Competence Certificate**

- about a topic selected by oneself:
  - presentation, appr. 15-20 min.,
  - manuscript, 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 have to be fulfilled:

1. The course T-BGU-106788 - Examination Prerequisite Aquatic Ecosystems must have been passed.

**Recommendation**

none

**Annotation**

none
6.12 Course: Basics of Finite Elements [T-BGU-100047]

Responsible: Prof. Dr.-Ing. Peter Betsch
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: M-BGU-100052 - Basics of Finite Elements

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Competence Certificate
oral exam, appr. 30 min.

Prerequisites
none

Recommendation
none

Annotation
none
### 6.13 Course: Basics of Prestressed Concrete [T-BGU-100019]

**Responsible:** Prof. Dr.-Ing. Lothar Stempniewski  
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:** M-BGU-100036 - Basics of Prestressed Concrete

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| SS 2019 | 6211803 | Grundlagen des Spannbetons | 2 SWS | Lecture (V) | Stempniewski |
| SS 2019 | 6211804 | Übungen zu Grundlagen des Spannbetons | 2 SWS | Practice (Ü) | Müller |

**Competence Certificate**  
written exam, 90 min.

**Prerequisites**  
none

**Recommendation**  
none

**Annotation**  
none
## 6.14 Course: Bracing and Stability in Reinforced Concrete [T-BGU-100018]

**Responsible:** Prof. Dr.-Ing. Lothar Stempniewski  
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:** M-BGU-100003 - Bracing and Stability in Reinforced Concrete

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<td>2 SWS</td>
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<td>6211802 Übungen zu Aussteifung und Stabilität im Stahlbetonbau</td>
<td>2 SWS</td>
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**Competence Certificate**
written exam, 90 min.

**Prerequisites**
none

**Recommendation**
none

**Annotation**
none
6 COURSES

Course: Brownfield Sites - Investigation, Evaluation, Rehabilitation [T-BGU-100089]

6.15 Course: Brownfield Sites - Investigation, Evaluation, Rehabilitation [T-BGU-100089]

Responsible: Dr.-Ing. Andreas Bieberstein
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: M-BGU-100079 - Environmental Geotechnics

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Events

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Competence Certificate
oral exam, appr. 20 min.

Prerequisites
none

Recommendation
none

Annotation
none

Below you will find excerpts from events related to this course:

Brownfield Sites - Investigation, Evaluation, Rehabilitation
6251915, WS 19/20, 2 SWS, Language: German, Open in study portal

Learning 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
### 6.16 Course: Building and Environmental Aerodynamics [T-BGU-103563]

**Responsible:** Dr.-Ing. Christof-Bernhard Gromke  
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:** M-BGU-103897 - Interaction Flow - Building Structure

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**Competence Certificate**  
oral exam, appr. 30 min.

**Prerequisites**  
none

**Recommendation**  
none

**Annotation**  
none
### Course: Building Information Modeling (BIM) [T-BGU-108007]

**Responsible:** Prof. Dr.-Ing. Shervin Haghsheno  
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:** M-BGU-103916 - Building Information Modeling (BIM)

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**Competence Certificate**  
Project report appr. 10 pages and presentation appr. 10 min.

**Prerequisites**  
None

**Recommendation**  
None

**Annotation**  
None
6.18 Course: Building Preservation of Concrete and Masonry Constructions [T-BGU-100038]

**Responsible:** Dr.-Ing. Engin Kotan

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:** M-BGU-100058 - Building Preservation of Concrete and Masonry Constructions

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**Competence Certificate**
oral exam, appr. 30 min.

**Prerequisites**
none

**Recommendation**
none

**Annotation**
none
6.19 Course: Building Preservation of Steel and Timber Structures [T-BGU-100027]

Responsible: Dr.-Ing. Matthias Frese
Prof. Dr.-Ing. Thomas Ummenhofer

Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences

Part of: M-BGU-100043 - Building Preservation of Steel and Timber Structures

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Competence Certificate
written exam, 90 min. (45 min. for each course)

Prerequisites
none

Recommendation
none

Annotation
none
# 6.20 Course: Building Technology [T-BGU-100040]

**Responsible:** Dr.-Ing.habil Stefan Wirth  
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:** M-BGU-103950 - Building Physics I

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**Competence Certificate**  
oral exam, appr. 20 min.

**Prerequisites**  
none

**Recommendation**  
none

**Annotation**  
none
### 6.21 Course: Business and Human Resource Management [T-BGU-108002]

**Responsible:** Prof. Dr.-Ing. Shervin Haghsheno  
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:** M-BGU-100111 - Business and Human Resource Management

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**Competence Certificate**  
written exam, 90 min.

**Prerequisites**  
none

**Recommendation**  
none

**Annotation**  
none
6.22 Course: City Transport Facilities [T-BGU-100083]

Responsible: Prof. Dr.-Ing. Ralf Roos
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: M-BGU-100026 - City Transport Facilities

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Competence Certificate
oral exam, appr. 45 min.

Prerequisites
Exercises and student research project City Transport Facilities has to be passed.

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-BGU-109912 - Exercises and student research project City Transport Facilities must have been passed.

Recommendation
none

Annotation
none
6.23 Course: Computational Analysis of Structures [T-BGU-100031]

Responsible: Prof. Dr.-Ing. Werner Wagner
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: M-BGU-100047 - Computational Analysis of Structures

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**Competence Certificate**
oral exam, appr. 30 min.

**Prerequisites**
Student research project "Computational Analysis of Structures" has to be passed.

**Modeled Conditions**
The following conditions have to be fulfilled:

1. The course T-BGU-100174 - Student Research Project 'Computational Analysis of Structures' must have been passed.

**Recommendation**
none

**Annotation**
none
6.24 Course: Computational Structural Dynamics [T-BGU-100999]

**Responsible:** Prof. Dr.-Ing. Peter Betsch

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:** M-BGU-100579 - Numerical Structural Dynamics

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**Competence Certificate**
oral exam, appr. 30 min.

**Prerequisites**
none

**Recommendation**
none

**Annotation**
none
6.25 Course: Concrete Construction Technology [T-BGU-100036]

**Responsible:** Prof. Dr.-Ing. Frank Dehn

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:** M-BGU-100056 - Concrete Construction Technology

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**Competence Certificate**
oral exam, appr. 30 min.

**Prerequisites**
none

**Recommendation**
none

**Annotation**
none
6.26 Course: Construction of Steel and Composite Bridges [T-BGU-100024]

**Responsible:** Prof. Dr.-Ing. Thomas Ummenhofer  
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:** M-BGU-100040 - Construction of Steel and Composite Bridges

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**Competence Certificate**  
oral exam, 60 min.

**Prerequisites**  
none

**Recommendation**  
none

**Annotation**  
none
6.27 Course: Contact Mechanics [T-BGU-109947]

Responsible: Marlon Franke
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: M-BGU-104916 - Contact Mechanics

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Competence Certificate
oral exam, appr. 30 min.

Prerequisites
none

Recommendation
none

Annotation
none
6.28 Course: Continuum Mechanics [T-BGU-106196]

**Responsible:** Marlon Franke

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:**
- M-BGU-100064 - Continuum Mechanics of Heterogeneous Solids
- M-BGU-100070 - Basics of Numeric Modeling

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**Competence Certificate**
oral exam, appr. 30 min.

**Prerequisites**
none

**Recommendation**
none

**Annotation**
none
6.29 Course: Coupled Geomechanic Processes [T-BGU-100085]

Responsible: N.N.
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: M-BGU-100077 - Coupled Geomechanic Processes

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Competence Certificate
oral exam, appr. 40 min.

Prerequisites
none

Recommendation
none

Annotation
none
### 6.30 Course: Decommissioning of Nuclear Facilities [T-BGU-100627]

**Responsible:** Prof. Dr.-Ing. Sascha Gentes  
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:** M-BGU-100345 - Decommissioning of Nuclear Facilities

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**Competence Certificate**  
oral exam, appr. 30 min.

**Prerequisites**  
keine

**Recommendation**  
one

**Annotation**  
one
6.31 Course: Design and Construction of Components in Reinforced Concrete [T-BGU-100015]

**Responsible:** Prof. Dr.-Ing. Lothar Stempniewski

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:** M-BGU-100033 - Design and Construction of Components in Reinforced Concrete

**Type**
- Written examination

**Credits**
- 4

**Recurrence**
- Each term

**Version**
- 2

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**Competence Certificate**
- written exam, 90 min.

**Prerequisites**
- none

**Recommendation**
- none

**Annotation**
- none
### 6.32 Course: Digital Planning and Building Information Modeling [T-BGU-110382]

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**Competence Certificate**

preparation of BIM flat pattern plan and report, approx. 20 pages, with presentation, approx. 10 min.

**Prerequisites**

none

**Recommendation**

none

**Annotation**

none
6.33 Course: Digitalization in Facility and Real Estate Management [T-BGU-108941]

**Responsible:** Prof. Dr.-Ing. Kunibert Lennerts

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:** M-BGU-104348 - Digitalization in Facility and Real Estate Management

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<td>project work incl. report, appr. 15 pages, and presentation/colloquium, appr. 15 min</td>
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**Prerequisites**
none

**Recommendation**
none

**Annotation**
none
6.34 Course: Durability and Service Life Design [T-BGU-100037]

Responsible: Dr.-Ing. Michael Vogel
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: M-BGU-100057 - Durability and Service Life Design

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Competence Certificate
oral exam, appr. 30 min.

Prerequisites
none

Recommendation
none

Annotation
none
### 6.35 Course: Dynamics of Structures [T-BGU-100077]

**Responsible:** Prof. Dr.-Ing. Peter Betsch  
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:** M-BGU-100035 - Surface Structures and Dynamics of Structures

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**Competence Certificate**
- written exam, 60 min.

**Prerequisites**
- none

**Recommendation**
- none

**Annotation**
- none
### 6.36 Course: Earthworks and Foundation Engineering [T-BGU-100068]

**Responsible:** N.N.

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:** M-BGU-100068 - Earthworks and Foundation Engineering

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**Competence Certificate**
written exam, 90 min.

**Prerequisites**
none

**Recommendation**
preparation of the student research project for examination preparation

**Annotation**
none

Below you will find excerpts from events related to this course:

#### Foundation Types

6251701, WS 19/20, 2 SWS, Open in study portal

**Lecture / Practice (VÜ)**

**Learning 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,


#### Basics in Earthworks and Embankment Dams

6251703, WS 19/20, 2 SWS, Language: German, Open in study portal

**Lecture / Practice (VÜ)**
**Learning Content**
- cross section and longitudinal section of filled dams
- requirements for zonation
- sealing
- combined effects dam/subsoil
- construction methods for seepage cutoff
- 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
6.37 Course: Economics and Management in Construction [T-BGU-100143]

Responsible: Prof. Dr.-Ing. Shervin Haghsheno
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: M-BGU-100102 - Economics and Management in Construction

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Competence Certificate
written exam, 90 min.

Prerequisites
none

Recommendation
none

Annotation
none
6.38 Course: Environmental Communication [T-BGU-101676]

**Responsible:** Dr. Charlotte Kämpf

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:** M-BGU-101108 - Environmental Communication

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**Competence Certificate**
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 have to be fulfilled:

1. The course T-BGU-106620 - Examination Prerequisite Environmental Communication must have been passed.

**Recommendation**
none

**Annotation**
none
T 6.39 Course: Environmental Fluid Mechanics [T-BGU-106767]

**Responsible:** Prof. Dr. Olivier Eiff  
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:** M-BGU-103383 - Environmental Fluid Mechanics

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**Competence Certificate**  
written exam, 90 min.

**Prerequisites**  
none

**Recommendation**  
none

**Annotation**  
none
6.40 Course: Environmentally-Friendly Recycling and Disassembly of Buildings [T-BGU-100146]

**Responsible:** Prof. Dr.-Ing. Sascha Gentes  
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:** M-BGU-100110 - Environmentally-friendly Recycling and Disassembly of Buildings

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**Competence Certificate**
oral exam, appr. 30 min.

**Prerequisites**
none

**Recommendation**
none

**Annotation**
none
6.41 Course: Equipment and special Construction Techniques in Building Practice [T-BGU-108009]

**Responsible:** Prof. Dr.-Ing. Sascha Gentes

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:** M-BGU-103918 - Equipment and special Construction Techniques in Building Practice

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**Competence Certificate**

oral exam, appr. 45 min.

**Prerequisites**

none

**Recommendation**

none

**Annotation**

none
### 6.42 Course: Examination Prerequisite Aquatic Ecosystems [T-BGU-106788]

**Responsible:** Dr. Charlotte Kämpf  
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:** M-BGU-103400 - Aquatic Ecosystems

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**Competence Certificate**  
literature annotation, appr. 150 words, and short presentation, appr. 10 min.

**Prerequisites**  
none

**Recommendation**  
none

**Annotation**  
none
### 6.43 Course: Examination Prerequisite Environmental Communication [T-BGU-106620]

**Responsible:** Dr. Charlotte Kämpf  
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:** M-BGU-101108 - Environmental Communication

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**Competence Certificate**  
2 literature annotations, appr. 150 words each, and short presentation, appr. 10 min.

**Prerequisites**  
none

**Recommendation**  
none

**Annotation**  
none
6.44 Course: Exercises and student research project City Transport Facilities [T-BGU-109912]

**Responsible:** Prof. Dr.-Ing. Ralf Roos

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:** M-BGU-100026 - City Transport Facilities

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**Competence Certificate**

1 report approx. 5 pages and 3 planning documents

**Prerequisites**

none

**Recommendation**

none

**Annotation**

none
6.45 Course: Experimental Hydraulics II [T-BGU-106773]

Responsibility: Dr.-Ing. Frank Seidel
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: M-BGU-103388 - Experimental Hydraulics and Measuring Techniques

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Competence Certificate

term paper, appr. 10 pages

Prerequisites

none

Recommendation

none

Annotation

none
6.46 Course: Experiments in Fluid Mechanics [T-BGU-106760]

**Responsible:** Prof. Dr. Olivier Eiff

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:** M-BGU-103377 - Experiments in Fluid Mechanics

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**Competence Certificate**

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

**Recommendation**

None

**Annotation**

None
6.47 Course: Facility Management in Hospitals and Hospital Management [T-BGU-109291]

Responsible: Prof. Dr.-Ing. Kunibert Lennerts
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: M-BGU-100347 - Facility Management in Hospitals and Hospital Management

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Competence Certificate

term paper appr. 10 pages, with final presentation appr. 10 min.

Prerequisites
none

Recommendation
none

Annotation
none
### 6.48 Course: FE-Applications in Practical Engineering [T-BGU-100032]

**Responsible:** Prof. Dr.-Ing. Werner Wagner  
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:** M-BGU-100048 - FE-Applications in Practical Engineering

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**Competence Certificate**  
oral exam, appr. 30 min.

**Prerequisites**  
none

**Recommendation**  
none

**Annotation**  
none
6.49 Course: Field Training Water Quality [T-BGU-109957]

Responsible: Dr.-Ing. Stephan Fuchs
Dr.-Ing. Stephan Hilgert

Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences

Part of: M-BGU-104922 - Freshwater Ecology

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Competence Certificate
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 have to be fulfilled:

1. The course T-BGU-109956 - Applied Ecology and Water Quality must have been started.

Recommendation
none

Annotation
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.
6.50 Course: Finite Elements in Solid Mechanics [T-BGU-100998]

Responsible: Prof. Dr.-Ing. Peter Betsch
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: M-BGU-100578 - Finite Elements in Solid Mechanics

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Competence Certificate:
oral exam, appr. 30 min.

Prerequisites:
none

Recommendation:
none

Annotation:
none
6.51 Course: Flow and Sediment Dynamics in Rivers [T-BGU-106782]

**Responsible:** Prof. Dr. Franz Nestmann

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:** M-BGU-103393 - Flow and Sediment Dynamics in Rivers

**Type:** Oral examination

**Credits:** 6

**Recurrence:** Each term

**Version:** 1

**Competence Certificate**
oral exam, appr. 30 min.

**Prerequisites**
The accomplishment 'Seminar Paper Flow Behavior of Rivers' (T-BGU-106781) has to be passed.

**Modeled Conditions**
The following conditions have to be fulfilled:

1. The course T-BGU-106781 - Seminar Paper 'Flow Behavior of Rivers' must have been passed.

**Recommendation**
none

**Annotation**
none
6.52 Course: Flow and Sediment Dynamics in Rivers [T-BGU-108467]

**Responsible:** Prof. Dr. Franz Nestmann
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences
**Part of:** M-BGU-104083 - Flow and Sediment Dynamics in Rivers

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<td>SS 2019 6222807</td>
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**Competence Certificate**
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 have to be fulfilled:

1. The course T-BGU-108466 - Seminar Paper 'Flow Behavior of Rivers' must have been passed.

**Recommendation**
none

**Annotation**
none
Course: Flow Measurement Techniques [T-BGU-110411]

Responsible: Dr.-Ing. Christof-Bernhard Gromke
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: M-BGU-103388 - Experimental Hydraulics and Measuring Techniques

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Competence Certificate
oral exam, appr. 30 min.

Prerequisites
none

Recommendation
none

Annotation
none
6.54 Course: Fracture and Damage Mechanics [T-BGU-100087]

**Responsible:** Prof. Dr.-Ing. Thomas Seelig

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:** M-BGU-100053 - Fracture and Damage Mechanics

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**Competence Certificate**
oral exam, appr. 45 min.

**Prerequisites**
none

**Recommendation**
none

**Annotation**
none
6.55 Course: Freight Transport [T-BGU-106611]

**Responsible:** Bastian Chlond

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:** M-BGU-100020 - Intermodality in Freight, Long-Distance and Air Transport

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**Competence Certificate**
written exam, 60 min.

**Prerequisites**
none

**Recommendation**
none

**Annotation**
none
### 6.56 Course: Geostatistics [T-BGU-106605]

**Responsible:** Prof. Dr.-Ing. Erwin Zehe  
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:** M-BGU-103762 - Analysis of Spatial Data

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**Competence Certificate**
oral exam, appr. 30 min.

**Prerequisites**
none

**Recommendation**
none

**Annotation**
none
6.57 Course: Geotechnical Testing and Measuring Technology [T-BGU-100075]

Responsible: N.N.
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: M-BGU-100076 - Geotechnical Testing and Measuring Technology

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Competence Certificate
oral exam, appr. 40 min.

Prerequisites
none

Recommendation
none

Annotation
none

Below you will find excerpts from events related to this course:

**Rock Testing**
6251909, WS 19/20, 1 SWS, Language: German, [Open in study portal]

Learning 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

**Testing in Dam and Wastefill Engineering**
6251910, WS 19/20, 1 SWS, Language: German, [Open in study portal]
Learning 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

Geotechnical Measuring Technology
6251911, WS 19/20, 2 SWS, Language: German, Open in study portal

Learning 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
6.58 Course: Glass, Plastic and Cable Structures [T-BGU-100025]

**Responsible:** Dr.-Ing. Daniel Ruff

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:** M-BGU-100041 - Glass, Plastic and Cable Structures

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**Competence Certificate**
oral exam, appr. 30 min.

**Prerequisites**
none

**Recommendation**
none

**Annotation**
none
6.59 Course: Ground Improvement, Grouting and Soil Freezing [T-BGU-100080]

**Responsible:** Dr.-Ing. Wolfgang Orth  
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:** M-BGU-100078 - Special Underground Engineering

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**Competence Certificate**
oral exam, appr. 20 min.

**Prerequisites**
none

**Recommendation**
none

**Annotation**
none

**Below you will find excerpts from events related to this course:**

**V**

**Ground Improvement, Grouting and Soil Freezing**  
6251820, SS 2019, 2 SWS, Language: German, Open in study portal

**Learning 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**
Kutzner, Ch. (1991), Injektionen im Baugrund, F.Enke
6.60 Course: Ground Investigation [T-BGU-100072]

Responsible: N.N.
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: M-BGU-100071 - Ground Investigation

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Competence Certificate
oral exam, appr. 40 min.

Prerequisites
none

Recommendation
none

Annotation
none

Below you will find excerpts from events related to this course:

**Soil Mechanical Laboratory Exercises**
6251808, SS 2019, 2 SWS, Language: German, [Open in study portal](#)

Learning Content
Explanation, demonstration and execution of standard tests in soil mechanics:
- particle size distribution
- state limits
- water content
- density evaluation: limit densities, specific density, proctor test
- oedometer (compressibility)
- simple shear
- triaxial tests (drained, undrained)
- permeability

**Geomechanical Field Exercise**
6251809, SS 2019, 2 SWS, Language: German, [Open in study portal](#)

Learning Content
- Density in-situ, standard, cone penetration and vane tests
- Plate loading test
- Inclinometer measuring
- Boreholes ans sampling, sample handling, special samples
- Selection of required lab tests according to soil type, sample quality and test conditions
- Subsoil evaluation and foundation recommendation
- Geological maps
6.61 Course: Ground Water and Earth Dams [T-BGU-100091]

Responsible: Dr.-Ing. Andreas Bieberstein
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: M-BGU-100073 - Ground Water and Earth Dams

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Competence Certificate
oral exam, appr. 40 min.

Prerequisites
none

Recommendation
none

Annotation
none

Below you will find excerpts from events related to this course:

Geotechnical Ground Water Problems
6251814, SS 2019, 2 SWS, Language: German, Open in study portal

Learning 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

Embankment Dams (Advanced)
6251816, SS 2019, 2 SWS, Language: German, Open in study portal
Learning 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
6.62 Course: Groundwater Flow around Structures [T-BGU-106774]

Responsibility: Ph.D. Luca Trevisan

Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences

Part of: M-BGU-103389 - Hydraulic Structures

Type: Oral examination
Credits: 3
Recurrence: Each term
Version: 1

Events

| SS 2019 | 6221815 | Groundwater Flow around Structures | 2 SWS | Lecture / Practice (VÜ) | Trevisan |

Competence Certificate
oral exam, appr. 30 min.

Prerequisites
none

Recommendation
none

Annotation
none

Below you will find excerpts from events related to this course:

Groundwater Flow around Structures
6221815, SS 2019, 2 SWS, Language: English, Open in study portal

Description
The course is intended to explain hydrogeological processes occurring around underground structures and to provide tools to solve the most common problems associated with stability of such structures. Some bench-scale physical experiments will be used to familiarize the students with the theoretical concepts through a practical approach.

Learning 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)
**Course: Groundwater Hydraulics [T-BGU-100624]**

**Responsible:** Dr. Ulf Mohrlok  
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:** M-BGU-100340 - Groundwater Management

**Type**  
Oral examination

**Credits**  
3

**Recurrence**  
Each term

**Version**  
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**Competence Certificate**  
oral exam, appr. 20 min.

**Prerequisites**  
none

**Recommendation**  
none

**Annotation**  
none

Below you will find excerpts from events related to this course:

**Notes**

**target audience:**
students of the programs Civil Engineering M.Sc., Water Science and Engineering M.Sc., interested persons in topic Groundwater

**learning target:**
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 calculate concentrations and mass fluxes respectively. They are able to apply these balance approaches in management scenarios for quantity and quality of groundwater resources.

**addressed topics:**
- 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

**Learning 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
6.64 Course: Group exercise Project Integrated Planning [T-BGU-109916]

**Responsible:** Prof. Dr.-Ing. Ralf Roos

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:** M-BGU-100018 - Project Integrated Planning

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**Events**

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**Competence Certificate**
integrated term paper of the whole group and 2 presentations of the result

**Prerequisites**
none

**Recommendation**
none

**Annotation**
none
6.65 Course: Group Exercise Project Management in Construction and Real Estate Industry [T-BGU-101006]

**Responsible:** Prof. Dr.-Ing. Shervin Haghsheno

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:** M-BGU-100338 - Project Management in Construction and Real Estate Industry

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**Competence Certificate**

term paper, appr. 10 pages

**Prerequisites**
one

**Recommendation**
one

**Annotation**
one
6.66 Course: Highway Design [T-BGU-100057]

**Responsible:** Prof. Dr.-Ing. Ralf Roos  
Dr.-Ing. Matthias Zimmermann

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:** M-BGU-100017 - Highway Design

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<td>Zimmermann, Roos</td>
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**Competence Certificate**
oral exam, appr. 30 min.

**Prerequisites**
Study project Design of a Rural Road hat to be passed.

**Modeled Conditions**
The following conditions have to be fulfilled:

1. The course T-BGU-109917 - Study project Design of a Rural Road must have been passed.

**Recommendation**
none

**Annotation**
none
6.67 Course: History of Urban Planning [T-BGU-108441]

**Responsible:** Prof. Dr. Joachim Vogt

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:** M-BGU-100013 - Urban Renewal

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| Events | SS 2019 | 6328016 | Städtebau I: Städtebaugeschichte | 2 SWS | Lecture (V) | Vogt, Ross |

**Competence Certificate**
oral exam, appr. 25 min.

**Prerequisites**
none

**Recommendation**
none

**Annotation**
none
### 6.68 Course: Hollow Section Structures [T-BGU-100086]

**Responsible:** Dr.-Ing. Stefan Herion  
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:** M-BGU-100004 - Hollow Section Structures

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**Competence Certificate**  
oral exam, appr. 30 min.

**Prerequisites**  
none

**Recommendation**  
none

**Annotation**  
none
6.69 Course: Homework 'Basics of Finite Elements' [T-BGU-109908]

**Responsible:** Prof. Dr.-Ing. Peter Betsch  
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:** M-BGU-100052 - Basics of Finite Elements

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<td>Practice (Ü)</td>
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**Competence Certificate**  
processing of two exercise sheets

**Prerequisites**  
one
6.70 Course: Homework 'Introduction to Environmental Data Analysis and Statistical Learning' [T-BGU-109950]

**Responsible:** Dr.-Ing. Uwe Ehret

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:** M-BGU-104880 - Introduction to Environmental Data Analysis and Statistical Learning

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**Competence Certificate**

Course associated assignments, short reports appr. 1 page each

**Prerequisites**

None

**Recommendation**

None

**Annotation**

None
6.71 Course: Homework 'Practical Noise Control' [T-BGU-109946]

**Responsible:** Dr.-Ing. Reiner Grigo

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:** M-BGU-100060 - Building Physics II

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**Events**

| SS 2019 | 6211814 | Praktischer Schallschutz | 2 SWS | Lecture (V) | Grigo, Grunau |

**Competence Certificate**

2 short reports, appr. 5 pages each

**Prerequisites**

none

**Recommendation**

none

**Annotation**

none
6.72 Course: Hydraulic Engineering [T-BGU-106759]

**Responsible:** Prof. Dr. Franz Nestmann

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:** M-BGU-103376 - Hydraulic Engineering

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<td>Lecture / Practice (VÜ)</td>
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**Competence Certificate**
written exam, 75 min.

**Prerequisites**
none

**Recommendation**
none

**Annotation**
none
6.73 Course: Hydro Power Engineering [T-BGU-100139]

**Responsible:** Dr.-Ing. Peter Oberle  
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:** M-BGU-100103 - Hydro Power Engineering

**Type**  
Oral examination  
**Credits**  
6  
**Recurrence**  
Each term  
**Version**  
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**Compentence Certificate**  
oral exam, appr. 20 min.

**Prerequisites**  
none

**Recommendation**  
none

**Annotation**  
none

Below you will find excerpts from events related to this course:

**Hydro Power Engineering**  
6222801, SS 2019, 4 SWS, Language: German, Open in study portal  
Lecture / Practice (VÜ)

**Learning Content**  
- political frame conditions (EEG)  
- Environmental requirements  
- Turbine technology and electrical aspects  
- Constructive characteristics of hydro power plants  
- 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,
6.74 Course: Hydrological Measurements in Environmental Systems
[T-BGU-106599]

Responsible: Dr. Jan Wienhöfer
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: M-BGU-103763 - Hydrological Measurements in Environmental Systems

Type: Examination of another type
Credits: 6
Recurrence: Each summer term
Version: 1

Events
SS 2019 6224807 Hydrological Measurements in Environmental Systems 4 SWS Wienhöfer, Ehret

Competence Certificate
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

Recommendation
none

Annotation
none
6.75 Course: Industrial Water Management [T-BGU-108448]

**Responsible:** Dr.-Ing. Tobias Morck

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:** M-BGU-104073 - Industrial Water Management

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**Events**

| SS 2019 | 6223810 | Industrial Water Management | 4 SWS | Lecture / Practice (VU) | Morck |

**Competence Certificate**
oral exam, appr. 30 min.

**Prerequisites**
Lab report 'Industrial Water Management' has to be passed.

**Modeled Conditions**
The following conditions have to be fulfilled:

1. The course T-BGU-109980 - Lab report 'Industrial Water Management' must have been passed.

**Recommendation**
none

**Annotation**
none
### 6.76 Course: Information Management for Public Mobility Services [T-BGU-106608]

**Responsible:** Prof. Dr.-Ing. Peter Vortisch  
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:** M-BGU-103357 - Special Issues of Public Transport

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**Competence Certificate**  
lecture accompanying exercises, appr. 5 pieces

**Prerequisites**  
none

**Recommendation**  
none

**Annotation**  
none
6.77 Course: Infrastructure Management [T-BGU-106300]

Responsible: Prof. Dr.-Ing. Ralf Roos
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: M-BGU-100009 - Infrastructure Management

Type: Written examination  Credits: 6  Recurrence: Each term  Version: 1

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Competence Certificate:
written exam, 120 min.

Prerequisites:
none

Recommendation:
none

Annotation:
none
### 6.78 Course: Interaction Flow - Hydraulic Structures [T-BGU-110404]

**Responsible:** Michael Gebhardt  
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:**  
- M-BGU-103389 - Hydraulic Structures  
- M-BGU-103897 - Interaction Flow - Building Structure

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**Events**

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**Competence Certificate**  
written exam, 60 min.

**Prerequisites**  
none

**Recommendation**  
none

**Annotation**  
none
**Course: Introduction to Environmental Data Analysis and Statistical Learning [T-BGU-109949]**

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| Events          | 6224908 | Introduction to Environmental Data Analysis and Statistical Learning | 4 SWS | Lecture / Practice (VÜ) | Ehret |

**Competence Certificate**
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 have to be fulfilled:

1. The course T-BGU-109950 - Homework 'Introduction to Environmental Data Analysis and Statistical Learning' must have been passed.

**Recommendation**
none

**Annotation**
none
6.80 Course: Introduction to Matlab [T-BGU-106765]

**Responsible:** Dr.-Ing. Uwe Ehret  
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:** M-BGU-103927 - Interdisciplinary Qualifications

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<td>Ehret, Wienhöfer</td>
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**Competence Certificate**

implementation of a Matlab code with report, appr. 1 page

**Prerequisites**

none

**Recommendation**

none

**Annotation**

none

Below you will find excerpts from events related to this course:

**Introduction to Matlab**

6224907, WS 19/20, 2 SWS, Language: English, [Open in study portal]

**Lecture / Practice (VÜ)**

**Notes**

- Universal programming basics: Programming 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
### Course: Lab report 'Industrial Water Management' [T-BGU-109980]

**Responsible:** Dr.-Ing. Tobias Morck  
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:** M-BGU-104073 - Industrial Water Management

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**Competence Certificate**
report on laboratory work, appr. 10 pages, as examination prerequisite

**Prerequisites**
none

**Recommendation**
none

**Annotation**
none
6.82 Course: Landfills [T-BGU-100084]

**Responsible:** Dr.-Ing. Andreas Bieberstein

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:** M-BGU-100079 - Environmental Geotechnics

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**Competence Certificate**
oral exam, appr. 20 min.

**Prerequisites**
none

**Recommendation**
none

**Annotation**
none

*Below you will find excerpts from events related to this course:* 

**Landfills**
6251913, WS 19/20, 2 SWS, Language: German, Open in study portal

**Learning 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**
DGHT, GDA-Empfehlungen – Geotechnik der Deponien und Altlasten, Ernst und Sohn, Berlin
Drescher (1997), Deponiebau, Ernst und Sohn, Berlin

**Responsible:** Hon.-Prof. Dr. Dietmar Hönig
Prof. Dr.-Ing. Ralf Roos
Prof. Dr.-Ing. Peter Vortisch

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:** M-BGU-100011 - Laws and Proceedings Concerning Traffic and Roads

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**Competence Certificate**
written exam, 120 min.

**Prerequisites**
none

**Recommendation**
none

**Annotation**
none
6.84 Course: Lean Construction [T-BGU-108000]

**Responsible:** Prof. Dr.-Ing. Shervin Haghsheno

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:** M-BGU-100104 - Lean Construction

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**Competence Certificate**
written exam, 70 min.

**Prerequisites**
none

**Recommendation**
none

**Annotation**
none
Course: Long-Distance and Air Traffic [T-BGU-106301]

**Responsible:** Bastian Chlond

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:** M-BGU-100020 - Intermodality in Freight, Long-Distance and Air Transport

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**Competence Certificate**

written exam, 60 min.

**Prerequisites**

none

**Recommendation**

none

**Annotation**

none
6.86 Course: Machinery and Process Engineering [T-BGU-100623]

**Responsible:** Prof. Dr.-Ing. Sascha Gentes

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:** M-BGU-100339 - Machinery and Process Engineering

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**Competence Certificate**

written exam, 90 min.

**Prerequisites**

none

** Recommendation**

none

** Annotation**

none
6.87 Course: Management of Water Resources and River Basins [T-BGU-106597]

**Responsible:** Dr.-Ing. Uwe Ehret

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:** M-BGU-103364 - Management of Water Resources and River Basins

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| Events |  
|--------|-------------------|
| SS 2019 | 6224801 Management of Water Resources and River Basins 4 SWS Lecture / Practice (VÜ) Ehret |

**Competence Certificate**
course associated assignments, short reports appr. 2 pages each, and final take home exam, report appr. 10 pages and colloquium

**Prerequisites**
none

**Recommendation**
none

**Annotation**
none
6.88 Course: Master Thesis [T-BGU-110135]

Responsible: Prof. Dr.-Ing. Peter Vortisch
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: M-BGU-104996 - Module Master Thesis

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Competence Certificate
duration appr. 6 months
presentation within one month after submission of the thesis

Prerequisites
defined for the module Master Thesis

Final Thesis
This course represents a final thesis. The following periods have been supplied:

- Submission deadline 6 months
- Maximum extension period 3 months
- Correction period 8 weeks

This thesis requires confirmation by the examination office.

Recommendation
see module

Annotation
Information about the procedure regarding admission and registration of the Master Thesis see chap. 2.8.
6.89 Course: Master Thesis [T-BGU-108097]

**Responsible:** Prof. Dr.-Ing. Peter Vortisch

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:** M-BGU-103953 - Module Master Thesis

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**Competence Certificate**
- duration appr. 6 months
- presentation within one month after submission of the thesis

**Prerequisites**
- defined for the module Master Thesis

**Recommendation**
- see module

**Annotation**
- Information about the procedure regarding admission and registration of the Master Thesis see chap. 1.8.
Course: Material Models in Solid Mechanics [T-BGU-100044]

**Responsible:** Prof. Dr.-Ing. Thomas Seelig

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:** M-BGU-100054 - Material Models in Solid Mechanics

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**Competence Certificate**
oral exam, appr. 45 min.

**Prerequisites**
none

**Recommendation**
none

**Annotation**
none
6.91 Course: Material Science, Welding and Fatigue [T-BGU-100023]

**Responsible:** Dr. Peter Knödel

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:** M-BGU-100039 - Material Science, Welding and Fatigue

**Type**
- Written examination

**Credits** 6

**Recurrence** Each term

**Version** 1

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**Competence Certificate**
written exam, 90 min.

**Prerequisites**
none

**Recommendation**
none

**Annotation**
none

Below you will find excerpts from events related to this course:

**Stahlwerkstoffe, Schweißtechnik und Ermüdung**
6212803, SS 2019, 4 SWS, Language: German, Open in study portal

**Learning 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 1993-1-10: Design of steel structures- Part1-10: Material toughness and through-thickness properties
- DIN EN 1090: Execution of steel structures and aluminium structures

Responsible: Dr.-Ing. Nico Herrmann
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: M-BGU-100061 - Materials Testing and Measuring Techniques

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Competence Certificate
oral exam, appr. 30 min.

Prerequisites
none

Recommendation
none

Annotation
none
6.93 Course: Micromechanics of Heterogeneous Solids [T-BGU-108879]

**Responsible:** Dr. Ingo Schmidt

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:** M-BGU-100064 - Continuum Mechanics of Heterogeneous Solids

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**Events**

| SS 2019 | 6215805 | Mechanik heterogener Festkörper | 2 SWS | Lecture (V) | Schmidt |

**Competence Certificate**
oral exam, appr. 20 min.

**Prerequisites**
none

**Recommendation**
none

**Annotation**
none
**Course: Modeling Techniques in Solid Mechanics [T-BGU-103223]**

**Responsible:** Dr. Alexander Konyukhov  
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:** M-BGU-101673 - Modeling in Solid Mechanics

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**Events**

| SS 2019 | 6215807 | Modellbildung in der Festigkeitslehre | 4 SWS | Lecture / Practice (VÜ) | Konyukhov |

**Competence Certificate**
oral exam, appr. 30 min.

**Prerequisites**
none

**Recommendation**
none

**Annotation**
none
6.95 Course: Models and Methods in Traffic Engineering and Transportation Planning [T-BGU-100012]

Responsible: Prof. Dr.-Ing. Peter Vortisch
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: M-BGU-100008 - Models and Methods in Traffic Engineering and Transportation Planning

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Competence Certificate
oral exam, appr. 20 min.

Prerequisites
none

Recommendation
none

Annotation
none
6.96 Course: Non-linear Analysis of Beam Structures [T-BGU-100030]

**Responsible:** Prof. Dr.-Ing. Werner Wagner

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:** M-BGU-100046 - Non-linear Analysis of Beam Structures

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**Competence Certificate**
written exam, 90 min.

**Prerequisites**
none

**Recommendation**
none

**Annotation**
none
### 6.97 Course: Non-linear Analysis of Surface Structures [T-BGU-100035]

**Responsible:** Prof. Dr.-Ing. Werner Wagner  
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:** M-BGU-100051 - Non-linear Analysis of Surface Structures

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**Competence Certificate**  
oral exam, appr. 3 min.

**Prerequisites**  
none

**Recommendation**  
none

**Annotation**  
none

**Responsible:** Dr.-Ing. Peter Oberle

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:** M-BGU-103390 - Numerical Flow Modeling in Hydraulic Engineering

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**Competence Certificate**
oral exam, appr. 20 min.

**Prerequisites**
none

**Recommendation**
none

**Annotation**
none

Below you will find excerpts from events related to this course:

**Numerische Strömungsmodellierung im Wasserbau**
6222903, WS 19/20, 4 SWS, Language: German, [Open in study portal](#)

**Learning 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
**6.99 Course: Numerical Fluid Mechanics [T-BGU-106758]**

**Responsible:** Prof. Dr.-Ing. Markus Uhlmann  
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:** M-BGU-103375 - Numerical Fluid Mechanics

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**Competence Certificate**  
written exam, 90 min.

**Prerequisites**  
one

**Recommendation**  
one

**Annotation**  
one
6.100 Course: Numerical Fluid Mechanics II [T-BGU-106768]

**Responsible:** Prof. Dr.-Ing. Markus Uhlmann  
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:** M-BGU-103384 - Advanced Computational Fluid Dynamics

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**Competence Certificate**  
oral exam, appr. 30 min.

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

**Modeled Conditions**  
The following conditions have to be fulfilled:

1. The module M-BGU-103375 - Numerical Fluid Mechanics must have been passed.

**Recommendation**  
none

**Annotation**  
none

Responsible: Dr. Ulf Mohrlok
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: M-BGU-100340 - Groundwater Management

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Events

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Competence Certificate
project report, appr. 15 pages

Prerequisites
none

Recommendation
none

Annotation
none

Below you will find excerpts from events related to this course:

Notes
target audience:
students of the programs Civil Engineering M.Sc., Water Science and Engineering M.Sc., interested persons in topic Groundwater Modelling with background knowledge

learning target:
The participants can set up a numerical groundwater model for a given problem and can simulate a given scenario under guidance. They are able to describe the essential aspects of setting up the model. According to instructions, they can analyse the simulation results and can evaluate their validity with respect to the used numerical methods.

addressed topics:

• numerical methods
• space and time discretization
• accuracy, stability
• working on a study project

Learning Content

• numerical methods
• space and time discretization
• accuracy, stability
• working on a study project
Literature
### Course: Numerical Methods in Structural Analysis [T-BGU-100034]

**Responsible:** Prof. Dr.-Ing. Werner Wagner  
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:** M-BGU-100050 - Numerical Methods in Structural Analysis

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**Competence Certificate**  
oral exam, appr. 30 min.

**Prerequisites**  
none

**Recommendation**  
none

**Annotation**  
none
6.103 Course: Numerical Modelling in Geotechnics [T-BGU-100107]

Responsible: apl. Prof. Dr. Andrzej Niemunis
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: M-BGU-100075 - Numerical Modelling in Geotechnics

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Events

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Competence Certificate
oral exam, appr. 30 min.;
on base of a programming project worked at during the semester

Prerequisites
none

Recommendation
none

Annotation
none

Below you will find excerpts from events related to this course:

Exercises in Numerical Modelling
6251818, SS 2019, 2 SWS, Language: German, Open in study portal

Learning Content
- beam on elastic half-space
- slope stability with layer procedure according to Bishop
- 2D and 3D pile rafts with lateral subground reaction
- FE-modeling of spatially correlated fluctuations of soil parameters
- FE settlement prediction with nonlinearity for small strains

Literature
FORTRAN 95 HP Manual

FEM Applications in Geotechnical Modelling
6251819, SS 2019, 2 SWS, Language: German, Open in study portal

Learning 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
Hibbit, Karlsson, Sorensen (1997): Contact in ABAQUS/Standard
6.104 Course: Numerics in Geotechnics [T-BGU-106197]

- **Responsible:** apl. Prof. Dr. Andrzej Niemunis
- **Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences
- **Part of:** M-BGU-100070 - Basics of Numeric Modeling

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### Events

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**Competence Certificate**
oral exam, appr. 30 min.

**Prerequisites**
none

**Recommendation**
none

**Annotation**
none

Below you will find excerpts from events related to this course:

**Numerics in Geotechnics**
6251707, WS 19/20, 2 SWS, Language: German, Open in study portal

**Learning 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
6.105 Course: Parallel Programming Techniques for Engineering [T-BGU-106769]

Responsible: Prof. Dr.-Ing. Markus Uhlmann
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: M-BGU-103384 - Advanced Computational Fluid Dynamics

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Competence Certificate
oral exam, appr. 30 min.

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

Modeled Conditions
The following conditions have to be fulfilled:

1. The module M-BGU-103375 - Numerical Fluid Mechanics must have been passed.

Recommendation
none

Annotation
none
6.106 Course: Planning of Transportation Systems [T-BGU-100013]

**Responsible:** Prof. Dr.-Ing. Peter Vortisch

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:** M-BGU-100016 - Planning of Transportation Systems

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**Competence Certificate**

oral exam, appr. 20 min.

**Prerequisites**

none

**Recommendation**

none

**Annotation**

none
### 6.107 Course: Practical Fire Protection [T-BGU-100042]

| Responsible: | Prof.Dipl.-Ing. Hermann Schröder |
| Organisation: | KIT Department of Civil Engineering, Geo- and Environmental Sciences |
| Part of: | M-BGU-100060 - Building Physics II |

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**Competence Certificate**
oral exam, appr. 20 min.

**Prerequisites**
none

**Recommendation**
none

**Annotation**
none
6.108 Course: Practical Noise Control [T-BGU-108024]

**Responsible:** Dr.-Ing. Reiner Grigo

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:** M-BGU-100060 - Building Physics II

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**Competence Certificate**

oral exam, appr. 20 min.

**Prerequisites**

none

**Recommendation**

none

**Annotation**

none
**6.109 Course: Project Integrated Planning [T-BGU-100061]**

**Responsible:** Prof. Dr.-Ing. Ralf Roos  
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:** M-BGU-100018 - Project Integrated Planning

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**Competence Certificate**  
oral exam, appr. 30 min.

**Prerequisites**  
Group exercise Project Integrated Planning has to be passed.

**Modeled Conditions**  
The following conditions have to be fulfilled:

1. The course T-BGU-109916 - Group exercise Project Integrated Planning must have been passed.

**Recommendation**  
none

**Annotation**  
none
6.110 Course: Project Management in Construction and Real Estate Industry [T-BGU-100622]

Responsible: Prof. Dr.-Ing. Shervin Haghsheno
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: M-BGU-100338 - Project Management in Construction and Real Estate Industry

Type: Written examination
Credits: 4
Recurrence: Each term
Version: 3

Events

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Competence Certificate
written exam, 90 min.

Prerequisites
none

Recommendation
none

Annotation
none
6.111 Course: Project Paper Lean Construction [T-BGU-101007]

**Responsible:** Prof. Dr.-Ing. Shervin Haghsheno

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:** M-BGU-100104 - Lean Construction

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**Competence Certificate**

- project:
  - report, appr. 10 pages, and
  - presentation, appr. 10 min.

**Prerequisites**

- none

**Recommendation**

- none

**Annotation**

- none

Responsible: Prof. Dr. Franz Nestmann
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: M-BGU-104100 - Water Distribution Systems

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Competence Certificate
project report, appr. 15 pages, and presentation, appr. 15 min.

Prerequisites
none

Recommendation
none

Annotation
none
### 6.113 Course: Project Studies in Water Resources Management [T-BGU-106783]

**Responsible:** Prof. Dr. Franz Nestmann  
Dr.-Ing. Frank Seidel

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:** M-BGU-103394 - Project Studies in Water Resources Management

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**Competence Certificate**  
Project work: term paper, appr. 15 pages, with presentation

**Prerequisites**  
none

**Recommendation**  
none

**Annotation**  
none
### 6.114 Course: Real Estate Management [T-BGU-100629]

**Responsible:** Prof. Dr.-Ing. Kunibert Lennerts  
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:** M-BGU-100346 - Real Estate Management

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**Competence Certificate**  
oral exam, appr. 40 min.

**Prerequisites**  
none

**Recommendation**  
none

**Annotation**  
none
6.115 Course: Research Seminar Construction Management [T-BGU-108008]

**Responsible:** Prof. Dr.-Ing. Shervin Haghsheno  
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:** M-BGU-103917 - Research Seminar Construction Management

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**Competence Certificate**

- project report, appr. 25 pages, and colloquium

**Prerequisites**

- none

**Recommendation**

- none

**Annotation**

- none
6.116 Course: River Basin Modelling [T-BGU-106603]

Responsible: Dr.-Ing. Stephan Fuchs
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: M-BGU-103373 - River Basin Modeling

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Events

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<td>Modelling Mass Fluxes in River Basins</td>
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Competence Certificate
project report, appr. 10 pages, and presentation, appr. 15 min.

Prerequisites
none

Recommendation
none

Annotation
none
6.117 Course: Road Construction [T-BGU-100058]

**Responsible:** Prof. Dr.-Ing. Ralf Roos

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:** M-BGU-100006 - Road Construction

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<td>Bemessung von Fahrbaephonkonstruktionen und Schadensanalytik</td>
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**Competence Certificate**

oral exam, appr. 30 min.

**Prerequisites**

none

**Recommendation**

none

**Annotation**

none
6.118 Course: Road Safety [T-BGU-100062]

Responsible: Dr.-Ing. Matthias Zimmermann
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: M-BGU-100021 - Road Safety

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<td>WS 19/20</td>
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Competence Certificate
oral exam, appr. 30 min.

Prerequisites
Seminar paper Road Safety has to be passed.

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-BGU-109915 - Seminar paper Road Safety must have been passed.

Recommendation
none

Annotation
none
6.119 Course: Rock Engineering and Underground Construction [T-BGU-100074]

Responsible: Dr.-Ing. Peter Kudella
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: M-BGU-100074 - Rock Engineering and Underground Construction

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Competence Certificate
written exam, 90 min.

Prerequisites
none

Recommendation
none

Annotation
none

Below you will find excerpts from events related to this course:

Aboveground Rock Engineering
6251905, WS 19/20, 2 SWS, Language: German, Open in study portal

Learning 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

Tunnel Construction in Soils and in Existence
6251907, WS 19/20, 2 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)
**Learning 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**
6.120 Course: Rock Mechanics and Tunneling [T-BGU-100069]

Responsible: Dr. Carlos Grandas Tavera
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: M-BGU-100069 - Rock Mechanics and Tunneling

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Competence Certificate

written exam, 90 min.

Prerequisites

none

Recommendation

preparation of the student research project for examination preparation

Annotation

none

Below you will find excerpts from events related to this course:

Basics in Rock Mechanics

6251804, SS 2019, 2 SWS, Language: German, Open in study portal

Learning Content

- basics of petrography
- rocks and rock mass classification
- rock pressure
- genesis 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


Basics in Tunnel Construction
6251806, SS 2019, 2 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)

Learning 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
- collapse 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
6.121 Course: Seminar in Transportation [T-BGU-100014]

**Responsible:** Bastian Chlond
Prof. Dr.-Ing. Peter Vortisch

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:** M-BGU-103357 - Special Issues of Public Transport

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**Competence Certificate**

Seminar paper, appr. 10 pages, and presentation, appr. 10 min.

**Prerequisites**

None

**Recommendation**

None

**Annotation**

None

**Responsible:** Prof. Dr. Franz Nestmann  
Dr.-Ing. Frank Seidel

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:** M-BGU-103393 - Flow and Sediment Dynamics in Rivers

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**Competence Certificate**
seminar paper in the course Flow Behavior of Rivers, appr. 15 pages

**Prerequisites**
none

**Recommendation**
none

**Annotation**
none

Responsibility: Prof. Dr. Franz Nestmann  
Dr.-Ing. Frank Seidel

Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences

Part of: M-BGU-104083 - Flow and Sediment Dynamics in Rivers

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Events

| SS 2019 | 6222807 | Flow Behavior of Rivers | 2 SWS | Lecture / Practice (VÜ) | Seidel, Eiff, Dupuis |

Competence Certificate

Seminar paper in the course Flow Behavior of Rivers, appr. 15 pages

Prerequisites

None

Recommendation

None

Annotation

None
**6.124 Course: Seminar paper Road Safety [T-BGU-109915]**

**Responsible:** Dr.-Ing. Matthias Zimmermann  
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:** M-BGU-100021 - Road Safety

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**Competence Certificate**

Integrated seminar paper of the team, appr. 10 pages/person and plan documents, presentation appr. 10 min.

**Prerequisites**

none

**Recommendation**

none

**Annotation**

none
### Course: Seminar Paper 'Waterway Engineering' [T-BGU-106779]

**Responsible:** Dr.-Ing. Andreas Kron  
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:** M-BGU-103392 - Waterway Engineering

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**Competence Certificate**

seminar paper, appr. 15 pages

**Prerequisites**
none

**Recommendation**
none

**Annotation**
none
**Course: Shell Structures and Stability of Structures [T-BGU-100033]**

**Responsible:** Prof. Dr.-Ing. Werner Wagner  
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:** M-BGU-100049 - Shell Structures and Stability of Structures

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**Competence Certificate**  
oral exam, appr. 40 min.

**Prerequisites**  
Student research project "Shell Structures and Stability of Structures" has to be passed.

**Modeled Conditions**  
The following conditions have to be fulfilled:

1. The course T-BGU-100254 - Student Research Project 'Shell Structures and Stability of Structures' must have been passed.

**Recommendation**  
none

**Annotation**  
none
6.127 Course: Solid Construction Bridges [T-BGU-100020]

**Responsible:** Prof. Dr.-Ing. Lothar Stempniewski

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:** M-BGU-100037 - Solid Construction Bridges

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**Competence Certificate**

written exam, 90 min.

**Prerequisites**

none

**Recommendation**

none

**Annotation**

none
### Course: Space and Infrastructure [T-BGU-100056]

**Responsible:** Dr.-Ing. Martin Kagerbauer  
Dr. Sina Keller

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:** M-BGU-100014 - Space and Infrastructure

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**Competence Certificate**
oral exam, appr. 30 min.

**Prerequisites**
none

**Recommendation**
none

**Annotation**
none
Course: Special Issues of Soil Mechanics [T-BGU-100071]

**Responsible:** N.N.

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:** M-BGU-100005 - Special Issues of Soil Mechanics

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<td>Unsaturated, Viscous and Cyclic Soil Behaviour - Theory and Element Tests</td>
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**Competence Certificate**
oral exam, appr. 40 min.

**Prerequisites**
none

**Recommendation**
none

**Annotation**
none

*Below you will find excerpts from events related to this course:*

**Unsaturated, Viscous and Cyclic Soil Behaviour - Theory and Element Tests**

6251901, WS 19/20, 2 SWS, Language: German, [Open in study portal]

**Learning 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

**Soil Dynamics**

6251903, WS 19/20, 2 SWS, Language: German, [Open in study portal]
Learning 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
Course: Special Topics in Highway Engineering [T-BGU-106734]

**Responsible:** Rainer Hess  
Prof. Dr.-Ing. Ralf Roos

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:** M-BGU-100022 - Special Topics in Highway Engineering

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**Competence Certificate**
oral exam, appr. 30 min.

**Prerequisites**
none

**Recommendation**
none

**Annotation**
none
6.131 Course: Steel and Composite Structures [T-BGU-100016]

Responsible: Prof. Dr.-Ing. Thomas Ummenhofer
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: M-BGU-100034 - Steel and Composite Structures

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Competence Certificate
written exam, 90 min.

Prerequisites
none

Recommendation
none

Annotation
none
6.132 Course: Structures in Steel [T-BGU-106798]

Responsible: Prof. Dr.-Ing. Thomas Ummenhofer
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: M-BGU-100042 - Structures in Steel and Timber

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Competence Certificate
project work with final presentation, presentation and colloquium appr. 30 min.

Prerequisites
none

Recommendation
none

Annotation
none
### 6.133 Course: Structures in Timber [T-BGU-106799]

**Responsible:** Dr.-Ing. Matthias Frese  
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:** M-BGU-100042 - Structures in Steel and Timber

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**Competence Certificate**
oral examination, appr. 30 min.

**Prerequisites**
none

**Recommendation**
none

**Annotation**
none
6.134 Course: Student Research Project 'Building Preservation of Concrete and Masonry Constructions' [T-BGU-100175]

**Responsible:** Dr.-Ing. Engin Kotan

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:** M-BGU-100058 - Building Preservation of Concrete and Masonry Constructions

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**Competence Certificate**

student research paper, 15-20 pages;
definition of a project available from lecturer

**Prerequisites**
none

**Recommendation**
none

**Annotation**
none
6.135 Course: Student Research Project 'Computational Analysis of Structures' [T-BGU-100174]

**Responsible:** Prof. Dr.-Ing. Werner Wagner  
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:** M-BGU-100047 - Computational Analysis of Structures

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**Competence Certificate**
student research project, appr. 15 pages

definition of a project available from lecturer

**Prerequisites**
none

**Recommendation**
none

**Annotation**
none
6.136 Course: Student Research Project 'Cost Estimation in Structural Engineering and Earthworks' [T-BGU-108010]

**Responsible:** Dr.-Ing. Harald Schneider

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:** M-BGU-100102 - Economics and Management in Construction

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**Competence Certificate**

term paper, appr. 15 pages, with test

**Prerequisites**

none

**Recommendation**

none

**Annotation**

none
6.137 Course: Student Research Project 'Dynamics of Structures' [T-BGU-107819]

Responsible: Prof. Dr.-Ing. Peter Betsch
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: M-BGU-100035 - Surface Structures and Dynamics of Structures

Type: Completed coursework
Credits: 1
Recurrence: Each winter term
Version: 2

Events
WS 19/20 6215701 Baudynamik 2 SWS Lecture (V) Franke

Competence Certificate
term paper;
definition of a project available from lecturer

Prerequisites
none

Recommendation
none

Annotation
none
Course: Student Research Project 'Earthworks and Foundation Engineering' [T-BGU-100178]

**Responsible:** Dr.-Ing. Andreas Bieberstein
N.N.

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:** M-BGU-100068 - Earthworks and Foundation Engineering

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**Competence Certificate**

report appr. 45 pages;
definition of a project available from lecturer

**Prerequisites**

none

**Recommendation**

none

**Annotation**

none

Below you will find excerpts from events related to this course:

**Foundation Types**

6251701, WS 19/20, 2 SWS, Open in study portal

**Learning 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,
Basics in Earthworks and Embankment Dams
6251703, WS 19/20, 2 SWS, Language: German, Open in study portal

Lecture / Practice (VÜ)

Learning Content
- cross section and longitudinal section of filled dams
- requirements for zonation
- sealing
- combined effects dam/subsoil
- construction methods for seepage cutoff
- 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
### 6.139 Course: Student Research Project ‘Excavation Pit Development and Shuttering Planning’ [T-BGU-108012]

**Responsible:** Dr.-Ing. Harald Schneider  
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:** M-BGU-100339 - Machinery and Process Engineering

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**Competence Certificate**  
term paper, appr. 15 pages, with test

**Prerequisites**  
none

**Recommendation**  
none

**Annotation**  
none
6.140 Course: Student Research Project 'Reinforced Concrete' [T-BGU-100170]

**Responsible:** Prof. Dr.-Ing. Lothar Stempniewski  
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:** M-BGU-100033 - Design and Construction of Components in Reinforced Concrete

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**Competence Certificate**

term paper;
definition of a project available from lecturer

**Prerequisites**

none

**Recommendation**

none

**Annotation**

none
6.141 Course: Student Research Project 'Rock Mechanics and Tunneling' [T-BGU-100179]

Responsible: Dr. Carlos Grandas Tavera
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences University
Part of: M-BGU-100069 - Rock Mechanics and Tunneling

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Competence Certificate
- report appr. 15 pages;
- definition of a project available from lecturer

Prerequisites
- none

Recommendation
- none

Annotation
- none

Below you will find excerpts from events related to this course:

**Basics in Rock Mechanics**
- 6251804, SS 2019, 2 SWS, Language: German, Open in study portal
- Lecture / Practice (VÜ)

Learning Content

- basics of petrography
- rocks and rock mass classification
- rock pressure
- genesis 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 isotropic and biaxial primary stress fields (elastic)
- circular tunnels in elastoplastic ground
- elliptical cross sections
- shaft problem
Literature

Basics in Tunnel Construction
6251806, SS 2019, 2 SWS, Language: German, Open in study portal Lecture / Practice (VÜ)

Learning 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
### 6.142 Course: Student Research Project 'Scheduling and Building Site Facilities' [T-BGU-108011]

**Responsible:** Dr.-Ing. Harald Schneider  
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:** M-BGU-100338 - Project Management in Construction and Real Estate Industry

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**Competence Certificate**  
Term paper, appr. 15 pages, with test

**Prerequisites**  
None

**Recommendation**  
None

**Annotation**  
None
6.143 Course: Student Research Project 'Shell Structures and Stability of Structures' [T-BGU-100254]

**Responsible:** Prof. Dr.-Ing. Werner Wagner

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:** M-BGU-100049 - Shell Structures and Stability of Structures

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**Competence Certificate**

Student research project, appr. 15 pages

definition of a project available from lecturer

**Prerequisites**

none

**Recommendation**

none

**Annotation**

none
6.144 Course: Student Research Project 'Steel Structures' [T-BGU-100171]

**Responsible:** Prof. Dr.-Ing. Thomas Ummenhofer

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:** M-BGU-100034 - Steel and Composite Structures

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**Competence Certificate**
term paper; definition of a project available from lecturer

**Prerequisites**
none

**Recommendation**
none

**Annotation**
none
6.145 Course: Student Research Project 'Surface Structures' [T-BGU-107818]

Responsible:  Prof. Dr.-Ing. Werner Wagner
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: M-BGU-100035 - Surface Structures and Dynamics of Structures

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Events

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Competence Certificate
term paper;
definition of a project available from lecturer

Prerequisites
none

Recommendation
none

Annotation
none
6.146 Course: Study project Design of a Rural Road [T-BGU-109917]

**Responsible:** Prof. Dr.-Ing. Ralf Roos  
Dr.-Ing. Matthias Zimmermann

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:** M-BGU-100017 - Highway Design

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**Competence Certificate**

preparation of 4 planning documents

**Prerequisites**
none

**Recommendation**
none

**Annotation**
none
6.147 Course: Surface Structures [T-BGU-100017]

**Responsible:** Prof. Dr.-Ing. Werner Wagner

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:** M-BGU-100035 - Surface Structures and Dynamics of Structures

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**Competence Certificate**
written exam, 60 min.

**Prerequisites**
none

**Recommendation**
none

**Annotation**
none
### 6.148 Course: Sustainability in Real Estate Management [T-BGU-100149]

**Responsible:** Prof. Dr.-Ing. Kunibert Lennerts  
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:** M-BGU-100112 - Sustainability in Real Estate Management

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**Competence Certificate**  
written exam, 90 min.

**Prerequisites**  
none

**Recommendation**  
none

**Annotation**  
none
6.149 Course: Tank Construction [T-BGU-101000]

**Responsible:** Dr. Peter Knödel

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:** M-BGU-100580 - Tank Construction

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**Competence Certificate**

oral exam, appr. 20 min.

**Prerequisites**

none

**Recommendation**

none

**Annotation**

none

Below you will find excerpts from events related to this course:

**Tank Construction**

6212910, WS 19/20, 3 SWS, Language: German, [Open in study portal](#)

**Learning Content**

- classification of tank types
- impacts: characteristic of loads by wind, filing, internal pressure, earthquake and deonation
- characteristics of shell structures
- proof of strength and stability with linear and non-linear calculation
- design and construction
- specific problems

**Literature**

- lecture note
- 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
T 6.150 Course: Technical Hydraulics [T-BGU-106770]

Responsible: Prof. Dr. Olivier Eiff
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: M-BGU-103385 - Technical Hydraulics

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Competence Certificate
written exam, 100 min.

Prerequisites
none

Recommendation
none

Annotation
none
6.151 Course: Tendering, Planning and Financing in Public Transport [T-BGU-101005]

**Responsible:** Prof. Dr.-Ing. Peter Vortisch

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:** M-BGU-103357 - Special Issues of Public Transport

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**Competence Certificate**
oral exam, appr. 20 min.

**Prerequisites**
none

**Recommendation**
none

**Annotation**
none
**6.152 Course: Term Paper 'International Sanitary Engineering' [T-BGU-109265]**

**Responsible:** Dr.-Ing. Stephan Fuchs  
Dr.-Ing. Tobias Morck

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:** M-BGU-104917 - Wastewater Treatment Technologies

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**Competence Certificate**
- presentation, appr. 15 min., term paper, appr. 10 pages

**Prerequisites**
- none

**Recommendation**
- none

**Annotation**
- keine
6.153 Course: Term Paper Tank Construction [T-BGU-101001]

**Responsible:** Dr. Peter Knödel

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:** M-BGU-100580 - Tank Construction

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**Competence Certificate**

term paper with presentation, appr. 20 pages

**Prerequisites**

none

**Recommendation**

none

**Annotation**

none

Below you will find excerpts from events related to this course:

**Tank Construction**

6212910, WS 19/20, 3 SWS, Language: German, [Open in study portal](#)

**Lecture (V)**

**Learning Content**

- classification of tank types
- impacts: characteristic of loads by wind, filing, internal pressure, earthquake and deonation
- characteristics of shell structures
- proof of strength and stability with linear and non-linear calculation
- design and construction
- specific problems

**Literature**

- lecture note
- 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
6.154 Course: Term Paper Upgrading of Existing Buildings and Energetic Refurbishment [T-BGU-100621]

**Responsible:** Prof. Dr.-Ing. Kunibert Lennerts

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:** M-BGU-100108 - Upgrading of Existing Buildings and Energetic Refurbishment

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**Compentence Certificate**
term paper, appr. 10 pages, and presentation, appr. 10 min.

**Prerequisites**
none

**Recommendation**
none

**Annotation**
none
Course: Theoretical Soil Mechanics [T-BGU-100067]

6.155

Responsible: N.N.
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: M-BGU-100067 - Theoretical Soil Mechanics

**Type**  Written examination
**Credits**  6
**Recurrence**  Each term
**Version**  1

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**Competence Certificate**
written exam, 90 min.

**Prerequisites**
none

**Recommendation**
none

**Annotation**
none

Below you will find excerpts from events related to this course:

**Theoretical Soil Mechanics**
6251801, SS 2019, 4 SWS, Language: German, Open in study portal

**Learning 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)
**Course: Timber and Wood-Based Materials [T-BGU-100029]**

**Responsible:** Prof. Dr.-Ing. Hans Joachim Blaß  
Dr. Carmen Sandhaas

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:** M-BGU-100045 - Timber and Wood-Based Materials

**Type**  
Oral examination

**Credits**  
6

**Recurrence**  
Each term

**Version**  
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**Competence Certificate**  
oral exam, appr. 30 min.

**Prerequisites**  
none

**Recommendation**  
none

**Annotation**  
none
6.157 Course: Timber Structures [T-BGU-100028]

**Responsible:** Prof. Dr.-Ing. Hans Joachim Blaß  
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:** M-BGU-100044 - Timber Structures

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**Competence Certificate**  
written exam, 90 min.

**Prerequisites**  
none

**Recommendation**  
none

**Annotation**  
none

Responsible: Jan Tzschaschel
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: M-BGU-100581 - Track Guided Transport Systems - Operation and Capacity

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Events

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Competence Certificate
oral exam, appr. 45 min.

Prerequisites
none

Recommendation
none

Annotation
none

Below you will find excerpts from events related to this course:

**Operation Track Guided Systems**
6234801, SS 2019, 2 SWS, Language: German, Open in study portal

Learning Content
- Operation Systems
- International Comparison of Operating Modes
- Signalling Systems
- International Comparison of Railway Signalling
- Basics of Operational Planning
- Railway Timetable Construction

Literature
Fiedler, Grundlagen der Bahntechnik, Werner-Verlag, Düsseldorf-Hausmann, Enders, Grundlagen des Bahnbetriebs, Bahn-Fachverlag, Heidelberg
Pachl, Systemtechnik des Schienenverkehrs, Teubner-Verlag, Stuttgart

**Operation Systems and Track Guided Infrastructure Capacity**
6234804, SS 2019, 2 SWS, Language: German, Open in study portal

Learning Content
- Blocking Time and Minimum Headway Time
- Signal Box Technologies
- Capacity of Railway Infrastructure
- Modelling Operational Processes
**Literature**
Fiedler, Grundlagen der Bahntechnik, Werner-Verlag, Düsseldorf
Hausmann, Enders, Grundlagen des Bahnbetriebs, Bahn-Fachverlag, Heidelberg
Pachl, Systemtechnik des Schienenverkehrs, Teubner-Verlag, Stuttgart
6.159 Course: Traffic Management und Simulation Methods [T-BGU-100008]

Responsible: Prof. Dr.-Ing. Peter Vortisch
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: M-BGU-100015 - Traffic Management und Simulation Methods

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Events

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Competence Certificate
oral exam, appr. 20 min.

Prerequisites
none

Recommendation
none

Annotation
none
Course: Transport and Transformation of Contaminants in Hydrological Systems [T-BGU-106598]

Responsible: Prof. Dr.-Ing. Erwin Zehe
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: M-BGU-103872 - Subsurface Flow and Contaminant Transport

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Competence Certificate
oral exam, appr. 30 min.

Prerequisites
none

Recommendation
none

Annotation
none
### 6.161 Course: Turnkey Construction [T-BGU-101208]

**Responsible:** Prof. Dr.-Ing. Shervin Haghsheno  
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:** M-BGU-100676 - Turnkey Construction

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**Competence Certificate**

written exam, 90 min.

**Prerequisites**

none

**Recommendation**

none

**Annotation**

none
6.162 Course: Upgrading of Existing Buildings and Energetic Refurbishment [T-BGU-108001]

Responsible: Prof. Dr.-Ing. Kunibert Lennerts
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: M-BGU-100108 - Upgrading of Existing Buildings and Energetic Refurbishment

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Events

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Competence Certificate
written exam, 70 min.

Prerequisites
none

Recommendation
none

Annotation
none
# 6.163 Course: Urban and Regional Planning [T-BGU-100050]

**Responsible:** Dr. Tamer Soylu  
Sebastian Wilske

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:** M-BGU-100007 - Urban and Regional Planning

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**Competence Certificate**
oral exam, appr. 30 min.

**Prerequisites**
none

**Recommendation**
none

**Annotation**
none
6.164 Course: Urban Management [T-BGU-108442]

**Responsible:** Prof. Dr. Anke Karmann-Woessner

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:** M-BGU-100013 - Urban Renewal

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**Competence Certificate**
oral exam, appr. 15 min.

**Prerequisites**
none

**Recommendation**
none

**Annotation**
none
### 6.165 Course: Urban Water Infrastructure and Management [T-BGU-106600]

**Responsible:** Dr.-Ing. Stephan Fuchs  
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:** M-BGU-103358 - Urban Water Infrastructure and Management

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**Competence Certificate**  
written exam, 60 min.

**Prerequisites**  
none

**Recommendation**  
none

**Annotation**  
none
6.166 Course: Wastewater and Storm Water Treatment Facilities [T-BGU-109934]

Responsible: Dr.-Ing. Stephan Fuchs
Dr.-Ing. Tobias Morck

Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: M-BGU-104898 - Wastewater and Storm Water Treatment Facilities

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Competence Certificate
term paper, appr. 10 pages, and presentation, appr. 15 min.

Prerequisites
none

Recommendation
none

Annotation
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 Geocology 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.
6.167 Course: Wastewater Treatment Technologies [T-BGU-109948]

**Responsible:** Dr.-Ing. Stephan Fuchs
Dr.-Ing. Tobias Morck

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:** M-BGU-104917 - Wastewater Treatment Technologies

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**Competence Certificate**
written exam, 60 min.

**Prerequisites**
The accomplishment Term paper 'International Sanitary Engineering' (T-BGU-109265) has to be passend.

**Modeled Conditions**
The following conditions have to be fulfilled:

1. The course T-BGU-109265 - Term Paper 'International Sanitary Engineering' must have been passed.

**Recommendation**
none

**Annotation**
none
6.168 Course: Water and Energy Cycles [T-BGU-106596]

**Responsible:** Prof. Dr.-Ing. Erwin Zehe

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:** M-BGU-103360 - Water and Energy Cycles

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<td>Lecture / Practice (VÜ)</td>
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**Competence Certificate**

oral exam, appr. 30 min.

**Prerequisites**

none

**Recommendation**

none

**Annotation**

none
6.169 Course: Water Distribution Systems [T-BGU-108486]

**Responsible:** Prof. Dr. Franz Nestmann

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:** M-BGU-104100 - Water Distribution Systems

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**Competence Certificate**
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 have to be fulfilled:

1. The course T-BGU-108485 - Project Report Water Distribution Systems must have been passed.

**Recommendation**
none

**Annotation**
none
6.170 Course: Waterway Engineering [T-BGU-106780]

**Responsible:** Dr.-Ing. Andreas Kron

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences

**Part of:** M-BGU-103392 - Waterway Engineering

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**Competence Certificate**
oral exam, appr. 20 min.

**Prerequisites**
The accomplishment 'Seminar Paper Waterway Engineering' (T-BGU-106779) has to be passed.

**Modeled Conditions**
The following conditions have to be fulfilled:

1. The course T-BGU-106779 - Seminar Paper 'Waterway Engineering' must have been passed.

**Recommendation**
none

**Annotation**
none
### T Course: Wildcard [T-BGU-108027]

**Organisation:** University  
**Part of:** M-BGU-103927 - Interdisciplinary Qualifications

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Appendix: 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.

<table>
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Construction Engineering

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Subject-Specific Supplements

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Sum per semester

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<td>5E+</td>
<td>1nA</td>
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explanation for the table:
- CP = credit point
- LC = learning control
- wE = written exam
- oE = oral exam
- ngA = not graded accomplishment
- S = seminar
- E = exercise
- Pj = study project

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