Module Handbook
Applied Geosciences Master 2016 (Master of Science (M.Sc.))
SPO 2016
Summer term 2021
Date: 02/03/2021

KIT DEPARTMENT OF CIVIL ENGINEERING, GEO- AND ENVIRONMENTAL SCIENCES
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1. Admission Requirements for the Master in Applied Geosciences at KIT

The Admission requirements for the Master Program Applied Geosciences at KIT are as follows:
(Excerpt from the “Statutes for the admission in the Master program in Applied Geosciences at the Karlsruhe Institute of Technology (KIT)” official announcement number 60, dated November 24, 2020: https://www.sle.kit.edu/downloads/AmtlicheBekanntmachungen/2020_AB_060.pdf)

1.1. §5 (1) An outstanding Bachelor’s degree in Applied Geosciences or a related scientific field. The completed study program needs to include a minimum of 180 ECTS.

1.2. §5 (2) Necessary ECTS in the following fields need to be included in the completed study program
- Geosciences: min. 60 ECTS, geoscientific subjects like structural geology, mineralogy, petrology, hydrogeology, engineering geology, geochemistry, paleontology, geophysics, geological excursions and geological mapping
- Chemistry: min. 10 ECTS,
- Mathematics or Physics: min. 15 ECTS,
- Furthermore min. 20 ECTS in mathematical-scientific or geoscientific fields.

1.3 §5 (4) Language skills:
- German Skills according to the KIT admission and enrollment regulations https://www.intl.kit.edu/istudies/9074.php
- or English Skills according to the Statutes for the Admission in the Master Program in Applied Geoscience at KIT: Overview (translated from the original in German language):
  Very good proficiency in the English language corresponding to level B2 of the Common European Framework of Reference for Languages (GER), as confirmed by the
  • Test of English as a Foreign Language (TOEFL), with a result of at least 90 points
  • International English Language Testing Service (IELTS), with a result of at least 6.5 points and no partial examination worse than 5.5 points
  • University of Cambridge Certificate in Advanced English (CAE) or University of Cambridge Certificate of Proficiency in English (CPE)
  • UNIcert at least level II.

For the following cases the proof of the B2 proficiency can be omitted:
- A university degree of a studies program with English as the only teaching language (documented in the Diploma Supplement, the Transcript of Records or a final certificate)
- The University Entrance Qualification Certificate with the English course having been attended by the applicant for at least five years until graduation and the final or average grade of the last two years of the language class corresponding at least to the German grade 4 (sufficient) or at least 5 points.

For other questions relating the application of international students please refer to the International Department of KIT. https://www.intl.kit.edu/english/index.php
For study requirements and University entrance qualification: https://www.intl.kit.edu/istudies/3167.php
For Tuition Fees for International Students: http://www.intl.kit.edu/istudies/12606.php

If you have any questions regarding modules or exams (partial achievements) please contact:

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mirja.lohkamp-schmitz@kit.edu
2 QUALIFICATION GOALS

2. Qualification Goals of the "Applied Geosciences" Master's Degree Program at KIT

Applied Geosciences have continuously contributed to the development of KIT’s research and teaching activities since its establishment in 1825. At the oldest technical university in Germany, we focus on the sustainable utilization of georesources on and below the Earth’s surface.

You at KIT!
Whether renewable energies, climate protection, water or raw materials for batteries and solar systems - are you interested in the sustainable use of resources? We at the KIT University of Excellence, are one of the few Applied Geoscience Institutes in Germany that reach top positions in international rankings. Here at one of the largest technical research institutions in Europe, you are offered excellent training and will get to know your lecturers personally. Karlsruhe, one of the sunniest cities in Southwest Germany, offers you a high quality of life in one of the economically strongest regions in Europe. Together, we will develop sustainable solutions for the global challenges!

Profiles of the Master's Degree Program of Applied Geosciences @KIT
Our Applied Geosciences MSc degree program offers three profiles: Energy, Resources, & Storage (ERS), Hydrogeology & Engineering Geology, as well as Mineralogy & Geochemistry (MiG). You can choose your modules from different profiles. The complete ERS profile is offered in English.

Our MSc Profile of Energy, Resources, & Storage - ERS
You will study the sustainable use of geoenergy, georesources, and raw materials and acquire deep understanding of major infrastructure developments, such as geological storage systems. Your broad geoscientific knowledge relating to ERS may be complemented by in-depth knowledge in the areas of groundwater and tunnel construction. You will acquire applied specialist knowledge of high practical relevance and, at the same time, you will learn to handle unknown problems.

We teach what we study in research and study what we teach in the following areas:
• Geoenergy - generation of geothermal energy, use of fossil and chemical energy sources, such as hydrogen, for an increased use of climate-friendly energy sources;
• Raw materials - increasing the security of supply and transparency of raw materials (metals, minerals, and water) for the increased use of renewable energy sources, battery storage systems, and industrial products;
• Large infrastructures - geostorage systems for heat, cold, chemical energy sources, hydropower, greenhouse gases (CCS), repositories, and other subsurface systems.

Your Future
Your commitment and our practice-oriented approach qualify you for jobs in industry, the service sector, in public administration, and for a scientific career (doctorate). The University of Excellence KIT, its excellent research infrastructure in the Helmholtz Association, and our affiliation to the KIT Department of Civil Engineering, Geo-, and Environmental Sciences will enable you to shape your future.
3. About this Handbook – Notes and Rules

3.1. Structure of the MSc Program

3.2. Course Types

3.3. The Module Handbook

3.3.1. Beginning and Completion of a Module

3.3.2. Modules and Partial Achievements

3.3.3. First Use

3.3.4. General or Partial Examinations

3.3.5. Types of Examinations

3.3.6. Repetition of Exams

3.3.7. Additional Modules and Courses

3.4. Further Information

3.1. Structure of the MSc Program

Our two-year MSc program is associated with a work expenditure of 120 credits (ECTS), usually 30 credits per semester. Choose one of the three profiles (i) Energy, Resources, & Storage Systems, (ii) Hydrogeology - Engineering Geology, (iii) Mineralogy - Geochemistry or choose the elective modules according to your interests. In addition to your courses in the amount of 90 credits, you will write your master's thesis of 30 credits at the end of your studies. One credit corresponds to about 30 working hours and covers both courses with your attendance and self-studies. The program consists of a compulsory part of 19 credits and an elective part of 71 credits. The elective part includes three elements (key competences, specializations, subject-related additional studies). The modules consist of assigned courses with the credits corresponding to the respective workload.

This handbook provides information on the profile Energy, Resources & Storage. The language of instruction of this MSc-profile is English. Please refer to the German handbook for further information of the profiles Hydrogeology - Engineering Geology and Mineralogy - Geochemistry.

3.2. Course Types

The master's degree program covers the following types of teaching and learning:

- Lectures (V)
- Exercises (Ü)
- Seminars and field seminars (S and GEL)
- Internships (P)
- Excursions (E)
- Project study, job internship, colloquia, tutorials (TU), master’s thesis

In lectures, contents are mainly conveyed through presentations by the lecturers. In practical exercises, students apply the knowledge acquired in case studies with intensive support by the lecturers. In seminars, knowledge is imparted to small groups of students. This also includes geological seminars in rough terrain. The seminars focus on presentations by students and discussions of special scientific topics. Internships serve to deepen previously acquired theoretical knowledge in practical application or to gain new experience and skills through practical work individually or as member of a group. Excursions are educational trips to selected destinations, such as company visits. Colloquia are special events often held by academic guests, which consist of a lecture and a discussion and in which the students are supposed to take part. In the project study, the students work on a geoscientific problem either individually or in a group under the guidance by lecturers.

In the master’s thesis, the specialist knowledge acquired is applied to a geoscientific problem. The work is supervised by lecturers, but is intended to demonstrate the student’s ability to independently work on, present, and solve geoscientific problems.

3.3. The Module Handbook

The module handbook describes the modules of the study program. It covers
3 ABOUT THIS HANDBOOK - NOTES AND RULES

- the courses of each of the modules (partial achievements),
- the size of the modules (in credits),
- interdependencies of the modules,
- qualification goals of the modules,
- types of examination, and
- calculation of the grade for a module.

The module handbook does not replace the university calendar which provides information about the variable dates of courses (e.g. time and venue of the course) in every semester.

3.3.1. Beginning and Completion of a Module
Each module and each course (partial achievement) within a module can only be chosen once. The student’s performance is proven by a module examination or by examinations/controls of success in courses within the module. Successful completion of a module or course is reflected by either a passed examination (graded or ungraded) or an ungraded coursework with the student’s participation. A module is completed or passed, if the module examination has been passed (grade at least 4.0). The following applies to modules that are completed by examinations in several courses: The module is completed when all required courses (partial achievements) of a module have been passed. The module grade is determined by weighting the predefined credits for each course (partial achievement) within the module. An exception is the master’s thesis module, the credits of which are weighted by a factor of 1.5 when calculating the total grade.

3.3.2. Modules and Partial Achievements
A new module or a new partial achievement results, when the contents or credits of modules / new courses change. Legitimate expectations of all students, who already have successfully completed a course, are protected, which means that they can complete the old module under the conditions, under which they registered (exceptions are governed by the examination board). The decisive factor is the time when the “binding declaration” about the choice of module is made by the student according to Article 5 (2) of the Studies and Examination Regulations. This binding declaration is made when a student registers for the first exam in this module. At the written request of the student to the examination board, the choice of the module or its assignment to the regular curriculum can be changed afterwards. In the current module handbook, the modules and courses are presented in their current version. The version number is given in the module description. Older module versions are available in the previous module manuals at https://www.agw.kit.edu/11368.php

3.3.3. First Use
The so-called “first use” (EV) indicates from / until when a course or module version can be selected in the study schedule. Modules with a date of first use are highlighted in the chapter “Structure of the Course.”

3.3.4. General and Partial Examinations
Module examinations may be general or partial examinations. If the module examination is offered as a general examination, examination covers the entire content of the module. If the module examination is subdivided into partial examinations, the module examination consists of individual examinations (partial achievements) in the respective courses. Register for the respective exams online on the Campus Management Portal at https://campus.studium.kit.edu.

3.3.5. Types of Examinations
- Graded exams: Written exams, oral exams, and examinations of another type (e.g. reports, seminar presentations, or the submission of a laboratory or field book).
- Ungraded coursework: Can be repeated several times. The result is indicated as “passed.”

3.3.6. Repetition of Exams
Anyone who does not pass a written exam, oral exam, or examination of another type can repeat the exam once. If the repeated examination (in case of written exams, an additional oral exam is carried out) is not passed as well, the entitlement to the examination for the respective module in the study program is lost. The application for a second re-examination (hardship claim) has to be submitted to the examination board in writing within two months after the entitlement is lost at the latest.
3.3.7. **Additional Modules and Courses**
Students can attend voluntary, additional modules or courses with a maximum of 30 credits from all lectures and courses offered by KIT. Such modules or courses can be included in the certificate at the request of the student to the examination board. The result of the additional modules or courses is not taken into account when completing the degree program or calculating the total grade. When students register for an exam in this additional module or course, they can declare the latter to be an additional achievement. At the written request of the student to the examination board, this can be changed afterwards.

3.4. **Further Information**
All information about the legal and official conditions for your studies is given in the relevant Studies and Examination Regulations for the respective degree program. This legally binding information is available under the official announcements of KIT:
4. Overview of the MSc profile Energy, Resources & Storage

Legend: Module name D - German, E - English, Ex - Excursion, L - Lecture, P - Practical, S - Seminar, GEL - Field Seminar
Course name
FB - submission of field book, N - No Exam, OE - Oral Exam, PR - Presentation, WE - Written Exam, WR - Written Report

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PROFILE Energy - Resources & Storage

1.2 Elective modules (Core Electives - 36 + Electives 1 - 25 + Electives 2 - 10 CP = Total at least 71 CP)

| Borehole Technology | | 5 | | 60 | WE | | Kohl, Gaucher | M-BGU-102449 |
| x | 2 | Drilling | E LP | 2 | | 3 | WE | Blum | 6310426 |
| x | 1 | Borehole Technology - Logging | E LP | 2 | | 30 | Eiche | 6310086 |
| Applied Mineralogy: Clay Science | | 5 | | 60 | WE | | Emmerich | M-BGU-102444 |
| x | 1 | Clay Mineralogy Introduction | E LP | 2 | | 3 | WE | Blum | 6310086 |
| x | 1 | Advanced Clay Mineralogy | E P | 2 | | 30 | WE | Blum | 6310430 |
| Geothermics: Energy and Transport Processes | | 5 | | 60 | WE | | Kohl | M-BGU-102432 |
| x | 1 | Energy Budget of the Earth | E L | 1 | | 30 | WE | Schilling | 6339090 |
| x | 1 | General Geothermics | E L | 2 | | 60 | WE | Kohl | 6339091 |
| x | 1 | General Geothermics Field Exercises | E Ex | | | 0,5 | 15 | WE | Kohl | 6339092 |
| Geology | | 5 | | 45 | WE | | Hilgers | M-BGU-102431 |
| x | 1 | Analysis of Geological Structures | E LP | 3 | | 3 | WE | Hilgers | 6339080 |
| x | 1 | Depositional Systems | E LP | 1 | | 2 | WE | Hilgers | 6339086 |
| Industrial Minerals and Environment | | 5 | | 45 | WE | | Kohl | M-BGU-103993 |
| x | 1 | Industrial Minerals | E LP | 2 | | 2 | WE | Kolb, Patten, Walter | 6310124 |
| x | 1 | Environmental Aspects of Mining | E L | 1 | | 15 | WE | Eiche | 6339090 |
| x | 1 | Fieldtrip Industrial Minerals (2.5 days) | E GEL | 2 | | 37,5 | WE | Kolb, Patten, Walter | 6310428 |
| Applied Geothermics | | 5 | | 40 | WE | | Kohl | M-BGU-102447 |
| x | 2 | Applied Geothermics | E LP | 2 | | 4 | WE | Kolb | 6310425 |
| x | 2 | Applied Geothermics - Excursion | E E | 1 | | 1 | WE | Kolb | 6310427 |
| Geological Storage of Gas | | 5 | | 30 | WE | | Schilling | M-BGU-102445 |
| x | 2 | Geological Storage of Gas | E L | 2 | | 30 | WE | Schilling | 6339093 |
| x | 2 | Fundamentals of Reservoir Geomechanics | E LP | 2 | | 30 | WE | Schilling, Müller | 6339094 |
| Applied Mineralogy: Petrophysics | | 5 | | 30 | WE | | Schilling | M-BGU-102443 |
| x | 2 | Petrophysics I | E L | 3 | | 2 | WE | Schilling | 6310428 |
| x | 2 | Petrophysics II | E P | 1 | | 3 | WE | Schilling | 6310429 |
| Structural Geology | | 5 | | 30 | WE | | Kontny | M-BGU-102451 |
| x | 2 | Microstructures | E LP | 2 | | 3 | WE | Kontny | 6339085 |
| x | 2 | Field Course (e.g. Pyrenees, Spain, 5 days) | E GEL | 4 | | 3 | 45 | WE | Bilby, Patten, Walter | 6310400 |
| Diagenesis and Cores | | 5 | | 30 | WE | | Hilgers | M-BGU-103734 |
| x | 3 | Diagenesis (3 days) | E S | 2 | | 3 | WE | Busch, Felder, Hilgers | 6339075 |
| x | 3 | Reservoir-Analogs and Core Description (3 days) | E S | 2 | | 30 | WE | Schmidt, Busch, Hilgers | 6339071 |
| Field Exercises / Excursion | | 5 | | 60 | WE | | Zeh | M-BGU-102456 |
| x x | 3 or 2 | Field trip / Big Excursion (10 days) | E GEL | 8 | | 5 | 60 | WE | varying | |
| Environmental Geology: Radio- & chemotoxic elements | | 5 | | 60 | WE | | Heberling | MBGU-102455 |
| x | 3 | Environmental Geology: Radio- & Chemotoxic Elements | E L | 2 | | 30 | WE | Heberling | 6339088 |
| x | 3 | Radiogeochemical Field Exercise and Seminar | E E | 2 | | 30 | WE | Heberling | 6339089 |
| Ore Geology of Metals | | 5 | | 30 | WE | | Kolb | M-BGU-103994 |
| x | 3 | Ore forming processes | E LP | 3 | | 3 | 45 | OE | Kolb, Patten | 6339090 |
| x | 3 | Fieldtrip Ore Geology (2 days) | E GEL | 2 | | 3 | 35 | WE | Kolb, Patten | 6339091 |
| Geothermal Reservoir Engineering | | 5 | | 30 | WE | | Kolb | M-BGU-105136 |
| x | 3 | Reservoir Engineering - Topics | E L | | 3 | WE | Kolb, Gholami Korzani, Nitschke | 6339092 |
| x | 3 | Geothermal Reservoir Engineering - Seminar | E S | | 2 | WE | Schilling, Gholami Korzani, Nitschke | 6339093 |
| Sedimentary Petrology | | 5 | | 30 | WE | | Zeh | M-BGU-103733 |
| x | 3 | Sedimentary Petrology | E LP | 4 | | 5 | 90 | WE | Zeh | 6339040 |
The CP provide information about the workload to be performed by the students.
1 CP = 30 hours.

In the module handbook itself, the CPs can only be displayed in whole numbers, in this table they are also given in 0.5 steps according to the real workload.
## 5 Field of study structure

### Mandatory

<table>
<thead>
<tr>
<th>Course</th>
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<tr>
<td>Key Competences in Geosciences</td>
<td>55 CR</td>
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<tr>
<td>Specialization in Geosciences</td>
<td>25 CR</td>
</tr>
<tr>
<td>Specific Supplements</td>
<td>10 CR</td>
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</table>

### 5.1 Master Thesis

- **Mandatory**
  - **M-BGU-103726** Module Master Thesis: 30 CR

### Modelled Conditions

The following conditions have to be fulfilled:

1. You need to earn at least 70 credits in the following fields:
   - Specific Supplements
   - Key Competences in Geosciences
   - Specialization in Geosciences

### 5.2 Key Competences in Geosciences

<table>
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<th>Course</th>
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<tr>
<td>M-BGU-102437</td>
<td>Geological Mapping and Processing of Geospatial Data</td>
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<td><strong>Election block: Project Study or Internship (1 item)</strong></td>
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<tr>
<td>M-BGU-102432</td>
<td>Geothermics: Energy and Transport Processes</td>
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<tr>
<td>M-BGU-102433</td>
<td>Hydrogeology: Methods and Applications</td>
</tr>
<tr>
<td>M-BGU-102434</td>
<td>Engineering Geology: Laboratory and Field Methods</td>
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<td>M-BGU-102440</td>
<td>Hydrogeology: Karst and Isotopes</td>
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<td>M-BGU-102445</td>
<td>Geological Storage of Gas</td>
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<td>M-BGU-103993</td>
<td>Industrial Minerals and Environment</td>
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<td>Engineering Geology: Mass Movements and Modelling</td>
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<tr>
<td>M-BGU-105150</td>
<td>Hydrogeology: Karst and Isotopes (with Field Trip)</td>
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### 5.3 Specialization in Geosciences

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<td>M-BGU-102439 Hydrogeology: Groundwater Modelling</td>
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<td>M-BGU-102440 Hydrogeology: Karst and Isotopes</td>
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<td>M-BGU-102441 Hydrogeology: Field and Laboratory Methods</td>
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<td>M-BGU-102443 Applied Mineralogy: Petrophysics</td>
<td>5 CR</td>
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<tr>
<td>M-BGU-102444 Applied Mineralogy: Clay Science</td>
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<td>M-BGU-102445 Geological Storage of Gas</td>
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<td>M-BGU-102449 Borehole Technology</td>
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<td>M-BGU-103995 Geochemical Processes and Analytical Methods</td>
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<td>M-BGU-105506 Current Research Topics in Hydrogeology and Engineering Geology</td>
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<td>M-BGU-105505 Geospatial Data Analysis I – Programming and Geostatistics</td>
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<td>M-BGU-105634 Geodata Analysis II – Big Data and Machine Learning</td>
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*First usage possible from 4/1/2021.*
### 5.4 Specific Supplements

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<td>M-BGU-100069</td>
<td>Rock Mechanics and Tunneling</td>
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<td>M-BGU-103360</td>
<td>Water and Energy Cycles</td>
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6 Modules

6.1 Module: Advanced Analysis in GIS (GEOD-MPEA-3) [M-BGU-101053]

Responsible: Dr.-Ing. Norbert Rösch
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: Specific Supplements

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<th>Level</th>
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Mandatory

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<td>T-BGU-101782</td>
<td>Advanced Analysis in GIS</td>
<td>4 CR</td>
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Competence Certificate
The assessment consists of an oral exam (20 min.)

Competence Goal
The students explain the advanced concepts of spatial analysis and 2D interpolation procedures. Especially the different aspects of statistical reasoning are analyzed. They can categorize all analysis problems with spatial background and estimate possible solutions.

Module grade calculation
The grade of the module is the grade of the oral exam.

Prerequisites
None

Content
After an introduction to analysis in GIS in general, this lecture is dealing with the specific approaches of statistical analysis of spatial data. Among them, in particular, the different methods of pattern analysis. This also encompasses the test strategies inherent to the aforementioned methods. Another topic is data mining, which is introduced as an extension of the point pattern analysis. Furthermore the 2D interpolation procedures are discussed (e. g. Natural Neighbor Interpolation, Kriging, ...).

Workload
Contact hours: 30 hours
- courses plus course-related examination

Self-study: 90 hours
- consolidation of subject by recapitulation of lectures
- processing of exercises
- consolidation of subject by use of references and by own inquiry
- preparations for exam
## 6.2 Module: Applied Geothermics [M-BGU-102447]

**Responsible:** Prof. Dr. Thomas Kohl  
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:** Specialization in Geosciences

<table>
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<th>Level</th>
<th>Version</th>
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<td>Applied Geothermics</td>
<td>4 CR</td>
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<td>T-BGU-108018</td>
<td>Applied Geothermics - Excursion</td>
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<td>Kohl</td>
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### Competence Certificate

The assessment consists of a written exam (45min) according to §4 (2) of the examination regulations and a non-assessed coursework (participation in field trip and report), see §4 (3) of the examination regulations.

### Competence Goal

- The students develop shallow and deep geothermal projects with cost estimates
- The students are able to explicate examples and case studies in theory and practice

### Module grade calculation

The grade of the module is the grade of the written exam.

### Prerequisites

none

### Content

- Introduction into geothermal utilization  
- Hydrothermal and enhanced (or engineered) geothermal systems (EGS)  
- Stimulation methods  
- Geothermal Exploration  
- Thermodynamics and power plant processes  
- Shallow geothermics  
- Examples

### Annotation

The date for the excursion and the closing date for the excursion report will be promptly announced. The practical part of this course is carried out in presence. The field courses are essential for the progress of the participants.

### Workload

30 hours regular attendance,  
2 days excursion (30 hours),  
90 hours self studying time

Responsible: Dr. Katja Emmerich
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: Specialization in Geosciences

<table>
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<th>Level</th>
<th>Version</th>
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<td>Clay Mineralogy Introduction</td>
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<td>T-BGU-104840</td>
<td>Advanced Clay Mineralogy</td>
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<td>Emmerich</td>
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Competence Certificate

The assessment consists of a written exam (Clay Mineralogy Introduction, 90 min) according to §4 (2) of the examination regulations and an examination of another type (Advanced Clay Mineralogy, graded report, ca. 12 pages, submission till 4 weeks after the end of the lecture period).

Module grade calculation

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

Prerequisites

None

Annotation

Depending on the auditorium, this module is held in German or English

The practical part of this course is carried out in presence. It requires special rooms (laboratory) and is essential for the study progress of the participants.

Workload

contact hours: 60
self study time: 90
6.4 Module: Applied Mineralogy: Geomaterials [M-BGU-102430]

Responsible: Prof. Dr. Frank Schilling
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: Key Competences in Geosciences (Compulsory Elective Modules)

Credits 5
Recurrence Each winter term
Duration 1 term
Language English
Level 5
Version 2

Mandatory

| T-BGU-104811 | Applied Mineralogy: Geomaterials | 5 CR | Danisi, de la Flor, Martin, Schilling |

Competence Certificate
The assessment consists of a written exam (90 min) according to §4 (2) of the examination regulations.

To pass the exam, at least 50% of the points must be achieved.

Competence Goal
The students are qualified to apply basic mineralogical approaches to describe and targeted use of geomaterials.

The students have knowledge of basic methods of applied mineralogy:

- about the basics of crystallography, this includes the detailed consideration from point to space groups.
- to describe and visualise the structures of relevant geomaterials.
- to analyse group-subgroup relationships and phase transitions of different geo-materials.

They master basic crystallographic methods and are able to apply these to a technically important group of minerals, the zeolites. The students have:

- a deep understanding of the crystal chemistry of microporous mineral phases.
- advanced knowledge of framework structures and their physico-chemical properties.
- basic knowledge of modern functional materials with key applications in industry.
- the competence to investigate and characterize materials using diffraction techniques.

Module grade calculation
The module grade is the grade of the written examination.

Prerequisites
keine

Content
Modern geoscientific materials research focuses on the relationship between structure and (thus mostly) anisotropic material behaviour. Therefore, a profound understanding of symmetry and structure relationships is the focus of the course, in addition to a detailed process understanding of the mode of action of one of the most important geomaterials - zeolites. These nanoporous materials are of fundamental importance in many technical processes which cannot be imagined without them (from the food industry to petrochemistry).

- Crystallography; from point groups to space groups
- Crystal structures descriptions
- Symmetry relations between crystal structures
- group-subgroup relationships
- phase transitions of different geo-materials
- Zeolite and zeolite-like framework structures
- Industrial applications: molecular sieves, catalysts and ion exchangers.
- Fundamentals of diffraction: Theory and Praxis
- Structural determination of microporous mineral phases

Recommendation
Openness for new ideas and things

Annotation
Enthusiasm and commitment to mineralogical questions are expected

The practical part of this course is carried out in presence. It requires special rooms (laboratory) and is essential for the study progress of the participants.
Workload
60 hours attendance time and 90 hours self-study

Learning type
- Lectures
- Exercises
- Laboratory Exercises
- Self-study
- Discussions

Literature
Will be discussed during the lectures
## 6.5 Module: Applied Mineralogy: Petrophysics [M-BGU-102443]

**Responsible:** Prof. Dr. Frank Schilling  
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:** Specialization in Geosciences

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#### Competence Certificate

The assessment consists of a written exam according to §4 (2) of the examination regulations. Successfully completed laboratory exercises are the prerequisite to attend the written exam.

#### Prerequisites

none

#### Annotation

Depending on the auditorium, this module is held in German or English

In Abhängigkeit vom Auditorium wird dieses Modul in deutscher oder englischer Sprache gehalten

The practical part of this course is carried out in presence. It requires special rooms (laboratory) and is essential for the study progress of the participants.
6.6 Module: Borehole Technology [M-BGU-102449]

Responsible: Prof. Dr. Thomas Kohl
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: Specialization in Geosciences

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Competence Certificate
The assessment consists of a written exam (90 min) according to §4 (2) of the examination regulations. The oral presentation in the seminar is included in the grade of the written exam.

Competence Goal
- The students are able to characterize reservoirs from logging data.
- The students are able to explain the basics of different drillhole technologies and are able to present results graphically and to evaluate and present them scientifically.

Module grade calculation
The overall module grade is the grade of the written exam, in which the oral presentation in the seminar is included.

Prerequisites
none

Content
Logging (winter term)
Summary Petrophysics: Density / Porosity / Saturation
Electr. properties of rocks
Electrical survey - Resistivity distribution around Hydrocarbon / geothermal wells
Electrical survey - SP-Log
Electrical survey - Resistivity & Induction
Nuclear logs: Gamma Log
Nuclear logs: Density Log
Nuclear logs: Neutron Log
Image-Logs
Sonic-Logs
Logging software - introduction
Logging software - practical application

Drilling (summer term)
Introduction Drill Rig
Blow-out Preventer
Gas Kick
Mud circuit
ROP / Mudlog
Drilling Fluid
Pressure Profile
Drill bit
Directional drilling
Rotary / downhole motor,
BHA Bottom Hole Assembly,
MWD & LWD
Casing design

Workload
regular attendance: 60h
seld study including exam: 90h
6.7 Module: Current Research Topics in Hydrogeology and Engineering Geology
[M-BGU-105506]

Responsible: Prof. Dr. Nico Goldscheider
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: Specialization in Geosciences

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<td>Current Research Topics in Hydrogeology and Engineering Geology</td>
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Competence Certificate
Attendance at current lecture series, excursion report(s) (1 page/day), presentation (20 min)

Competence Goal
The students can name and explain current research topics in hydro- and engineering geology. They are able to analyse, discuss and present current research topics.

Prerequisites
Choice of the profile Hydrogeology and Engineering Geology

Content
- Selected lectures on current research topics in hydro- and engineering geology (e.g. Geologisches Fachgespräch, Karst Lecture, International Distinguished Lectures)
- Changing excursions to current research regions
- Review of a current research topic on the basis of literature, presentation and discussion, accompanying mentoring program

Workload
150 h, of which 70 h attendance time and 80 h self-study time
### 6.8 Module: Diagenesis and Cores [M-BGU-103734]

**Responsible:** Prof. Dr. Christoph Hilgers  
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:** Specialization in Geosciences

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<td>T-BGU-107624</td>
<td>Reservoir-Analogs and Core Description</td>
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**Competence Certificate**
The assessment consists of partial exams according to §4 (2) of the examination regulations. It consists of two examinations of another type:

1. **Diagenesis:** Examination: Report (5 p.) on own practical microscopic analysis (4h on the day after the end of the course): petrographic description of sedimentary clastic rock and interpretation, raw data and thin section images. Submission: 2 weeks after end of course.
2. **Reservoir-Analogs and Core Description:** Report (1 page) and digitized core description plus written notes. Submission 2 weeks after end of course.

**Competence Goal**

- After this course students will be able to apply a workflow of petrographic analyses especially of sediments (description, quantification etc.), sandstone- and carbonate classification, provenance, evaluation of reservoir characteristics and diagenetic processes. They can critically assess data for sampling campaigns.
- After this course students are enabled to describe reservoir rocks in the field and in cores according to industry standards. They derive facies models and integrate data into state-of the art software.

**Prerequisites**

See modeled conditions

**Modeled Conditions**
The following conditions have to be fulfilled:

1. The module **M-BGU-103742 - Reservoir-Geology** must have been passed.

**Content**

- Petrography, rock typing and reservoir quality: granulometry, texture and fabric, porosity and porosity loss, primary and secondary porosity, compaction vs. cementation, identification of detrital grains, sandstone classification, intra- and extraclasts, provenance, authigenic mineralogy, quantification via estimation and point counting, sandstone diagenesis, paragenetic sequence and stages of diagenesis, diagenetic processes, geological control factors and burial history, structural diagenesis
- Description of reservoir- and source rocks as well as seals from analogs in the field and reservoir rocks from cores

**Recommendation**
The student shall have a basic knowledge of reservoir geology

**Annotation**
The practical part of this course is carried out in presence. The microscopy exercises as well as the field course are essential for the study progress of the participants.

**Literature**

- Literature "Diagenesis":  
- Literature "Reservoir-analogs and core description":  
Module: Earthworks and Foundation Engineering (bauM5P2-ERDGB) [M-BGU-100068]

Responsible: Dr.-Ing. Peter Kudella
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: Specific Supplements

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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;

Annotaiton
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,
### 6.10 Module: Electron Microscopy I [M-PHYS-103760]

**Responsible:**  
Jun.-Prof. Dr. Yolita Eggeler  
Prof. Dr. Dagmar Gerthsen

**Organisation:**  
KIT Department of Physics

**Part of:**  
Specific Supplements

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### 6.11 Module: Electron Microscopy II [M-PHYS-103761]

**Responsible:** Jun.-Prof. Dr. Yolita Eggeler  
Prof. Dr. Dagmar Gerthsen

**Organisation:** KIT Department of Physics

**Part of:** Specific Supplements

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6.12 Module: Engineering Geology: Laboratory and Field Methods [M-BGU-102434]

Responsible: Prof. Dr. Philipp Blum
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: Key Competences in Geosciences (Compulsory Elective Modules)

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| T-BGU-104814 | Engineering Geologie: Laboratory and Field Methods | 7 CR | Blum |

Competence Certificate
The assessment consists of an oral exam (20 min) according to §4 (2) of the examination regulations and two non-assessed reports (Laboratory and field methods).

Prerequisites
keine

Annotation
The practical part of this course is carried out in presence. The field courses and laboratory courses are essential for the progress of the participants.

**Responsible:** Dr. Kathrin Menberg

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

**Part of:** Key Competences in Geosciences (Compulsory Elective Modules) Specialization in Geosciences

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<td>Engineering Geology: Modelling</td>
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**Prerequisites**

none

**Responsible:** Dr. Frank Heberling  
Dr. Volker Metz

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

**Part of:** Specialization in Geosciences

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<td>Radiogeochemical Field Excercise and Seminar</td>
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**Competence Certificate**

The assessment consists of a written exam (90 min) about the lecture and an examination of another type (Seminar as preparation for field exercise (15 min presentation) and report (15-20 pages, submission till 2 months after the exercise)) according to §4 (2) of the examination regulations.

**Prerequisites**

None

**Annotation**

Depending on the auditorium, this module is held in German or English

The practical part of this course is carried out in presence. The field courses and laboratory courses are essential for the progress of the participants.
6.15 Module: Environmental Geotechnics (bauiM5S09-UMGEOTEC) [M-BGU-100079]

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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
6.16 Module: Environmental Mineralogy [M-BGU-104466]

**Responsible:** apl. Prof. Dr. Stefan Norra

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

**Part of:** Specialization in Geosciences

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**Competence Certificate**
The assessment consists of an examination of another type (graded report about the lecture and the practice) according to §4 (2) of the examination regulations.

**Prerequisites**
None

**Annotation**
The practical part of this course is carried out in presence. The field courses and laboratory courses are essential for the progress of the participants.
6.17 Module: Field Exercises / Excursion [M-BGU-102456]

Responsible: Prof. Dr. Armin Zeh
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: Specialization in Geosciences

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T-BGU-104878 Field Excercise / Excursion 5 CR Zeh

Competence Certificate
The assessment consists of an examination of another type according to §4 (2) of the examination regulations. It consists of the participation in field trips (required excursion days: 10) (often international), keeping a field book and different assignments (for example a preparing literature seminar with presentations, daily protocols, reports etc.)

Prerequisites
None

Annotation
The practical part of this course is carried out in presence. The field courses are essential for the progress of the participants.
### Module: Geochemical Processes and Analytical Methods [M-BGU-103995]

**Responsible:** Dr. Elisabeth Eiche  
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:** Key Competences in Geosciences (Compulsory Elective Modules)  
Specialization in Geosciences

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<td>Geochemical Processes and Analytical Methods</td>
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| Eiche |

### Competence Certificate

The assessment consists of an examination of another type (ca. 10 exercise sheets in ILIAS for the lecture, a short presentation on one analysis method and a 30-45 min presentation in groups of two or three on a given laboratory project for the practice) according to §4 (2) of the examination regulations.

**Prerequisites**

none

**Recommendation**

none

**Annotation**

The practical part of this course is carried out in presence. It requires special rooms (laboratory) and is essential for the study progress of the participants.
M 6.19 Module: Geodata Analysis II – Big Data and Machine Learning [M-BGU-105634]

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

**Part of:** Specialization in Geosciences (Usage from 4/1/2021)

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<td>Geodata Analysis II – Big Data and Machine Learning</td>
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**Competence Certificate**

Other kind: Independent development of a given problem

**Competence Goal**

The students can handle large geospatial data sets (e.g. satellite data, climate data). They master basic machine learning methods and are able to program simple application cases independently.

**Prerequisites**

Choice of the profile Hydrogeology and Engineering Geology. To register for the exam, the module Geodata Analysis I - Programming and Geostatistics must have been passed.

**Modeled Conditions**

The following conditions have to be fulfilled:

1. The module **M-BGU-105505 - Geospatial Data Analysis I – Programming and Geostatistics** must have been passed.

**Content**

- Advanced programming
- Big data analysis (z.B. Satellitendaten, Klimaprojektionen)
- Google Earth Engine (Programming in Java Script)
- Fundamentals of Machine Learning (Supervised and Unsupervised Learning, Learning Algorithms, Classification and Regression)
- Neural Network Basics (Types on ANN, Learning Algorithms, Training, Validation, Testing, Over- and Underfitting)
- Feature Engineering
- Hyperparameter Tuning, Regularization, Ensembles
- Application Examples (Python)

**Workload**

50 h attendance time and 100 h self-study time

**Learning type**

Combined lecture and computer exercises
6.20 Module: Geological Mapping and Processing of Geospatial Data [M-BGU-102437]

**Responsible:** apl. Prof. Dr. Kirsten Drüppel

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

**Part of:** Key Competences in Geosciences (Compulsory Modules)

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**Mandatory**

| T-BGU-104819 | Geological Mapping and Processing of Geospatial Data | 8 CR | Drüppel |

**Competence Certificate**

The assessment consists of an examination of another type according to §4 (2) of the examination regulations. It consists of field work, creating a geological map and a mapping report.

**Prerequisites**

keine

**Annotation**

The practical part of this course is carried out in presence. The field courses are essential for the progress of the participants.
6.21 Module: Geological Storage of Gas [M-BGU-102445]

**Responsible:** Prof. Dr. Frank Schilling  
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:** Key Competences in Geosciences (Compulsory Elective Modules)  
Specialization in Geosciences

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**Mandatory**

| T-BGU-104841 | Geological Storage of Gas | 5 CR | Schilling |

**Competence Certificate**
The assessment consists of an examination of another type (presentation) according to §4 (2) of the examination regulations.

**Annotation**
Depending on the auditorium, this module is held in German or English.

**Literature**
IPCC Report zur CO2-Speicherung  
EU Richtlinie zur CO2 Speicherung  
Module: Geology [M-BGU-102431]

**Responsible:** Prof. Dr. Christoph Hilgers

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

**Part of:** Key Competences in Geosciences (Compulsory Elective Modules)

**Credits:** 5

**Recurrence:** Each winter term

**Duration:** 1 term

**Language:** English

**Level:** 5

**Version:** 1

**Mandatory**

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**Competence Certificate**
The assessment consists of a written exam (90 min) according to §4 (2) of the examination regulations.

**Competence Goal**

- Students will be trained to apply structural geology at an advanced level and using real world examples.
- Students will be trained to link rocks to depositional systems and vice versa.

**Prerequisites**
Requirements for participation in the module exam: submission of all exercises on time, 80% of them correct.

**Content**

**Applied Structural Geology:**
- Stress and Strain
- Fractures and Mohr Circle
- Joints and Veins
- Normal faults
- Thrust faults
- Strike slip faults
- Inversion
- Strain measurements
- Diapirs & Intrusions
- Folds
- Folds and Cleavage
- Microstructures
- Maps / Structural Analysis

**Depositional Systems:**
- Overview, description of sediments
- Eolian systems
- Fluvial systems
- Estuaries and incised valleys
- Deltas & Clastic Shorelines
- Evaporites
- Clastic shelves
- Reefs and platforms
- Submarine fans and Turbidites
- Sea level change
- Sequence stratigraphy

**Literature**

**Structural Geology**

**Depositional Systems**
Slatt, R.M. 2006. Stratigraphic reservoir characterization for petroleum geologists, geophysicists and engineers. Elsevier 478 pp
Module: Geospatial Data Analysis I – Programming and Geostatistics [M-BGU-105505]

**Responsible:** Dr. Kathrin Menberg

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

**Part of:** Specialization in Geosciences

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**Competence Certificate**

Student research project: programming of a code for data analysis, written documentation (ca. 5 pages)

**Competence Goal**

Students can use the Python programming language to apply methods for statistical analysis to different geospatial datasets, prepare the results graphically, and discuss and summarize them.

**Prerequisites**

Choice of the profile Hydrogeology and Engineering Geology

**Content**

The course is divided into a lecture (2 SWS) and an exercise (2 SWS). The lecture teaches theoretical basics of programming in Python (program structures, database structures, data ethics & licenses, etc.), as well as methods for geostatistical analysis (regression analysis, time series analysis, error analysis, etc.) of spatial and temporal datasets.

The exercise covers the practical aspects of programming, data analysis, visualization and interpretation.

**Recommendation**

This module should be attended and completed before the module Geodata Analysis II (starting summer term 2021) that builds on it.

**Workload**

60 h attendance time and 120 h self-study time

**Learning type**

Lecture and exercise, student research project
Module: Geotechnical Engineering (bauiBFP7-GEOING) [M-BGU-103698]

Responsible: Dr.-Ing. Peter Kudella

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

Part of: Specific Supplements

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T-BGU-107465 Geotechnical Engineering 11 CR Kudella, Niemunis

Competence Certificate
- 'Teilleistung' T-BGU-107465 with written examination according to § 4 Par. 2 No. 1

details about the learning control see at the 'Teilleistung'

Competence Goal
The students have a scientifically sound understanding of the building material 'soil' with respect to its appearance and mechanical behaviour. They are able to describe the latter on base of soil mechanical and soil hydraulic models, to classify and to analyse respective field and laboratory tests. Because of their knowledge in usual geotechnical construction methods they can self-dependently select, design and describe the construction process for standard applications, such as building foundations, construction pit linings and tunnels adapted to the respective ground and groundwater conditions. Further, they are able to proof self-dependently ultimate limit states and serviceability limit states of those geotechnical constructions and natural slopes and to evaluate the results critically.

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

Prerequisites
none

Content
The module imparts theoretical principles of soil behavior and demonstrates their practical application in designing of the most common geotechnical constructions. This covers:

- standards, codes and safety concepts in foundation engineering
- subsoil investigation, soil classification, soil properties and soil parameters
- permeability, seepage and groundwater management
- stress distributions in the subsoil, compression behavior and consolidation
- shear resistance of soils, stability of slopes and foundations
- design and settlement calculation of shallow foundations
- earth pressure and earth resistance, design of retaining structures and retaining walls for excavations
- pile foundations, deep foundations and caisson foundations in open water
- methods for soil improvement
- introduction to tunneling

Recommendation
The not graded accomplishment Geology in Civil Engineering [T-BGU-103395] shall be passed.

The attendance of the lecture accompanied tutorials (6200417, 6200517) is recommended. Likewise, the preparation of voluntary term papers is absolutely recommended as follow-up and preparation for the examination.

Annotation
Tutorials are offered accompanying to the lectures, the participation is strongly recommended. Preparation and follow-up of the lectures can be done by ones-own in terms of working on a student research project.
**Workload**

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

- Basics in Soil Mechanics lecture, exercise, tutorial: 90 h
- Basics in Foundation Engineering lecture, exercise, tutorial: 90 h

independent study:

- preparation and follow-up lectures, exercises Basics in Soil Mechanics: 30 h
- preparation and follow-up lectures, exercises Basics in Foundation Engineering: 30 h
- examination preparation: 90 h

total: 330 h

**Literature**

Triantafyllidis, Th. (2014): Arbeitsblätter und Übungsblätter Bodenmechanik

Triantafyllidis, Th. (2011): Arbeitsblätter und Übungsblätter Grundbau

Gudehus, G (1981): Bodenmechanik, F. Enke


Kolymbas, D.: Geotechnik, Springer-Verlag 5. Auflage
Module: Geothermal Reservoir Engineering [M-BGU-105136]

**Responsible:** Prof. Dr. Thomas Kohl

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

**Part of:** Specialization in Geosciences

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<td>Geothermal Reservoir Engineering - Topics</td>
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<td>T-BGU-110428</td>
<td>Geothermal Reservoir Engineering - Seminar</td>
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**Competence Certificate**

The assessment consists of:
1. a written exam (90 minutes) (following §4(2) of the examination regulation).
2. oral presentation

**Competence Goal**
- The students will be able to compare and to analyze geothermal systems.
- The students will be able to assess and discuss geothermal systems.
- The student will be able to acquire and to present in front of their peers specific knowledge of geothermal systems from the literature and to discuss.

**Module grade calculation**
The overall grade of the module is the average of the grades for each course weighted by the credits.

**Prerequisites**
See modeled conditions

**Modeled Conditions**
The following conditions have to be fulfilled:

1. The module M-BGU-102432 - Geothermics: Energy and Transport Processes must have been passed.
2. The module M-BGU-102447 - Applied Geothermics must have been passed.

**Content**
The content of this course contains basics, technologies, and exploration methods of geothermal systems.
- Introduction into geothermal reservoir engineering
- Reservoir geology of crystalline and sedimentary rocks
- Geothermal exploration
- Geothermometry of thermal water
- Scalings
- Induced seismicity
- Seismic monitoring
- Numerical reservoir modelling
- Well testing

**Annotation**
1. Often you will hear the Name "Geothermie III" for this module.
2. Starting from the winter term 2019/2020 this is the new name for the module M-BGU-102448, Topics of Geothermal Research
3. Presentation required

**Workload**
regular attendance: 50 hours
self study 100 hours

**Responsible:** Prof. Dr. Thomas Kohl

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

**Part of:** Key Competences in Geosciences (Compulsory Elective Modules)

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**Competence Certificate**
The assessment consists of a written exam (45 min) according to §4 (2) of the examination regulations and a non-assessed coursework (participation in excursion and report) according to §4 (3) of the examination regulations.

**Competence Goal**
- The students obtain knowledge in the field of geothermics and are able to integrate relevant physical processes into the subject field
- The students are able to apply methods for geothermal subsurface investigations and to make calculations with the obtained data

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

**Prerequisites**
none

**Content**
- Heat budget of the Earth (influence of the sun, humans, stored heat, heat production)
- Heat transport in rocks (phonons, photons, elektrons, advective heat transport)
- Physical understanding of underlying mechanisms and processes
- Introduction into Geothermics, relations and boundaries to other related disciplines
- Energy conservation, thermal and petrophysical properties of rocks, temperature field of the Earth, influence of topography and climate on temperature distribution, Fourier law, stationary/instationary heat conduction, heat transport in continental and oceanic crust, advection by flow (Darcy law), Kelvin problem, Gauss error function
- Introduction into methods and applications in geothermics: Bullard plot interpretation, measurement, Bottom Hole Temperature data
- Introduction into geophysical geodynamics

**Annotation**
The date for the excursion and the closing date for the excursion report will be promptly announced.

The practical part of this course is carried out in presence. The field courses are essential for the progress of the participants.

**Workload**
45 hours regular attendance
105 hours excursion, report and self study time
Module: Ground Water and Earth Dams (bauIM5S04-GWDAMM) [M-BGU-100073]

Responsible: Dr.-Ing. Andreas Bieberstein
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: Specific Supplements

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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 geomechanical 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'

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
### 6.28 Module: Hydrogeology: Field and Laboratory Methods [M-BGU-102441]

**Responsible:** Dr. rer. nat. Nadine Göppert  
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:** Specialization in Geosciences

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**Competence Certificate**  
The assessment consists of an examination of another type (graded presentation in seminar) according to §4 (2) of the examination regulations.

**Prerequisites**  
keine

**Recommendation**  
We strongly recommend to attend the course "Hydrogeology: Methods and Applications", since it addresses the theoretical and practical background.

**Annotation**  
The practical part of this course is carried out in presence. The field courses are essential for the progress of the participants.
6.29 Module: Hydrogeology: Groundwater Modelling [M-BGU-102439]

**Responsible:** Dr. Tanja Liesch  
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:** Specialization in Geosciences

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**Competence Certificate**
The assessment consists of an examination of another type (working on a problem, submission ca. mid-February and a ca. 15min poster-presentation) according to §4 (2) of the examination regulations.

**Prerequisites**
It is mandatory to choose the module "Hydrogeology: Methods and Applications" as a requirement for this module, since it addresses the theoretical and practical background.
6.30 Module: Hydrogeology: Karst and Isotopes [M-BGU-102440]

**Responsible:** Prof. Dr. Nico Goldscheider

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

**Part of:** Key Competences in Geosciences (Compulsory Elective Modules)
Specialization in Geosciences

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**Competence Certificate**
The assessment consists of a written exam (90 min) according to §4 (2) of the examination regulations.

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

**Prerequisites**
none
6.31 Module: Hydrogeology: Karst and Isotopes (with Field Trip) [M-BGU-105150]

Responsible: Prof. Dr. Nico Goldscheider
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: Key Competences in Geosciences (Compulsory Elective Modules)

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Competence Certificate

The assessment consists of a written exam (90 min) according to §4 (2) of the examination regulations and a non-assessed coursework (non-assessed excursion report).

Prerequisites
none

Annotation
The practical part of this course is carried out in presence. The field courses are essential for the progress of the participants.
### Module: Hydrogeology: Methods and Applications [M-BGU-102433]

**Responsible:** Prof. Dr. Nico Goldscheider  
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:** Key Competences in Geosciences (Compulsory Elective Modules)

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**Mandatory**

| T-BGU-104750 | Hydrogeology: Methods and Applications | 7 CR | Goldscheider |

**Competence Certificate**  
The assessment consists of a written module exam (120 min) according to §4 (2) of the examination regulations.

**Prerequisites**  
none

**Annotation**  
It is mandatory to choose the module "Hydrogeology: Methods and Applications" as a requirement for the modules "M-BGU-102439 - Hydrogeology: Groundwater Modelling" and "M-BGU-102441 - Hydrogeology: Field and Laboratory Methods, since it addresses their theoretical and practical background".
6.33 Module: Industrial Minerals and Environment [M-BGU-103993]

**Mandatory**

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**Competence Certificate**

The assessment consists of an examination of another type (graded module report incl. field trip report) according to §4 (2) of the examination regulations.

**Competence Goal**

**Industrial Minerals**

The students know the fundamental characteristics of industrial mineral deposits. They know the different possibilities of industrial application and quality requirements of the respective raw material. They are able to describe samples from industrial mineral deposits, recognize the relevant structure, fabric, texture and mineral assemblage. They can use their observations to make interpretations regarding mineral deposit formation and ore deposit quality. The students know the principle ore deposit models and can use this knowledge in order to interpret their sample set. They are able to decide, which mineral exploration method would be required for exploration of the various deposits and they are able to make basic assumptions about the economy of the deposit. They know how to translate geological observations into key parameters for mineral exploration.

The students know how to analyze short scientific papers and are able to understand and present the main message. They can relate the message in the paper to own observations in the samples and present a joint interpretation.

The students know how to apply their theoretical knowledge in the field. They make interpretations at various scales (thin section, sample, outcrop, deposit, district). They know, how to make meaningful sketches and how to present their observations and interpretation in written and oral formats. They are able to analyze, interpret and discuss their data in conjunction with published ore deposit models and can decide on the style of mineralization and the way of mineral exploration.

**Environmental aspects of mining**

The students know different environmental risks related to the extraction of metal ores, industrial minerals and energy resources and assign them to the respective stage (exploration, extraction, processing etc.). They are able to derive the potential environmental hazards of individual types of resources and propose suitable reclamation measures based on a sound knowledge of their geochemical and mineralogical characteristics. They can assess the positive and negative effects of extraction, processing and use of different resources on humans and the environment in a differentiated manner and are thus able to critically evaluate their own behaviour in the context of sustainable use of resources.

**Prerequisites**

none

**Content**

**Industrial Minerals**

The combined lectures and practicals start with an introduction into the industrial minerals raw material market and mineral deposit evaluation. The following lessons combine a lecture about the fundamental processes of deposit formation and the relationship to mineral exploration and quality of the industrial mineral resource with practical study of representative samples. In addition, scientific papers will be read and interpreted in some lessons.

During two days of field work the theoretical and practical skills will be applied in the field in selected industrial mineral deposits. Standard methods of geological field work will be applied and directed towards interpretation of the respective deposit.

**Environmental aspects of mining**

It will be looked at different environmental impacts of ore extraction and processing like acid mine drainage, cyanide leaching, amalgamation or oil spillage with specific focus on the hydrosphere, pedosphere, atmosphere, human beings and society. Furthermore, different strategies on how to minimize environmental impacts will be discussed and different examples on renaturation and reclamation will be presented. Also legal aspects of mineral resources exploration and extraction will be addressed.
Annotation
Students should be aware of harsh conditions during field work and should let the responsible person know, if they would have problems to work underground in old mines.
Depending on the auditorium, the course "Environmental Aspects of Mining" is held in German or English.
The practical part of this course is carried out in presence. The field courses are essential for the progress of the participants.

Workload
60 hours lectures and practicals (including 2 days of field trip) and 90 hours self study/homework

Literature
Bewertungskriterien für Industrieminerale, Steine und Erden. Geologisches Jahrbuch Reihe H. Schweizerbart'sche Verlagsbuchhandlung, Stuttgart. Different publications of various authors; in German with English abstract.
Publications of the Geological Surveys: BGR, DERA, BGS, USGS, etc.
6.34 Module: Internship [M-BGU-103996]

Responsible: Prof. Dr. Philipp Blum
 Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
 Part of: Key Competences in Geosciences (Project Study or Internship)

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Mandatory
T-BGU-108210 Internship 5 CR

Competence Certificate
The assessment consists of
- submission of an internship certificate from the employer with information about the internship, duration and the field of activity
- an examination of another type (graded internship report ca. 10-20 pages, equivalent to the report of the project study, and ca. 20 min presentation)

according to §4 (2) of the examination regulations.

Prerequisites
None
Module: Introduction to Ceramics [M-BGU-105222]

**Responsible:** Prof. Dr. Michael Hoffmann

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

**Part of:** Specific Supplements

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**Competence Certificate**

The assessment consists of an oral exam (30 min) taking place at a specific date.

The re-examination is offered at a specific date.

**Workload**

180 h
6.36 Module: Mineral Exploration [M-BGU-105357]

**Responsible:** Dr. Clifford Patten  
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:** Specialization in Geosciences

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**Mandatory**

| T-BGU-110833 | Mineral Exploration | 5 CR | Patten |

**Competence Certificate**

The students will need to provide a report (~10 pages) on the specific project they have been assigned to. They need to show that they know the right methods of exploration. Deadline for the report is individually scheduled. The first version of the report has to be improved if necessary.

**Competence Goal**

The students know the different geochemical methods applied to mineral resources exploration. They can choose the best-suited methods at the different stages of exploration for optimizing ore deposits discovery. They also know which exploration methods to use for specific ore deposit types. The students know how to interpret geochemical data and how to correlate them with field and sample observations. They know how to write an exploration report. The students will have the qualifications required for working in the ore mineral industry.

**Module grade calculation**

Grade of the report is the module grade.

**Prerequisites**

Students need detailed knowledge on ore forming processes of metallic and non-metallic mineral resources. They also need detailed background in geochemistry and geochemical analytics. Basic knowledge of geophysical exploration methods will be expected.

**Content**

- Theory for mineral exploration at regional, district, area, target and deposit scale (scientific approach, economics…).
- Geochemical distribution of metals and element of interests in the primary environment (i.e. during magmatism, metamorphism and alteration processes…).
- Geochemical dispersion of metals and element of interests in the secondary environment (i.e. soil, gossans, till, laterites…).
- Greenfield methods for exploration such as stream sediments, soil, rock and water survey.
- Brownfield methods for exploration at deposit scale with specific focus on drill core logging.
- Field sampling and laboratory data acquisition.
- Data interpretation from study cases and from data personally acquired by the students.

**Recommendation**

The students should have done the course of "Ore Geology of Metals" and "Industrial Minerals and Environment" or have background knowledge in ore geology.

**Annotation**

The course is held in 3 blocks (1. Block short course, 2. Block short course and project preparation, 3. Block data interpretation). See university calendar / course catalogue

**Workload**

40h Lectures, 2-3 field work or sample selection (ca. 25h), ca. 25h laboratory work, 60h self-study (report) = 150 h

**Learning type**

Lecture, literature research, fieldwork and labwork, report

**Literature**

Papers presented in lectures
Module: Mineral Materials [M-BGU-102453]

**Responsible:** Dr. Matthias Schwotzer

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

**Part of:** Specialization in Geosciences

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**Competence Certificate**

The assessment consists of an oral exam (30 min) according to §4 (2) of the examination regulations.

**Prerequisites**

None

**Annotation**

The practical part of this course is carried out in presence. The laboratory courses are essential for the progress of the participants.

**Responsible:** Prof. Dr. Philipp Blum  
**Organisation:** University  
**Part of:** Master Thesis

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**Mandatory**

| T-BGU-107516 | Master Thesis | 30 CR Blum |

**Competence Certificate**

The assessment consists of the Master's Thesis and a presentation. The maximum processing time for the Master's Thesis is six months. The presentation should take place within 8 weeks after the submission of the Master's Thesis.

**Modeled Conditions**

The following conditions have to be fulfilled:

1. You need to earn at least 70 credits in the following fields:
   - Specific Supplements
   - Key Competences in Geosciences
   - Specialization in Geosciences

**Responsible:** Prof. Dr. Thomas Kohl

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

**Part of:** Key Competences in Geosciences (Compulsory Modules)

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**Mandatory**

| T-BGU-104816 Numerical Methods in Geosciences | 6 CR Kohl |

**Competence Certificate**
The assessment consists of a written exam (90 min) according to §4 (2) of the examination regulations.

**Competence Goal**
- The students are able to apply basic statistical analysis of geoscientific data
- The students are able to code simple programs in Matlab to process and plot data
- The students know the numerical methods used to solve partial differential equations
- The students have performed the pre-processing, processing and post-processing steps of a numerical simulation

**Module grade calculation**
The module grade is the grade of the written exam.

**Prerequisites**
none

**Content**
Basic of algorithmic and programming
- Introduction to Matlab programming language and basic coding to apply knowledge
- Statistical analysis of geoscientific data
- Physical mechanisms and processes in geosciences
- Numerical methods to solve complex coupled processes (finite differences, finite elements, coupling)
- Numerical simulation (pre-processing, processing and post-processing) of several case studies
- Borehole simulation of pressure & temperature fields after Thiem (extension of Theis)
- Reservoir simulation

**Recommendation**
Own laptop/PC

**Annotation**
Homework required

The practical part of this course is carried out in presence. The exercises are partly conducted in the computing lab and are essential for the progress of the participants.

**Workload**
regular attendance 60 hours
self study time 120 hours
Module: Ore Geology of Metals [M-BGU-103994]

**M 6.40 Module: Ore Geology of Metals [M-BGU-103994]**

**Responsible:** Prof. Dr. Jochen Kolb

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

**Part of:** Key Competences in Geosciences (Compulsory Elective Modules)
Specialization in Geosciences

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**Mandatory**

| T-BGU-109345 | Ore Geology of Metals | 5 CR | Kolb |

**Competence Certificate**

The assessment consists of an oral exam (30 min) according to §4 (2) of the examination regulations. A report of the field trip and a protocol have to be handed in before the exam.

**Competence Goal**

The students know the fundamental approach of describing samples from ore deposits (hand specimen, drill core) and thin and polished sections. They can analyze the samples and relate them to the specific ore deposit type. They know the specific textures and are able to discuss them in order to develop a model for the mineralization or hydrothermal alteration processes.

The students know the principle ore deposit models and can use this knowledge in order to interpret their sample set that comes from different parts or zones of an ore deposit. They understand the different scales that are involved in ore deposit formation and are able to use their observations to interpret and discuss the scale-dependent processes involved in mineralization.

The students know the principle methods of mineral exploration and are able to translate geological observations into key parameters for mineral exploration.

The students know how to analyze short scientific papers and are able to understand and present the main message. They can relate the message in the paper to own observations and present a joint interpretation.

The students know how to apply their theoretical knowledge in the field. They make interpretations at various scales (thin section, sample, outcrop, deposit, district). They know, how to make meaningful sketches and how to present their observations and interpretation in written and oral formats. They are able to analyze, interpret and discuss their data in conjunction with published ore deposit models and can decide on the style of mineralization and the way of mineral exploration.

**Prerequisites**

none

**Content**

- Detailed processes of ore deposit formation, including modern research advances.
- Ore petrology on sample, drill core, thin section and polished section.
- Reading and interpretation of short papers on ore deposit geology.
- Orthomagmatic Ni-PGE-Cu-Au deposits.
- Podiform Chromite deposits.
- Magmatic REE-Nb-Ta deposits.
- Copper Porphyry deposits.
- Epithermal Au-Ag deposits.
- Skarn deposits.
- VMS-SEDEX deposits.
- Orogenic Gold deposits.
- Iron Oxide Copper Gold deposits.
- MVT-SSC deposits.
- Fundamentals of recognizing and describing mineralization in the field.

**Recommendation**

Students should have a basic level of understanding of ore-forming processes from a previous Economic Geology course.

**Annotation**

The practical part of this course is carried out in presence. The field courses are essential for the progress of the participants.

**Workload**

Approx. 60 hours lectures and practicals (including a 2 day field trip) and 90 hours homework.
Learning type
Lecture / Practicals
(VÜ)

Literature
Books:
### Module: Petrology [M-BGU-102452]

**Responsible:** apl. Prof. Dr. Kirsten Drüppel

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

**Part of:** Specialization in Geosciences

**Credits:** 5

**Recurrence:** Each summer term

**Duration:** 1 term

**Language:** German

**Level:** 4

**Version:** 1

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**Competence Certificate**
The assessment consists of an examination of another type (graded homework) according to §4 (2) of the examination regulations.

**Prerequisites**
one

**Annotation**
The practical part of this course is carried out in presence. The field courses are essential for the progress of the participants.
6.42 Module: Physical Chemistry for Applied Geosciences [M-CHEMBIO-104581]

Responsible: wechselnde Dozenten, siehe Vorlesungsverzeichnis
PD Dr. Andreas-Neil Unterreiner

Organisation: KIT Department of Chemistry and Biosciences
Part of: Specialization in Geosciences

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<td>T-CHEMBIO-109395</td>
<td>Laboratory Work in Physical Chemistry</td>
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Prerequisites
None
6.43 Module: Project Study [M-BGU-102438]

Responsible: Prof. Dr. Philipp Blum
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: Key Competences in Geosciences (Project Study or Internship)

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<td>Introduction to Project Management</td>
<td>0 CR</td>
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Competence Certificate

The assessment consists of an examination of another type (Project Study: graded report and presentation) according to §4 (2) of the examination regulations, as well as a non-assessed coursework (participation in course "Introduction to Project Management" and presentation) according to §4 (3) of the examination regulations.

Prerequisites

none
Module: Reservoir-Geology [M-BGU-103742]

Responsible: Prof. Dr. Christoph Hilgers
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: Key Competences in Geosciences (Compulsory Elective Modules)
Specialization in Geosciences

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Mandatory

| T-BGU-107563 | Reservoir-Geology | 5 CR | Hilgers |

Competence Certificate
The assessment consists of a written exam (90 min) according to §4 (2) of the examination regulations and including the field book.

Competence Goal
After this course students are enabled to interpret fluid migration in porous and fractured rock in 3D sedimentary bodies over time, governing aspects from basin- and structural evolution to facies- and porosity-permeability development. They are enabled to map and characterize sedimentary rocks properties in the field including structural- and petrophysical aspects. They work in teams and critically evaluate own data with published literature.

Prerequisites
none

Content
Basins and reservoirs; methods: petrography, isotopy, microthermometry and cathodoluminescence; burial history and maturation; depositional settings and well correlations; structures; migration and traps; pore pressures, compaction and water saturation; diagenesis; reservoir characterization; reservoir quality prediction; plays and risks. Practical application of reservoir geology in a given field study area with special focus on structure, diagenesis and 3D geometries in sedimentary rocks

Recommendation
The student shall have a basic knowledge of sedimentology and structural geology, such as presented in the module Geologie (Geology), MSc 1st semester

Annotation
The practical part of this course is carried out in presence. The field courses are essential for the progress of the participants.

Literature
Module: Rock Mechanics and Tunneling (bauiM5P3-FMTUB) [M-BGU-100069]

Responsible: Dr.-Ing. Peter Kudella
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: Specific Supplements

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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
6.46 Module: Sedimentary Petrology [M-BGU-103733]

Responsible: Prof. Dr. Armin Zeh

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

Part of: Key Competences in Geosciences (Compulsory Elective Modules) Specialization in Geosciences

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<td>Sedimentary Petrology</td>
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Competence Certificate

The assessment consists of a written exam (90 min) according to §4 (2) of the examination regulations.

Module grade calculation

grade of the module is grade of the exam

Prerequisites

none

Annotation

Depending on the auditorium, this module is held in German or English

Workload

contact hours: 60h (lecture and exercises)
self study time: 90h incl. exam
Module: Structural and Phase Analysis [M-BGU-105236]

Responsible: Dr.-Ing. Susanne Wagner
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: Specific Supplements

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Mandatory

T-MACH-102170 Structural and Phase Analysis 4 CR Hinterstein, Wagner

Competence Certificate
The assessment consists of an oral exam (20-30 min) taking place at the agreed date (according to Section 4(2), 2 of the examination regulation).

The re-examination is offered upon agreement.

Competence Goal
The students know the fundamentals of crystallography, the generation and detection of x-rays as well as their interaction with the microstructure of crystalline materials. They have detailed knowledge about the different methods of x-ray diffraction measurements and are able to analyse x-ray spectra using modern methods of x-ray analysis both qualitatively and quantitatively.

Module grade calculation
The grade of the module is the grade of the oral examination.

Content
The course gives an overview to generation and detection of x-rays as well as their interaction with matter. It provides an introduction to crystallography and describes modern measurement and analysis methods of x-ray diffraction.

It is arranged in the following units:

- Generation and properties of X-Ray's
- Crystallography
- Fundamentals and application of different measuring methods
- Qualitative and quantitative phase analysis
- Texture analysis (pole figures)
- Residual stress measurements

Workload
regular attendance: 30 hours
self-study: 90 hours

Literature
Moderne Röntgenbeugung - Röntgendiffraktometrie für Materialwissenschaftler, Physiker und Chemiker, Spieß, Lothar / Schwarzer, Robert / Behnken, Herfried / Teichert, Gerd B.G. Teubner Verlag 2005
Module: Structural Ceramics [M-BGU-105223]

**Responsible:** Prof. Dr. Michael Hoffmann

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

**Part of:** Specific Supplements

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<td>Hoffmann</td>
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**Competence Certificate**

Oral examination, 20-30 min

**Literature**


Module: Structural Geology [M-BGU-102451]

Responsibility: apl. Prof. Dr. Agnes Kontrny
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: Specialization in Geosciences

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<td>3 CR</td>
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<td>T-BGU-107508</td>
<td>Field Course Applied Structural Geology</td>
<td>2 CR</td>
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</table>

Competence Goal
• Students will be trained in microstructural analysis in order to gain fundamental understanding of rock deformation. They learn to evaluate their own observation in relation to a tectonic context.
• Practical application of structural analysis in a given field study area.

Prerequisites
none

Content
• Microstructures: The students learn to describe and evaluate small scale structures in deformed rocks. They are enabled to describe and interpret rock fabric elements, foliation development, polyphase deformation, deformation mechanisms, porphyroblast growth-deformation relationship and shear zone fabrics.
• Field course Applied Structural Geology: The students learn to describe and interpret large scale structures in the field. They characterize the development of normal faults, folds, thrust systems, unconformities and explain polyphase deformation in space and time in different orogenic belts.

Annotation
The practical part of this course is carried out in presence. The field courses and microscopy courses are essential for the progress of the participants.

Literature

Further references to the field course will be delivered in advance.
Module: Thermal Use of Groundwater [M-BGU-103408]

6.50 Module: Thermal Use of Groundwater [M-BGU-103408]

Responsible: Prof. Dr. Philipp Blum
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: Specific Supplements

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

Mandatory
T-BGU-106803 Thermal Use of Groundwater 4 CR Blum

Competence Certificate
The assessment consists of an oral exam (approx. 15 min), according to § 4 Par. 2 No. 2.

Competence Goal
Students get familiar with the topic ’Thermal Use of Groundwater’ and will be able to integrate their knowledge in particular in an urban water energy nexus. They get knowledge about the fundamentals of thermal transport in groundwater and their application to shallow geothermal systems such as ground source and groundwater heat pump systems. Hence, analytical and numerical simulations will be performed using Excel and Matlab scripted codes. They will be able to perform their own simulations and will be able to design shallow geothermal systems in context of the water energy nexus.

Module grade calculation
The grade of the module is the grade of the oral exam.

Content
The content of this module is mainly based on the textbook on ’Thermal Use of Shallow Groundwater’ and is therefore structured as follows:
- Fundamentals (theory of heat transport in the subsurface)
- Analytical solutions for closed and open systems
- Numerical solutions for shallow geothermal systems
- Long-term operability and sustainability
- Field methods such as thermal tracer tests and thermal response tests (TRT)
- Case studies and applications

Analytical simulations are performed using Excel and Matlab scripted codes. In addition, calibration and validation exercises are performed using existing field and monitoring data. Finally, the students are actively planning an own geothermal system from the application up to the long-term performance of such a system. Hence, a final planning report should be written.

Recommendation
knowledge of programming with Matlab; otherwise, it is strongly recommended to attend the course ’Introduction to Matlab’ (6224907)

Workload
Regular Attendance, active participation in lectures: 30 hours
Preparation and follow-up of lectures (at home): 40 hours
Self-study, preparation for the exam plus oral exam: 50 hours
Total of 120 hours

Literature
Other documents such as recent publications are made available on ILIAS

Applied Geosciences Master 2016 (Master of Science (M.Sc.))
Module Handbook as of 02/03/2021
Module: Urban Ecology (E13) [M-BGU-101568]

Responsible: apl. Prof. Dr. Stefan Norra
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: Specific Supplements

Credits: 12
Recurrence: Each term
Duration: 2 terms
Language: German
Level: 5
Version: 3

Mandatory

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Prerequisites
None

Annotation
None
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:** Specific Supplements

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**Mandatory**

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

**Competence Certificate**
- 'Teilleistung' T-BGU-106596 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 most relevant processes of Hydrology including their feedbacks and limitations. They know the concepts to describe and predict these processes in the context of science and water management. Furthermore are they 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 simulate water balances and predict flood

**Recommendation**

course Hydrology (6200511) and module Water Resources Management and Engineering [bauiBFW9-WASSRM]; knowledge of programming with Matlab or another similar programming language, 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: 40 h
- preparation of term paper (examination): 80 h

total: 180 h
Literature
### 6.53 Module: Water Chemistry and Water Technology [M-CIWVT-103753]

**Responsible:** Prof. Dr. Harald Horn  
**Organisation:** KIT Department of Chemical and Process Engineering  
**Part of:** Specific Supplements

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<td>Water Chemistry and Water Technology</td>
<td>10</td>
<td>Horn</td>
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**Competence Goal**

- Students get familiar with processes in aquatic systems. These include the determination, occurrence and behavior of geogenic and anthropogenic compounds as well as microorganisms in the different parts of the hydrological cycle.
- Apart from the questions on the chemical and biological water quality, the focus also lies on technical aspects of water use, water treatment and water technology.

**Prerequisites**

None

**Content**

Chemische und physikalische Eigenschaften des Wassers, Wasserkreislauf und Inhaltsstoffe, Kalk-Kohlensäure-Gleichgewicht, Sättigungsindex, Grundwasser, Oberflächenwasser, Umsetzungen, Trinkwasser, Grundlagen der Wasserbeurteilung, analytische Verfahren zur Wasseruntersuchung, wassertechnologische und wasserchemische Verfahren (Flockung, Fällung, Enteisenung, Entmanganung, Adsorption und Ionenaustausch, Gas austausch, Entkalkung und/oder Entkarbonisierung, Oxidation und Entkeimung), Übungen

**Recommendation**

None

**Literature**

- Crittenden et al. (2005): Water Treatment, Principles and design. Wiley & Sons
- Vorlesungsskripte
Module: Water Technology [M-CIWVT-103407]

Responsible: Prof. Dr. Harald Horn
 Organisation: KIT Department of Chemical and Process Engineering
 Part of: Specific Supplements

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Mandatory
T-CIWVT-106802 Water Technology 6 CR Horn

Competence Certificate
Oral exam, 30 min

Competence Goal
Students learn fundamental knowledge in water chemistry and how to apply it to processes in aquatic systems in general and in reactors for water treatment. Water treatment will be taught for drinking water and partly waste water. The students are able to apply physical, chemical and biochemical treatment for the respective removal of particulate and dissolved components in water. They are able to use the fundamental design parameters for the different types of unit operations.

Prerequisites
None

Content
Water cycle, different types of raw water (ground and surface water). Water as solvent, carbonate balance, differentiation between microbiological and chemical population. Unit operations: sieving, sedimentation, filtration, flocculation, flotation, ion exchange, aeration, oxidation, disinfection, adsorption). For all unit operations design parameters will be provided. Simple 1D models will be discussed for description of kinetics and retention time in reactors for water treatment.

Workload
Attendance time: 45 h
Preparation/follow-up: 60 h
Examination + exam preparation: 75 h

Literature


Lecture notes will be provided in ILIAS
7 Courses

7.1 Course: Advanced Analysis in GIS [T-BGU-101782]

**Responsible:** Dr.-Ing. Norbert Rösch

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

**Part of:** M-BGU-101053 - Advanced Analysis in GIS

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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

**Competence Certificate**
oral exam with 20 minutes

**Prerequisites**
Keine

** Recommendation**
None

**Annotation**
Keine
### 7.2 Course: Advanced Clay Mineralogy [T-BGU-104840]

**Responsible:** Dr. Katja Emmerich

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

**Part of:** M-BGU-102444 - Applied Mineralogy: Clay Science

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<td>Anwendungen von Tonen und Laboreinführung</td>
<td>2 SWS</td>
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**Prerequisites**

none

**Annotation**

The practical part of this course is carried out in presence. It requires special rooms (laboratory) and is essential for the study progress of the participants.
### 7.3 Course: Applied Geothermics [T-BGU-108017]

**Responsible:**  Prof. Dr. Thomas Kohl  
**Organisation:**  KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:**  M-BGU-102447 - Applied Geothermics

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**Legend:**  🖥 Online,  🧩 Blended (On-Site/Online),  🔔 On-Site,  ☒ Cancelled

**Competence Certificate**  
The assessment consists of a written exam (45min) according to §4 (2) of the examination regulations.

**Prerequisites**  
none
7.4 Course: Applied Geothermics - Excursion [T-BGU-108018]

**Responsible:** Prof. Dr. Thomas Kohl

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

**Part of:** M-BGU-102447 - Applied Geothermics

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**Legend:** 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

**Competence Certificate**
Non-assessed coursework (participation in field trip and report), see §4 (3) of the examination regulations.

**Prerequisites**
none

**Annotation**
The date for the excursion and the closing date for the excursion report will be announced in the summer term.
The practical part of this course is carried out in presence. The field courses are essential for the progress of the participants.
7 COURSES

Course: Applied Mineralogy: Geomaterials [T-BGU-104811]

7.5 Course: Applied Mineralogy: Geomaterials [T-BGU-104811]

**Responsible:** Dr. Rosa Micaela Danisi  
Dr. Gemma de la Flor Martin  
Prof. Dr. Frank Schilling

**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
Part of: M-BGU-102430 - Applied Mineralogy: Geomaterials

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<td>2 SWS</td>
<td>Microporous Mineral Phases: Characterization and Applications Danisi, Schilling</td>
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<tr>
<td>WS 20/21 6339083</td>
<td>2 SWS</td>
<td>Crystallography applied to Geomaterials de la Flor Martin, Schilling</td>
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**Competence Certificate**
The assessment consists of a written exam (90 min) according to §4 (2) of the examination regulations.  
*To pass the exam, at least 50% of the points must be achieved.*

**Prerequisites**
none

**Annotation**
Will be held in Englisch to improve language competence.

The practical part of this course is carried out in presence. It requires special rooms (laboratory) and is essential for the course progress of the participants.
7.6 Course: Borehole Technology [T-BGU-104851]

**Responsible:** Prof. Dr. Thomas Kohl  
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:** M-BGU-102449 - Borehole Technology

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<td>SS 2021</td>
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<td>Drilling</td>
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#### Legend

- Online
- Blended (On-Site/Online)
- On-Site
- Cancelled

### Competence Certificate

The assessment consists of a written exam (90 min) according to §4 (2) of the examination regulations (45min Logging, 45min Drilling). The oral presentation in the seminar is included in the grade of the written exam.

### Prerequisites

none

### Annotation

The oral presentation in the seminar within the lecture "Drilling" consists of an oral presentation (20min), discussion (10min) and a written contribution about the oral presentation.
7.7 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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**Legend:** 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

**Competence Certificate**
oral exam, appr. 20 min.

**Prerequisites**
none

**Recommendation**
none

**Annotation**
none
7.8 Course: Clay Mineralogy Introduction [T-BGU-104839]

Responsible: Dr. Katja Emmerich
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: M-BGU-102444 - Applied Mineralogy: Clay Science

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Prerequisites

none

Annotation

The practical part of this course is carried out in presence. It requires special rooms (laboratory) and is essential for the study progress of the participants.
7.9 Course: Current Research Topics in Hydrogeology and Engineering Geology
[T-BGU-111067]

**Responsible:** Prof. Dr. Nico Goldscheider

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

**Part of:** M-BGU-105506 - Current Research Topics in Hydrogeology and Engineering Geology

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**Competence Certificate**

Attendance at current lecture series, excursion report(s) (1 page/day), presentation (20 min)

**Prerequisites**

Choice of the profile Hydrogeology and Engineering Geology
### 7.10 Course: Diagenesis [T-BGU-107559]

- **Responsible:** Prof. Dr. Christoph Hilgers
- **Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences
- **Part of:** M-BGU-103734 - Diagenesis and Cores

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**Type**
Examination of another type

**Credits**
3

**Recurrence**
Each winter term

**Version**
1

Legend:
🖥 Online,
🧩 Blended (On-Site/Online),
🗣 On-Site,
🗙 Cancelled

**Prerequisites**
Reservoir-Geology

**Annotation**
Diagenesis: Seminar as block course during winter term due to requirement of microscope lab and involvement of external lecturer

The practical part of this course is carried out in presence. The microscopy exercises are essential for the study progress of the participants.
### 7.11 Course: Earthworks and Foundation Engineering [T-BGU-100068]

**Responsible:** Dr.-Ing. Andreas Bieberstein  
Dr.-Ing. Lukas Knittel

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

**Part of:** M-BGU-100068 - Earthworks and Foundation Engineering

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Legend: 🖥️ Online, 🧩 Blended (On-Site/Online), 🔔 On-Site, ✗ Cancelled

**Competence Certificate**

written exam, 90 min.

**Prerequisites**

none

**Recommendation**

preparation of the student research project for examination preparation

**Annotation**

none
7.12 Course: Electron Microscopy I [T-PHYS-107599]

**Responsible:** Jun.-Prof. Dr. Yolita Eggeler  
Prof. Dr. Dagmar Gerthsen

**Organisation:** KIT Department of Physics

**Part of:** M-PHYS-103760 - Electron Microscopy I

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Legend: 🖥 Online, ⌂ Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

**Competence Certificate**

Oral Exam, ca. 45 min

**Prerequisites**

none
### Course: Electron Microscopy II [T-PHYS-107600]

**Responsible:** Jun.-Prof. Dr. Yolita Eggeler  
Prof. Dr. Dagmar Gerthsen

**Organisation:** KIT Department of Physics

**Part of:** M-PHYS-103761 - Electron Microscopy II

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**Competence Certificate**

Oral Exam, ca. 45 min

**Prerequisites**

none
### 7.14 Course: Engineering Geologie: Laboratory and Field Methods [T-BGU-104814]

**Responsible:** Prof. Dr. Philipp Blum  
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:** M-BGU-102434 - Engineering Geology: Laboratory and Field Methods

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| WS 20/21 | 6339112 | Ingenieurgeologisches Laborpraktikum | 2 SWS | Practice (Ü) / 🗣 | Menberg, Blum, Rau, Schweizer |
| SS 2021  | 6310404 | Ingenieurgeologisches Geländepraktikum/ Engineering Geological | 3 SWS | Practice (Ü) / 🗣 | Blum, Menberg, Rau |

**Legend:** 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

**Prerequisites**
none

**Annotation**
The practical part of this course is carried out in presence. The field courses and laboratory courses are essential for the progress of the participants.
## 7.15 Course: Engineering Geology: Mass Movements [T-BGU-110724]

**Responsible:** Dr. Kathrin Menberg  
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:** M-BGU-102442 - Engineering Geology: Mass Movements and Modelling

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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗓 On-Site, ✗ Cancelled
### Course: Engineering Geology: Modelling [T-BGU-110725]

**Responsible:** Dr. Kathrin Menberg  
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:** M-BGU-102442 - Engineering Geology: Mass Movements and Modelling

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Legend: 🖥 Online, 🟢 Blended (On-Site/Online), ⚫ On-Site, ✗ Cancelled
7.17 Course: Environmental Geology: Radio- & Chemotoxic Elements [T-BGU-107560]

**Responsible:** Dr. Frank Heberling

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

**Part of:** M-BGU-102455 - Environmental Geology: Radio- & Chemotoxic Elements

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**Prerequisites**

none
7.18 Course: Environmental Mineralogy [T-BGU-109325]

Responsible: apl. Prof. Dr. Stefan Norra
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: M-BGU-104466 - Environmental Mineralogy

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Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

Annotation
The practical part of this course is carried out in presence. The field courses and laboratory courses are essential for the progress of the participants.
### 7.19 Course: Field Course Applied Structural Geology [T-BGU-107508]

**Responsible:** apl. Prof. Dr. Agnes Kontrny  
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:** M-BGU-102451 - Structural Geology

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**Events**

| SS 2021 | 6310406 | Geländeübung zur Angewandten Strukturgeologie | 3 SWS | Practice (Ü) / • | Kontrny |

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), • On-Site, ✗ Cancelled

**Prerequisites**

none

**Annotation**

The practical part of this course is carried out in presence. The field courses are essential for the progress of the participants.
7.20 Course: Field Excercise / Excursion [T-BGU-104878]

**Responsible:** Prof. Dr. Armin Zeh

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

**Part of:** M-BGU-102456 - Field Excercises / Excursion

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Legend: 💻 Online, 🧩 Blended (On-Site/Online), 🗽 On-Site, ✗ Cancelled

**Prerequisites**

none

**Annotation**

The practical part of this course is carried out in presence. The field courses are essential for the progress of the participants.
# 7.21 Course: Field Trip General Geothermics [T-BGU-107635]

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Legend: 🖥 Online, ☐ Blended (On-Site/Online), ☑ On-Site, ✗ Cancelled

**Competence Certificate**

non-assessed coursework (participation in excursion and report) according to §4 (3) of the examination regulations

**Annotation**

The practical part of this course is carried out in presence. The field course is essential for the progress of the participants.
7.22 Course: Field Trip Karst Hydrogeology [T-BGU-110413]

**Responsible:** Prof. Dr. Nico Goldscheider

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

**Part of:** M-BGU-105150 - Hydrogeology: Karst and Isotopes (with Field Trip)

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**Events**

| SS 2021 | 6339078 | Exkursion zur Karsthydrogeologie/Field Trip Karst Hydrogeology | 1 SWS | Practice (Ü) | Goldscheider |

**Legend:** 🌐 Online, 🔄 Blended (On-Site/Online), ⚤ On-Site, ✗ Cancelled

**Annotation**
The practical part of this course is carried out in presence. The field courses are essential for the progress of the participants.
**7.23 Course: Geochemical Processes and Analytical Methods [T-BGU-108192]**

**Responsible:** Dr. Elisabeth Eiche

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

**Part of:** M-BGU-103995 - Geochemical Processes and Analytical Methods

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Legend: 📱 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

**Annotation**

The practical part of this course is carried out in presence. It requires special rooms (laboratory) and is essential for the study progress of the participants.
7.24 Course: Geodata Analysis II – Big Data and Machine Learning [T-BGU-111268]

**Responsible:** Dr. Tanja Liesch  
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:** M-BGU-105634 - Geodata Analysis II – Big Data and Machine Learning

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<td>Liesch, Rau</td>
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**Legend:** 🌐 Online, 📦 Blended (On-Site/Online), 🗓 On-Site, ⏹️ Canceled

**Prerequisites**
Choice of the profile Hydrogeology and Engineering Geology. To register for the exam, the module Geodata Analysis I - Programming and Geostatistics must have been passed.
7.25 Course: Geological Mapping and Processing of Geospatial Data [T-BGU-104819]

**Responsible:** apl. Prof. Dr. Kirsten Drüppel

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

**Part of:** M-BGU-102437 - Geological Mapping and Processing of Geospatial Data

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<td>Each summer term</td>
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**Prerequisites**
none

**Annotation**
The practical part of this course is carried out in presence. The field courses are essential for the progress of the participants.
7.26 Course: Geological Storage of Gas [T-BGU-104841]

**Responsible:** Prof. Dr. Frank Schilling

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

**Part of:** M-BGU-102445 - Geological Storage of Gas

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Legend: 🖥 Online, 🤸 Blended (On-Site/Online), 🎤 On-Site, ✗ Cancelled
### 7.27 Course: Geology [T-BGU-104812]

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**Legend:** 🖥 Online, 🧩 Blended (On-Site/Online), 🗓 On-Site, ✗ Cancelled

**Prerequisites**

none
### Course: Geospatial Data Analysis I – Programming and Geostatistics [T-BGU-111066]

**Responsible:** Dr. Kathrin Menberg  
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:** M-BGU-105505 - Geospatial Data Analysis I – Programming and Geostatistics

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<td>4 SWS</td>
<td>Lecture / Practice (VÜ)</td>
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**Legend:** 🖥 Online, 🧩 Blended (On-Site/Online), ● On-Site, ✗ Cancelled

**Competence Certificate**

Student research project: programming of a code for data analysis, written documentation (ca. 5 pages)

**Prerequisites**

Choice of the profile Hydrogeology and Engineering Geology

**Recommendation**

This module should be attended and completed before the module Geodata Analysis II (starting summer term 2021) that builds on it.
7.29 Course: Geotechnical Engineering [T-BGU-107465]

**Responsible:** Dr.-Ing. Peter Kudella
apl. Prof. Dr. Andrzej Niemunis

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

**Part of:** M-BGU-103698 - Geotechnical Engineering

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<td>Exercises to Basics of Foundation Engineering</td>
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Legend: 
- Online
- Blended (On-Site/Online)
- On-Site
- Cancelled

**Competence Certificate**

written exam, 150 min.

**Prerequisites**

none

**Recommendation**

The preparation of voluntary term papers is strongly recommended as preparation for the examination.

**Annotation**

none
7.30 Course: Geothermal Reservoir Engineering - Seminar [T-BGU-110428]

**Responsible:** Prof. Dr. Thomas Kohl

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

**Part of:** M-BGU-105136 - Geothermal Reservoir Engineering

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<td>Kohl, Gaucher, Grimmer, Gholamikorzani, Held</td>
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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ❌ Cancelled

**Competence Certificate**
The assessment consists of an oral presentation

**Prerequisites**
See modeled conditions under the module description
## 7.31 Course: Geothermal Reservoir Engineering - Topics [T-BGU-110427]

**Responsible:** Prof. Dr. Thomas Kohl  
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:** M-BGU-105136 - Geothermal Reservoir Engineering

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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), ● On-Site, ✗ Cancelled

**Competence Certificate**  
The assessment consists of a written exam (90 minutes) (following §4(2), of the examination regulation).

**Prerequisites**  
See modeled conditions under the module description.


7.32 Course: Geothermics: Energy and Transport Processes [T-BGU-104813]

Responsible: Prof. Dr. Thomas Kohl  
Prof. Dr. Frank Schilling

Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences  
Part of: M-BGU-102432 - Geothermics: Energy and Transport Processes

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<td>General Geothermics</td>
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<td>Lecture (V)</td>
<td>Kohl, Egert</td>
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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🔘 On-Site, ✗ Cancelled

Competence Certificate  
The assessment consists of a written exam (45 min) according to §4 (2) of the examination regulations

Prerequisites
none
### 7.33 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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<td>Geotechnical Ground Water Problems</td>
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Legend: 🌐 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ❌ Cancelled

**Competence Certificate**
oral exam, appr. 40 min.

**Prerequisites**
none

**Recommendation**
none

**Annotation**
none
7.34 Course: Hydrogeology: Field and Laboratory Methods [T-BGU-104834]

Responsible: Dr. rer. nat. Nadine Göppert
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: M-BGU-102441 - Hydrogeology: Field and Laboratory Methods

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**Legend:** 🖥 Online, 🌐 Blended (On-Site/Online), 📚 On-Site, ✗ Cancelled

**Prerequisites**

none

**Annotation**

It is mandatory to choose the module "Hydrogeology: Methods and Applications" as a requirement for this module, since it addresses the theoretical and practical background.

The practical part of this course is carried out in presence. The field courses are essential for the progress of the participants.
7.35 Course: Hydrogeology: Groundwater Modelling [T-BGU-104757]

Responsible: Dr. Tanja Liesch
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: M-BGU-102439 - Hydrogeology: Groundwater Modelling

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Liesch, Schäfer

Prerequisites

It is mandatory to choose the module "Hydrogeology: Methods and Applications" as a requirement for this module, since it addresses the theoretical and practical background.
Course: Hydrogeology: Karst and Isotopes [T-BGU-104758]

- **Responsible:** Prof. Dr. Nico Goldscheider
- **Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences
- **Part of:** M-BGU-102440 - Hydrogeology: Karst and Isotopes  
  M-BGU-105150 - Hydrogeology: Karst and Isotopes (with Field Trip)

### Type
- **Written examination**

### Credits
- **5**

### Recurrence
- **Each term**

### Version
- **1**

### Events

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<td>Each term</td>
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**Legend:** 🖥️ Online, 🧩 Blended (On-Site/Online), 🗺️ On-Site, ✗ Cancelled

### Competence Certificate
- Written Exam, 90 min.

### Recommendation
- Module "Hydrogeology: Methods and Applications" passed successfully
### 7.37 Course: Hydrogeology: Methods and Applications [T-BGU-104750]

**Responsible:** Prof. Dr. Nico Goldscheider  
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:** M-BGU-102433 - Hydrogeology: Methods and Applications

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*Legend: 📚 Online, 🛠 Blended (On-Site/Online), 🖥 On-Site, ✗ Cancelled*

**Prerequisites**

none
**Course: Industrial Minerals and Environment [T-BGU-108191]**

**Responsible:** Prof. Dr. Jochen Kolb

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

**Part of:** M-BGU-103993 - Industrial Minerals and Environment

**Type**
Examination of another type

**Credits**
5

**Recurrence**
Each winter term

**Version**
1

### Events

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**Legend:**

- Online
- Blended (On-Site/Online)
- On-Site
- Cancelled

**Prerequisites**

keine

**Annotation**

The course "Industrial Minerals in the Field" is part of this module, duration: 2 days. The date will be announced during the winter term.

The practical part of this course is carried out in presence. The field courses are essential for the progress of the participants.
### 7.39 Course: Internship [T-BGU-108210]

**Organisation:**  KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:**  M-BGU-103996 - Internship

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## 7.40 Course: Introduction to Ceramics [T-MACH-100287]

**Responsible:** Prof. Dr. Michael Hoffmann  
**Organisation:** KIT Department of Mechanical Engineering  
**Part of:** M-BGU-105222 - Introduction to Ceramics

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**Events**

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<td>Lecture (V) / 🖥</td>
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Legend: 🖥 Online, ⏺ Blended (On-Site/Online), ⚫ On-Site, ✗ Cancelled

**Competence Certificate**
The assessment consists of an oral exam (30 min) taking place at a specific date.  
The re-examination is offered at a specific date.

**Prerequisites**
None
## 7.41 Course: Introduction to Project Management [T-BGU-107639]

**Responsible:** Prof. Dr. Christoph Hilgers  
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:** M-BGU-102438 - Project Study

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| SS 2021 | 6339083 | Grundlagen des Projektmanagements | 1 SWS | Lecture (V) / 🧩 | Hilgers |

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), ⚤ On-Site, ✗ Cancelled
### Course: Laboratory Work in Physical Chemistry [T-CHEMBIO-109395]

**Organisation:** KIT Department of Chemistry and Biosciences  
**Part of:** M-CHEMBIO-104581 - Physical Chemistry for Applied Geosciences

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<td>8 SWS</td>
<td>Practical course (P) / 🗣</td>
<td>Böttcher, Nattland, Unterreiner, Die Dozenten des Instituts</td>
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<td>Physikalisch-chemisches Praktikum für Angewandte Geowissenschaften</td>
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**Prerequisites**

acc. to lecturer

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**Legend:** 🖥 Online, 🥑 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled
7.43 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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**Legend:** 📥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

**Competence Certificate**
oral exam, appr. 20 min.

**Prerequisites**
none

**Recommendation**
none

**Annotation**
none
7.44 Course: Master Thesis [T-BGU-107516]

Responsible: Prof. Dr. Philipp Blum
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: M-BGU-103726 - Module Master Thesis

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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
7.45 Course: Microstructures [T-BGU-107507]

Responsible:  apl. Prof. Dr. Agnes Kontry
Organisation:  KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of:  M-BGU-102451 - Structural Geology

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Events

| SS 2021 | 6339085 | Mikrogefüge von Gesteinen / Microstructures | 2 SWS | Lecture / Practice (VÜ) / 🗣 | Kontry |

Legend:  🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

Prerequisites

none

Annotation

The practical part of this course is carried out in presence. The microscopy courses are essential for the progress of the participants.
7.46 Course: Mineral and Rock Physics [T-BGU-104838]

**Responsible:** Prof. Dr. Frank Schilling

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

**Part of:** M-BGU-102443 - Applied Mineralogy: Petrophysics

### Events

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**Legend:** ![Online](image), ![Blended (On-Site/Online)](image), ![On-Site](image), ![Cancelled](image)

**Competence Certificate**

The assessment consists of a written exam according to §4 (2) of the examination regulations. Successfully completed laboratory exercises are the prerequisite to attend the written exam.

**Prerequisites**

none

**Annotation**

The practical part of this course is carried out in presence. It requires special rooms (laboratory) and is essential for the study progress of the participants.
7.47 Course: Mineral Exploration [T-BGU-110833]

**Responsible:** Dr. Clifford Patten

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

**Part of:** M-BGU-105357 - Mineral Exploration

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Legend: 📐 Online, 🗻 Blended (On-Site/Online), 🗻 On-Site, ✗ Cancelled

**Competence Certificate**

Report (after preliminary review), see module description

**Prerequisites**

see module description

**Recommendation**

see module description

**Annotation**

see module description
7.48 Course: Mineral Materials [T-BGU-104856]

Responsible: Dr. Matthias Schwotzer
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: M-BGU-102453 - Mineral Materials

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<td>Werkstoffschädigende Reaktionen</td>
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Legend: 🖥 Online, ⚫ Blended (On-Site/Online), ⬇ On-Site, ✗ Cancelled

Prerequisites
none

Annotation
The practical part of this course is carried out in presence. The laboratory courses are essential for the progress of the participants.
7.49 Course: Numerical Methods in Geosciences [T-BGU-104816]

**Responsible:** Prof. Dr. Thomas Kohl  
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:** M-BGU-102436 - Numerical Methods in Geosciences

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Legend: 🖥 Online, Blended (On-Site/Online), ⬙ On-Site, ✗ Cancelled

**Prerequisites**

none

**Annotation**

The practical part of this course is carried out in presence. The exercises are partly conducted in the computing lab and are essential for the progress of the participants.
### 7.50 Course: Ore Geology of Metals [T-BGU-109345]

**Responsible:** Prof. Dr. Jochen Kolb  
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:** M-BGU-103994 - Ore Geology of Metals

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**Legend:** 🖥 Online, 🕍 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

**Annotation**
The practical part of this course is carried out in presence. The field courses are essential for the progress of the participants.
**7.51 Course: Petrology [T-BGU-104854]**

**Responsible:** apl. Prof. Dr. Kirsten Drüppel  
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:** M-BGU-102452 - Petrology

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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), ⚪ On-Site, ✗ Cancelled

**Prerequisites**

none

**Annotation**

The practical part of this course is carried out in presence. The field courses are essential for the progress of the participants.
# 7.52 Course: Physical Chemistry [T-CHEMBIO-103385]

**Organisation:** KIT Department of Chemistry and Biosciences  
**Part of:** M-CHEMBIO-104581 - Physical Chemistry for Applied Geosciences

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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🔴 On-Site, ✗ Cancelled

**Prerequisites**
none
### 7.53 Course: Project Study [T-BGU-104826]

**Responsible:** Prof. Dr. Philipp Blum  
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:** M-BGU-102438 - Project Study

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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗝️ On-Site, ✗ Cancelled

**Prerequisites**

none
7.54 Course: Radiogeochemical Field Exercise and Seminar [T-BGU-107623]

**Responsible:** Dr. Frank Heberling

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

**Part of:** M-BGU-102455 - Environmental Geology: Radio- & Chemotoxic Elements

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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ⌣ Cancelled

**Annotation**
The practical part of this course is carried out in presence. The field courses are essential for the progress of the participants.
7.55 Course: Reservoir-Analogs and Core Description [T-BGU-107624]

| Responsible | Prof. Dr. Christoph Hilgers |
| Organisation | KIT Department of Civil Engineering, Geo- and Environmental Sciences |
| Part of | M-BGU-103734 - Diagenesis and Cores |

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Legend: 🖥 Online, ☝ Blended (On-Site/Online), ☘ On-Site, ✗ Cancelled

**Prerequisites**

... 

**Annotation**

Seminar as block course during winter term due to visit of industry core shed.

The practical part of this course is carried out in presence. The field course is essential for the study progress of the participants.
### 7.56 Course: Reservoir-Geology [T-BGU-107563]

**Responsible:** Prof. Dr. Christoph Hilgers  
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:** M-BGU-103742 - Reservoir-Geology

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**Prerequisites**  
none

**Recommendation**  
the student shall have a basic knowledge of sedimentology and structural geology, such as presented in the module Geologie (Geology), MSc 1st semester

**Annotation**  
The practical part of this course is carried out in presence. The field courses are essential for the progress of the participants.
# 7.57 Course: Rock Mechanics and Tunneling [T-BGU-100069]

**Responsible:** Dr.-Ing. Julia Leuthold  
Martin Wagner

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

**Part of:** M-BGU-100069 - Rock Mechanics and Tunneling

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<td>2 SWS</td>
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Legend: 🌐 Online, ☢ Blended (On-Site/Online), ⚑ On-Site, ❌ Cancelled

**Competence Certificate**
written exam, 90 min.

**Prerequisites**
none

**Recommendation**
preparation of the student research project for examination preparation

**Annotation**
none
### 7.58 Course: Sedimentary Petrology [T-BGU-107558]

**Responsible:** Prof. Dr. Armin Zeh  
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:** M-BGU-103733 - Sedimentary Petrology

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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣️ On-Site, ⌚️ Cancelled

#### Prerequisites

none
7.59 Course: Structural and Phase Analysis [T-MACH-102170]

**Responsible:** Dr. Manuel Hinterstein  
Dr.-Ing. Susanne Wagner

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-BGU-105236 - Structural and Phase Analysis

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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ❌ Cancelled

**Competence Certificate**

Oral examination

**Prerequisites**

none
7.60 Course: Structural Ceramics [T-MACH-102179]

**Responsible:** Prof. Dr. Michael Hoffmann

**Organisation:** KIT Department of Mechanical Engineering

**Part of:** M-BGU-105223 - Structural Ceramics

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**Events**

| SS 2021 | 2126775 | Structural Ceramics | 2 SWS | Lecture (V) / Online | Hoffmann |

Legend: Online, \(\square\) Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

**Competence Certificate**

Oral examination, 20 min

**Prerequisites**

none
# 7.61 Course: Student Research Project 'Earthworks and Foundation Engineering' [T-BGU-100178]

**Responsible:** Dr.-Ing. Andreas Bieberstein  
Dr.-Ing. Lukas Knittel

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

**Part of:** M-BGU-100068 - Earthworks and Foundation Engineering

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## Events

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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗺 On-Site, ✗ Cancelled

**Competence Certificate**

report appr. 45 pages; definition of a project available from lecturer

**Prerequisites**

none

**Recommendation**

none

**Annotation**

none
7.62 Course: Student Research Project 'Rock Mechanics and Tunneling' [T-BGU-100179]

**Responsible:** Dr.-Ing. Julia Leuthold
Martin Wagner

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

**Part of:** M-BGU-100069 - Rock Mechanics and Tunneling

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Legend: 🙆 Online, 🧩 Blended (On-Site/Online), 🗓 On-Site, ✗ Cancelled

**Competence Certificate**
report appr. 15 pages;
definition of a project available from lecturer

**Prerequisites**
one

**Recommendation**
one

**Annotation**
one
7.63 Course: Thermal Use of Groundwater [T-BGU-106803]

**Responsible:** Prof. Dr. Philipp Blum

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

**Part of:** M-BGU-103408 - Thermal Use of Groundwater

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Legend: 🖥 Online, 🎬 Blended (On-Site/Online), 🗣 On-Site, ❌ Cancelled

**Competence Certificate**
The assessment consists of an oral exam (approx. 15 min), according to § 4 Par. 2 No. 2.
7.64 Course: Urban Ecology [T-BGU-103001]

Responsible: Stefan Norra
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: M-BGU-101568 - Urban Ecology

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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣️ On-Site, ✗ Cancelled

Prerequisites
None

Recommendation
None

Annotation
None
### Course: Urban Ecology Lecture [T-BGU-106684]

**Responsible:** apl. Prof. Dr. Stefan Norra  
**Organisation:** KIT Department of Civil Engineering, Geo- and Environmental Sciences  
**Part of:** M-BGU-101568 - Urban Ecology

| Type                | Completed coursework (written) | Credits | 3 | Recurrence | Each summer term | Version | 4 |

**Events**

| SS 2021 | 6111211 | Urban Ecology | 2 SWS | Lecture (V) | Norra, Böhnke |

*Legend: [Online], [Blended (On-Site/Online)], [On-Site], [Cancelled]*

**Prerequisites**
None

**Recommendation**
None

**Annotation**
None
Responsible: apl. Prof. Dr. Stefan Norra
Organisation: KIT Department of Civil Engineering, Geo- and Environmental Sciences
Part of: M-BGU-101568 - Urban Ecology

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Prerequisites
None

Recommendation
None

Annotation
None
### 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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**Competence Certificate**

Submission of at least 50% of the weekly exercises plus a written term paper on a given topic, approx. 10 to 15 pages

**Prerequisites**

none

**Recommendation**

none

**Annotation**

as from summer term 2020 examination of other type

Legend: 🖥️ Online, ☀️ Blended (On-Site/Online), ⚪️ On-Site, ✗ Canceled
### 7.68 Course: Water Chemistry and Water Technology [T-CIWVT-107585]

**Responsible:** Prof. Dr. Harald Horn  
**Organisation:** KIT Department of Chemical and Process Engineering  
**Part of:** M-CIWVT-103753 - Water Chemistry and Water Technology

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Legend: 🖥 Online, 🟢 Blended (On-Site/Online), 📧 On-Site, ✗ Cancelled

**Prerequisites**

None
### 7.69 Course: Water Technology [T-CIWVT-106802]

| Responsible: | Prof. Dr. Harald Horn |
| Organisation: | KIT Department of Chemical and Process Engineering |
| Part of: | M-CIWVT-103407 - Water Technology |

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Legend: 🕹️ Online, 🛠️ Blended (On-Site/Online), 🗳️ On-Site, ⌚️ Cancelled