Module Handbook
Remote Sensing and Geoinformatics Master 2018 (Master of Science (M.Sc.))
SPO 2018
Winter term 2023/24
Date: 27/11/2023
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Chapter 1

The Handbook of Modules: Purpose and Organization

This module handbook is the relevant document providing information on the structure and the contents of the master’s degree program “Remote Sensing and Geoinformatics”. It contains helpful information and offers individual guidance for selecting courses and planning the studies. The organization of the degree program and its modules are described in detail. This document is meant to provide all necessary information for tailoring an interdisciplinary course of studies compliant with each student’s personal interests and needs.

Chapter 2 of this document describes the contents and structure of the master program as a whole and an exemplary study plan. In Chapter 3 the qualification targets are summarized. Chapter 4 give an overview over the courses of the modules and the applicable modes of examination. The detailed descriptions of each module are reported in Chapters 5-7. Chapter 8 provides contacts of the study program.

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Chapter 2

Contents and Structure of the Master Program

2.1 The Master Program

The purpose of the master’s degree program “Remote Sensing and Geoinformatics” offered by the Karlsruhe Institute of Technology (KIT) is to deepen and complement the scientific qualification the student has acquired in one of the related bachelor programs. The program is composed of a balanced combination of lectures, exercises, and seminars. In the compulsory modules of the topic “Remote Sensing” the students who may have bachelor’s degrees in different fields, will acquire a common basis of knowledge upon which the more specialized courses can build. The selection of one out of six profiles allows for a specialization according to the student’s interests as well as for some flexibility to react to the developments of the employment market. First experience in scientific work is gained in “Lab Rotations”. The final step is the master thesis on a topic in the field of remote sensing and/or geoinformatics; the master thesis shall be finished within 6 months. Successful students are awarded with the degree “Master of Science (M. Sc.)” in “Remote Sensing and Geoinformatics”

The language of the program is English. Some elective courses may also be offered in German. These are, however, not required to finish the program.

2.2 The Modular Structure of the Master Program

This master’s degree program is organized in various topics (Remote Sensing, Mathematics and Beyond, etc.), and each topic is in itself organized in multiple modules. Each module consists of one or multiple successive courses. Usually, a module is finished by passing the related examination. In many cases, for the admission to examinations requirements have to be fulfilled. The amount of work related to a module is reflected by the respective credit points (CP) which are booked after the successful finalization of the module. In this master program, some of the modules are compulsory, but there is a large number of compulsory elective or fully elective modules. This allows to tailor this interdisciplinary study program to the needs (both with respect to the time available and the contents) according to personal interests and job perspectives. This module handbook describes the modules of the degree program with respect to

- the composition of the modules,
- the number of credit points associated with the module,
• the dependencies of the modules among each other,
• the learning objectives of the module,
• the mode of control of success,
• the calculation of grades.

While the module handbook provides some necessary orientation and is meant to be a useful guide for planning the studies, it does by no means make the university calendar obsolete, which contains information about the actual data of each course (e.g. time and place of a course).

2.2.1 Finalization of a Module

Usually the final examination associated with a module covers the entire content of all courses of the module on one examination date. The module is successfully completed after passing the related examination with grade 4.0 or better. The weight of this grade in the calculation of the final grade is defined by the credit points of the module. Failed examinations must be repeated (see also below).

Online registration for module examinations is made via the SLE system, where the following actions are supported

• registration for examination or cancellation of registration
• inquiry about results of the examination
• compilation of a summary of grades achieved so far.

Further information on the “Studierendenportal” is available at

https://studium.kit.edu/

2.2.2 Repetition of Examinations

Possibilities of repetition of examinations are described in §8 of the “Studien- und Prüfungsordnung des Karlsruher Instituts für Technologie (KIT) für den Masterstudiengang Remote Sensing and Geoinformatics”.

2.2.3 Choices of Modules

Within topics there are compulsory modules and compulsory elective modules. The compulsory modules are associated with fewer credit points than required for the completion of the topic. The missing credit points can be obtained by compulsory elective modules of this topic of the student’s choice.

Each student selects one out of six profiles. As described above for topics in a general sense, each profile contains compulsory and elective modules. The total number of ECTS points from this profile shall be at least 20 in two semesters, whereof 10 have to be gained in the compulsory modules and 10 in the compulsory elective modules.
Knowledge of a second European language besides English is of great use to improve job market perspectives. Within the topic "Key Competences Modules" participation in a language course is highly recommended; for students with no or limited knowledge of German, a German-language course would be advisable. Further, participation in at least one seminar course is compulsory, regardless of which topic the seminar is assigned to. Beyond this, modules from any other profile or modules offered by other degree programs can be selected as part of the topic "Supplementary Modules". This shall foster interdisciplinarity, but in order to avoid too extravagant choices, approval by the Examination Committee is required.

2.2.4 Voluntary Modules / Additional Examinations

The purpose of voluntary modules is to develop a better interdisciplinary view and to develop competences overarching over specific fields. The grades of voluntary modules are not relevant for the final grade. When the student registers for the examination of a voluntary module, this has to be indicated as such. Retroactive rebooking of credit points and grades achieved for voluntary modules to compulsory modules, compulsory elective modules or elective modules is not possible. No more than 30 credit points can be acquired for voluntary modules.

2.2.5 Preliminary Examinations

The possibility of preliminary examinations ("Mastervorzugsleistungen") is regulated by the "Studien- und Prüfungsordnung des Karlsruher Instituts für Technologie (KIT) für den Masterstudiengang Remote Sensing and Geoinformatics". Since winter term 2022/23, students of KIT’s bachelor degree program "Geodäsie und Geoinformatik" are allowed to take all prequalifications/exams of KIT’s master degree program "Remote Sensing and Geoinformatics".

2.2.6 More Details

Information on all legal and official details of this master program are provided by the study regulations ("Studienordnung") and the examination regulations ("Prüfungsordnung").

2.3 Overview over the Structure of the Program and the Courses

The total sum of credit points (CP) is 120. They are distributed over the courses as follows:

- **Remote Sensing** 23 CP
- **Mathematics and Beyond** 15 CP
- **Profile Courses** 20 CP
  - Choice of 1 out of 6 profile courses, 20 CP.
  - Each profile contains compulsory (10 CP) and optional (10 CP) modules.
- **Supplementary Modules** 8 CP
- **Lab Rotation** 20 CP
- **Key Competences** 4 CP
• Master Thesis 30 CP

Commencement of studies in the winter semester is recommended. However, there is no mandatory sequence for most modules, thus commencement in the summer semester is also possible. An exemplary study plan of the study program MSc ‘Remote Sensing and Geoinformatics (begin winter semester)’ can be found for the exemplary profile choice ‘Profile 5: Geoinformatics and Environmental Geodesy’ in Section 2.7.

2.4 Overview over the modules and examination modes

<table>
<thead>
<tr>
<th>Topic: Remote Sensing</th>
<th>Module</th>
<th>CP</th>
<th>Examination mode</th>
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<tbody>
<tr>
<td>RSGI-MRCR</td>
<td>Computer Vision and Remote Sensing</td>
<td>8</td>
<td>oral, graded</td>
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<tr>
<td>GEOD-MAGI-2</td>
<td>Geoinformatics</td>
<td>5</td>
<td>oral, graded</td>
</tr>
<tr>
<td>RSGI-MRRA</td>
<td>Remote Sensing of the Atmosphere</td>
<td>5</td>
<td>oral, graded</td>
</tr>
<tr>
<td>RSGI-MRFE</td>
<td>Fundamentals of Environmental Geodesy</td>
<td>5</td>
<td>oral, graded</td>
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<table>
<thead>
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<th>Topic: Mathematics and Beyond</th>
<th>Module</th>
<th>CP</th>
<th>Examination mode</th>
</tr>
</thead>
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<tr>
<td>GEOD-MANM-2</td>
<td>Numerical Mathematics</td>
<td>6</td>
<td>written, graded</td>
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In addition, within the compulsory module ‘Scientific Programming’ a total of 3 or more CPs have to be acquired.

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<th>Module</th>
<th>CP</th>
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<tr>
<td>RSGI-MMCE-1</td>
<td>Scientific Programming</td>
<td>3</td>
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<tr>
<td>RSGI-MMCE-2</td>
<td>Dummy¹</td>
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¹ Other courses in scientific programming offered at KIT can be selected. The Examination Commission decides about their eligibility.
² tbd: to be determined with respect to the individual choice within the module ‘Scientific Programming’.
### Profiles (Choice of 1 out of 6)

<table>
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<th>Module</th>
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<th>Examination mode</th>
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<td>Computer Vision and Remote Sensing of the Atmosphere</td>
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<tr>
<td>Geoinformatics and Remote Sensing of the Atmosphere</td>
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<td>see module description</td>
</tr>
<tr>
<td>Remote Sensing of the Atmosphere and Environmental Geodesy</td>
<td>20</td>
<td>see module description</td>
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In each profile, the required number of CPs is 10 for compulsory modules and 10 for compulsory elective modules.

### Supplementary Modules

<table>
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<th>Module</th>
<th>CP</th>
<th>Examination mode</th>
</tr>
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<tbody>
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<td>Choice of modules summing up to 8 CP</td>
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### Key Competences

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<tr>
<td>Choice of modules summing up to 4 CP</td>
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### Lab Rotation

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<td>Choice of 2 Lab Rotations</td>
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<td>other according to SPO RSGI §4/2</td>
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### Master Thesis

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<th>Module</th>
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<th>Examination mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Master Thesis</td>
<td>30</td>
<td>Thesis</td>
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</table>

### 2.5 Accreditation of external accomplishments

#### 2.5.1 Accreditation of qualifications obtained outside of the Higher Education System

Accomplishments obtained outside of the higher education system, for example vocational training, can be accredited if the acquired competences contribute to the qualification goals of the MSc program. At maximum, 50 to the exams committee (Prüfungsausschuss). The exams committee verifies to which extent the acquired competences can be accredited, and which parts of the program they can replace. A form is available for this purpose on the web page of the MSc programme that can be used for the accreditation of externally obtained competences as equivalent to one or several of the modules in the programme, and for competences complementary to the program, but contributing to the general qualification goals.
2.5.2 Accreditation of qualifications obtained inside of the Higher Education System

Accomplishments obtained at other universities, for example credits from another MSc program or Eucor (The European Campus is a trinational alliance of five universities in the Upper Rhine), can be accredited if the acquired competences contribute to the qualification goals of the MSc program. A request for accreditation can be submitted to the exams committee (Prüfungsausschuss). The exams committee verifies to which extent the acquired competences can be accredited, and which parts of the program they can replace. A form is available for this purpose on the web page of the MSc programme that can be used for the accreditation of externally obtained competences as equivalent to one or several of the modules in the programme, and for competences complementary to the program, but contributing to the general qualification goals.

2.5.3 Study abroad during the programme

The lab rotations (semester 3) can be completed abroad, and other qualifications obtained in other countries can be accredited as well. Before going abroad, a student will set up a learning agreement together with the student counsellor of the programme (Michael Mayer), which the exams committee (Prüfungsausschuss) will then agree to, and modify where necessary. The form for accreditation of external accomplishments is available on the programme web page. For specific questions, any lecturer can be contacted. For general enquiries, please talk to the student counsellor of the programme.

2.6 Students with a Disability or Chronic Disease (§13, SPO)

(1) When organizing degree programs and examinations, the needs of students with a disability or chronic disease are to be considered. In particular, students with a disability or chronic disease are to be granted preferred access to courses with a limited number of participants and the order for passing certain courses shall be adapted to their needs. According to the Federal Equality Act (Bundesgleichstellungsgesetz, BGG) and Vol. 9 of the Social Code (SGB IX), students are disabled, if their bodily function, mental capacity, or emotional health most probably deviates from the state typical of the age for a period longer than six months and, hence, their participation in social life is impaired. At the request of the student, the examination committee shall decide on the existence of conditions outlined in clauses 2 and 3. The student shall submit the required evidence for this purpose. (2) If a student provides evidence of a disability or chronic disease, as a result of which she/he is not able to pass examinations completely or partly within the planned time or in the form envisaged, the examination committee may permit examinations within other time periods or in another form. In particular, disabled students shall be permitted to use the required aids. (3) In case students provide evidence of a disability or chronic disease, a result of which they are not able to attend courses regularly or to pass the required coursework or examinations as outlined in Article 19, the examination committee may permit at the student’s request passing of certain coursework and examinations after the expiry of the deadlines given in the present Regulations for Study and Examination.
2.7 Exemplary Study Plan

Exemplary study plan MSc: 'Remote Sensing and Geoinformatics' (Profile 5 Geoinformatics and Environmental Geodesy)

**1st Sem.**
- Remote Sensing / 6 CP
  - Computer Vision and Remote Sensing 1+0 0+1.5+2
  - Geoinformatics 1+1 0+1.1+4

- Fundamentals of Environmental Geodesy 1+1 0+1.1+4

- Mathematics and Beyond / 15 CP
  - Numerical Mathematics 1 1 0
  - Basics of Estimation Theory and its Applications 1 0+1 3+3
  - Scientific Programming 1 0

- Profiles / 20 CP
  - GeoDB 1 1 5
  - Geodetic Earth Observation 1 1+0 0+1.2+3

- 3D / 4D GIS 1 1 4
- Hyperspectral Remote Sensing 1 1 3
- Advanced Gravity Field Modelling 1 1 5

- Seminar Topics of Image Analysis 0 1 2
- Augmented Reality 1 1 4
- Seminar Environmental Geodesy 0 1 2

**2nd Sem.**
- Lab Rotations / 20 CP
  - Lab Rotation I 0 1 1 0
  - Lab Rotation II 0 1 1 0

- Master Thesis / 30 CP
  - Master Thesis I 0 1 3 0

**3rd Sem.**
- Compulsory modules for all students
- Profile Modules compulsory
- Profile Modules elective
- Supplementary Modules elective
- Key Competences elective
- Lab Rotations compulsory
- Thesis compulsory

Begin Wise: Exemplary profile choice "Profile 5: Geoinformatics and Environmental Geodesy"

**4th Sem.**
- Key Competences / 4 CP
  - Language Course 1 0

**Total:** 120 CP
Chapter 3
Qualification Goals of the Program

General Issues

Goals of qualification generally describe

- the subject-specific and overarching competences which students can acquire in this program

- which learning outcomes can/should be achieved during the studies in this program. These learning outcomes are specified on three levels. First on the level of the master program, and then on the levels of modules and courses. They describe competences and verifiable learning outcomes.

Subject-specific competences are related to fundamental as well as specific knowledge and understanding with respect to methods, tenets, concepts and working approaches in the field of remote sensing and geoinformatics. Overarching competences are basic as well as specific competences which are applicable in multiple fields and disciplines and which do not depend on a specific subject. Typical examples are soft skills like the ability of teamwork and of networked thinking, communication skills and so forth.

Learning outcomes describe the success of the learning/studying which is testable by examinations and allow to determine the level up to which the competence has been formed and developed during the studies.

3.1 Qualification Goals

In this master’s degree program the scientific qualification acquired in related bachelor programs are deepened and complemented. The goal of this program is to convey the ability to independently apply scientific knowledge and methods and to evaluate their implications and relevance to the solution of complex scientific problems.

The degree holders of the master program Remote Sensing and Geoinformatics have well-founded knowledge in current and future-oriented technologies and methods related to the processing and analysis of spatially and temporally resolved geoscientific and remotely sensed data. They have detailed technical and methodical knowledge in remote sensing and geoinformatics and have in-depth insight into selected professional fields for remote sensing scientists and geo-information scientists. Based on broad basic knowledge, they have the ability to identify, characterize and elaborate future scientific and technical key questions with innovation potential in the given subject area. They have actively developed the ability to methodically explore knowledge sources,
and are thus capable of acquainting themselves with advanced research problems.

They have the comprehensive ability to autonomously analyze and evaluate tasks in the field of remote sensing and geoinformatics and to implement related practical solutions. They can, under consideration of a particular situation, select the adequate methods, apply them in a targeted and problem-solving fashion, and to evaluate them critically. They have the ability to put the knowledge gained to work both in their own field as well as in an interdisciplinary context. The degree holders have proven to be able to collect and pre-select all relevant information, particularly in complex situations, to analyze and evaluate this information, to process, characterize, document, visualize relevant data and to present results in a compelling manner. They can familiarize themselves independently with current research topics and complex problems and thoroughly analyze, interpret and evaluate them. They have the ability to autonomously develop and implement concepts to tackle problems they have identified and analyzed. They classify subject-specific and interdisciplinary tasks and identify, or, if need be, develop, adequate methods of measurement, data analysis and processing as well as data characterization.

They are able to extensively document, compile, illustrate and interpret results in a goal-oriented manner. They have the ability to work both independently or in a team and can take leadership in interdisciplinary projects. They can thoroughly explore technical literature in English, bring forward their argument and defend their stance in topical discussions both with specialists and laypersons in an adequate language. In the application of their topic-related knowledge they consider societal, scientific, and ethical issues.

The qualification targets of the master program Remote Sensing and Geoinformatics are summarized in the following table in a structured manner. Then follow the qualification targets and learning outcomes on module and course levels.

The following abbreviations are used:
DQR: Deutscher Qualifikationsrahmen
QZ-Nr: Qualifikationszielenummer

<table>
<thead>
<tr>
<th>DQR</th>
<th>QZ-Nr.</th>
<th>Qualification targets on program level</th>
<th>Module</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subject-specific competences “Knowledge and Understanding”</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subject-specific competence: broadening of knowledge</td>
<td>1</td>
<td>The degree holder has profound knowledge in current and future-oriented techniques and methods for processing, characterization and analysis of spatially and temporally resolved geoscientific and remotely sensed data</td>
<td>all</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>The student has detailed technical and methodical knowledge in remote sensing and geoinformatics and has in-depth insight into selected professional fields for remote sensing scientists and geoinformation</td>
<td>all</td>
</tr>
<tr>
<td>Subject-specific competence: deepening of knowledge</td>
<td>3</td>
<td>Based on broad basic knowledge the degree holder can identify, describe and tackle advanced scientific questions with innovation potential in the given subject area.</td>
<td>all, particularly modules of the profiles</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>The student has actively developed the ability to methodically explore knowledge sources, is thus capable to acquaint themselves with advanced research problems.</td>
<td>all seminars lab rotations master thesis</td>
</tr>
<tr>
<td>Instrumental competence</td>
<td>5</td>
<td>The student has the comprehensive ability to analyze and evaluate tasks in the field of remote sensing and geoinformatics and to implement related practical solutions.</td>
<td>lab rotations master thesis</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>The student can, under consideration of a particular situation, select the adequate methods, apply them in a targeted and problem-solving fashion, and evaluate them critically.</td>
<td>seminars lab rotations master thesis</td>
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<tr>
<td></td>
<td>7</td>
<td>The student has the ability to put the knowledge gained to work both in their own field as well as in an interdisciplinary context.</td>
<td>all</td>
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<tr>
<td>System Competence</td>
<td>8</td>
<td>The degree holder has proven to be able to collect and pre-select all relevant information, particularly in complex situations, to analyze and evaluate this information, to process, characterize, document, visualize relevant data and to present results in a compelling manner.</td>
<td>all, particularly seminars</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>The student can familiarize themselves independently with current research topics and complex problems and thoroughly analyze, interpret and evaluate them.</td>
<td>seminars lab rotations master thesis</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>The student has the ability to develop and implement concepts to tackle problems.</td>
<td>seminars lab rotations master thesis</td>
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<tr>
<td></td>
<td>11</td>
<td>The student classifies subject-specific and interdisciplinary tasks and identifies adequate methods of measurement, data analysis and data processing as well as data characterization.</td>
<td>lab rotations master thesis</td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>The student is able to extensively document, compile, illustrate and interpret results in a targeted manner.</td>
<td>seminars lab rotations scientific writing master thesis</td>
</tr>
<tr>
<td></td>
<td>Communication Skills</td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>----------------------</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>In the application of the topical knowledge the student considers societal, scientific and ethical aspects.</td>
<td>all</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>The student has the ability to work both independently or in teams and can take leadership in interdisciplinary projects.</td>
<td>projects lab rotations master thesis</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>The student can thoroughly explore technical literature in the English language.</td>
<td>all</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>The student has the ability to bring forward their argument and defend their stance in topical discussions both with specialists and laypersons in adequate language.</td>
<td>seminars</td>
<td></td>
</tr>
</tbody>
</table>
Chapter 4

Overview Over the Courses of the Modules and Modes of Examination

4.1 Remote Sensing

<table>
<thead>
<tr>
<th>Module</th>
<th>Course No</th>
<th>Course</th>
<th>Sem.</th>
<th>Contact hours</th>
<th>CP</th>
<th>Condition for admission to examination</th>
<th>Examination type and duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer Vision and Remote Sensing</td>
<td>6048101/6048102</td>
<td>Methods of Remote Sensing</td>
<td>WS</td>
<td>1+1</td>
<td>3</td>
<td>Yes: Successful participation in exercise</td>
<td></td>
</tr>
<tr>
<td>RSGI-MRCR</td>
<td></td>
<td>Image Processing and Computer Vision</td>
<td>WS</td>
<td>2+1</td>
<td>3</td>
<td>No</td>
<td>oral ~40 min.</td>
</tr>
<tr>
<td></td>
<td>6042201</td>
<td>Sensors and Signals in Computer Vision and Remote Sensing</td>
<td>SS</td>
<td>2+0</td>
<td>2</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Geoinformatics GEOD-MAGI-2</td>
<td>6022105/6022106</td>
<td>Geoinformatics Part A</td>
<td>WS</td>
<td>1+1</td>
<td>5</td>
<td>Yes: Successful participation in both exercises</td>
<td>oral ~30 min.</td>
</tr>
<tr>
<td></td>
<td>6022205/6022206</td>
<td>Geoinformatics Part B</td>
<td>SS</td>
<td>1+1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RSGI-MRRA</td>
<td>6020247</td>
<td>Atmospheric Remote Sensing Infrastructures</td>
<td>SS</td>
<td>1</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fundamentals of Environmental Geodesy</td>
<td>6021201/6021202</td>
<td>Fundamentals of Environmental Geodesy Part A</td>
<td>WS</td>
<td>1+1</td>
<td>5</td>
<td>Yes: Successful participation in both exercises</td>
<td>oral ~30 min.</td>
</tr>
<tr>
<td>RSGI-MRFE</td>
<td>6020150</td>
<td>Fundamentals of Environmental Geodesy Part B</td>
<td>SS</td>
<td>1+1</td>
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</table>
4.2 Mathematics and Beyond

<table>
<thead>
<tr>
<th>Module</th>
<th>Course No</th>
<th>Course</th>
<th>Sem.</th>
<th>contact hours</th>
<th>CP</th>
<th>Condition for Admission to Examination</th>
<th>Examination Type and Duration</th>
</tr>
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<tbody>
<tr>
<td>Numerical Mathematics</td>
<td>GEOD-MANM-2</td>
<td>6062101/6062102</td>
<td>Numerical Mathematics</td>
<td>WS</td>
<td>3+1</td>
<td>6</td>
<td>Yes: Successful participation in exercises</td>
</tr>
<tr>
<td>Data Analysis in Geoscience Remote Sensing Projects</td>
<td>RSGI-MMCE-1</td>
<td>6043210/6043211</td>
<td>Data Analysis in Geoscience Remote Sensing Projects</td>
<td>WS</td>
<td>1+2</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Scientific Programming</td>
<td>RSGI-MMCE-1</td>
<td>6224907</td>
<td>Introduction to Matlab</td>
<td>WS</td>
<td>2</td>
<td>3</td>
<td>course achievement</td>
</tr>
</tbody>
</table>

Students who have little programming experience regarding matlab/python are strongly encouraged to attend a course where they can deepen these skills (e.g., Introduction to MATLAB, listed in table above). It is strongly recommended to take this course in the first semester, therefore in summer terms comparable lectures are provided.

Instead of focusing on MATLAB, students are allowed to take the winter term lecture Introduction to Python (module number 106199).

Students who have more advanced programming skills and therefore wish to attend another course are advised to consult with the student advisor of the study program.

4.3 Profile Courses

1 out of 6 profile has to be selected (Each of the 6 profiles is actually a combination of 2 out of 4 sub-profiles).

Sub-profiles:

- Computer Vision
- Geoinformatics
- Remote Sensing of the Atmosphere
- Environmental Geodesy

In addition to the listed modules, in each profile there are gradded and ungradded Place Holders available in order to be able to integrate further modules.
### Profile: Computer Vision and Geoinformatics

<table>
<thead>
<tr>
<th>Module</th>
<th>Course No</th>
<th>Course</th>
<th>Sem.</th>
<th>Contact hours</th>
<th>CP</th>
<th>Condition for admission to examination</th>
<th>Examination type and duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advanced Topics in Computer Vision RSGI-MPCV-1</td>
<td>6042103</td>
<td>Advanced Topics in Computer Vision</td>
<td>WS</td>
<td>4</td>
<td>5</td>
<td>Yes: Successful participation in exercises</td>
<td>oral ~ 20 min</td>
</tr>
<tr>
<td>GeoDB GEOD-MPGI-1</td>
<td>6026101/6026102</td>
<td>GeoDB</td>
<td>WS</td>
<td>2+1</td>
<td>5</td>
<td>Yes: Successful participation in exercises</td>
<td>oral ~ 20 min</td>
</tr>
<tr>
<td>Seminar Topics of Image Analysis GEOD-MWEB-1</td>
<td>6042201</td>
<td>Seminar Topics of Image Analysis</td>
<td>WS</td>
<td>1+0</td>
<td>2</td>
<td>No</td>
<td>oral ~ 20 min</td>
</tr>
<tr>
<td>Active Sensors for Computer Vision GEOD-MWEB-3</td>
<td>6043205</td>
<td>Active Sensors for Computer Vision</td>
<td>SS</td>
<td>2+0</td>
<td>3</td>
<td>No</td>
<td>oral ~ 20 min</td>
</tr>
<tr>
<td>Tomographic Laser- and Radar Sensing GEOD-MWCVC-8</td>
<td>6043212/6043213</td>
<td>Tomographic Laser- and Radar Sensing</td>
<td>SS</td>
<td>1+1</td>
<td>3</td>
<td>Yes: Successful Participation In Exercise</td>
<td>oral ~ 20 min</td>
</tr>
<tr>
<td>Augmented Reality GEOD-MWG-8</td>
<td>6026107/6026108</td>
<td>Augmented Reality</td>
<td>WS</td>
<td>1+2</td>
<td>4</td>
<td>Yes: Successful Participation In Exercise</td>
<td>oral ~ 20 min</td>
</tr>
<tr>
<td>3D / 4D GIS GEOD-MPGI-2</td>
<td>6026201/6026202</td>
<td>3D / 4D GIS</td>
<td>SS</td>
<td>2+1</td>
<td>4</td>
<td>Yes: Successful participation in exercises</td>
<td>oral ~ 20 min</td>
</tr>
<tr>
<td>Mobile GIS / Location Based Services GEOD-MWG-2</td>
<td>6026206/6026207</td>
<td>Mobile GIS / Location Based Services</td>
<td>SS</td>
<td>1+1</td>
<td>3</td>
<td>Yes: Successful participation in exercises</td>
<td>oral ~ 20 min</td>
</tr>
</tbody>
</table>
### Overview of the Courses of the Modules and Modes of Examination

**Remote Sensing and Geoinformatics Master 2018 (Master of Science (M.Sc.))**

**Module Handbook as of 27/11/2023**

#### 4.3.2 Profile: Computer Vision and Remote Sensing of the Atmosphere

<table>
<thead>
<tr>
<th>Module</th>
<th>Course No</th>
<th>Course</th>
<th>Sem.</th>
<th>Contact hours</th>
<th>CP</th>
<th>Condition for admission to examination</th>
<th>Examination type and duration</th>
</tr>
</thead>
<tbody>
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<td><strong>Compulsory Modules</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Advanced Topics in Computer Vision RSGI-MPCV-1</td>
<td>6042103</td>
<td>Advanced Topics in Computer Vision</td>
<td>WS</td>
<td>4</td>
<td>5</td>
<td>Yes: Successful participation in exercises</td>
<td>oral 20 min</td>
</tr>
<tr>
<td>Remote Sensing of Atmospheric Temperature, Trace Gases, Clouds, and Aerosols RSGI-MPRA</td>
<td>6042202</td>
<td>Passive Remote Sensing of Atmospheric Temperature and Composition</td>
<td>WS</td>
<td>1.5+0.5</td>
<td>2</td>
<td>Yes: Successful participation in exercises of course 2</td>
<td>oral 30 min.</td>
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<tr>
<td></td>
<td>6020250</td>
<td>Remote Sensing of Aerosols and Clouds</td>
<td>SS</td>
<td>1+1</td>
<td>3</td>
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<td><strong>Compulsory Elective Modules</strong></td>
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<td>Seminar Topics of Image Analysis GEOD-MWEB-1</td>
<td>6042201</td>
<td>Seminar Topics of Image Analysis</td>
<td>WS</td>
<td>1+0</td>
<td>2</td>
<td>No</td>
<td>oral 20 min</td>
</tr>
<tr>
<td>Active Sensors for Computer Vision GEOD-MWEB-3</td>
<td>6043205</td>
<td>Active Sensors for Computer Vision</td>
<td>SS</td>
<td>2+0</td>
<td>3</td>
<td>No</td>
<td>oral 20 min</td>
</tr>
<tr>
<td>Tomographic Laser- and Radar Sensing GEOD-MWCV-8</td>
<td>6043212/6043213</td>
<td>Tomographic Laser- and Radar Sensing</td>
<td>SS</td>
<td>1+1</td>
<td>3</td>
<td>Yes: Successful Participation In Exercise</td>
<td>oral 20 min</td>
</tr>
<tr>
<td>Augmented Reality GEOD-MWGI-8</td>
<td>6026107/6026108</td>
<td>Augmented Reality</td>
<td>WS</td>
<td>1+2</td>
<td>4</td>
<td>Yes: Successful Participation In Exercise</td>
<td>oral 20 min</td>
</tr>
</tbody>
</table>

---

Remote Sensing and Geoinformatics Master 2018 (Master of Science (M.Sc.))
Module Handbook as of 27/11/2023

20
<table>
<thead>
<tr>
<th>Module</th>
<th>Course No</th>
<th>Course Name</th>
<th>Sem.</th>
<th>Contact hours</th>
<th>CP</th>
<th>Condition for admission to examination</th>
<th>Examination type and duration</th>
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<tbody>
<tr>
<td>Atmospheric Spectroscopy and Middle Atmospheric Research</td>
<td>4052071</td>
<td>Atmospheric Radiation</td>
<td>SS</td>
<td>2</td>
<td>2</td>
<td>No</td>
<td>oral 30 min.</td>
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</tbody>
</table>

Remote Sensing and Geoinformatics Master 2018 (Master of Science (M.Sc.))
Module Handbook as of 27/11/2023
### 4.3.3 Profile: Computer Vision and Environmental Geodesy

<table>
<thead>
<tr>
<th>Module</th>
<th>Course No</th>
<th>Course</th>
<th>Sem.</th>
<th>Contact hours</th>
<th>CP</th>
<th>Condition for admission to examination</th>
<th>Examination type and duration</th>
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</thead>
<tbody>
<tr>
<td><strong>Compulsory Modules</strong></td>
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<tr>
<td>Advanced Topics in Computer Vision</td>
<td>6042103</td>
<td>Advanced Topics in Computer Vision</td>
<td>WS</td>
<td>4</td>
<td>5</td>
<td>Yes: Successful participation in exercises</td>
<td>oral ~ 20 min</td>
</tr>
<tr>
<td>RSGI-MPCV-1</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
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<td>Geodetic Earth Observation</td>
<td>6042204</td>
<td>Mass Variations</td>
<td>WS</td>
<td>1+1</td>
<td>5</td>
<td>Yes: Successful participation in both exercises</td>
<td>oral ~ 30 min</td>
</tr>
<tr>
<td>RSGI-MPEG-1</td>
<td>6019404</td>
<td>Deformation Processes</td>
<td>SS</td>
<td>1+1</td>
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</tr>
<tr>
<td><strong>Compulsory Elective Modules</strong></td>
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<td></td>
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</tr>
<tr>
<td>Seminar Topics of Image Analysis</td>
<td>6042201</td>
<td>Seminar Topics of Image Analysis</td>
<td>WS</td>
<td>1+0</td>
<td>2</td>
<td>No</td>
<td>oral ~ 20 min</td>
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<tr>
<td>GEOD-MWEB-1</td>
<td></td>
<td></td>
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<tr>
<td>Active Sensors for Computer Vision</td>
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<td>Active Sensors for Computer Vision</td>
<td>SS</td>
<td>2+0</td>
<td>3</td>
<td>No</td>
<td>oral ~ 20 min</td>
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<tr>
<td>GEOD-MWEB-3</td>
<td></td>
<td></td>
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<tr>
<td>Tomographic Laser- and Radar Sensing</td>
<td>6043212/</td>
<td>Tomographic Laser- and Radar Sensing</td>
<td>SS</td>
<td>1+1</td>
<td>3</td>
<td>Yes: Successful Participation In Exercise</td>
<td>oral ~ 20 min</td>
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<tr>
<td>GEOD-MWCV-8</td>
<td>6043213</td>
<td></td>
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<tr>
<td>Augmented Reality</td>
<td>6026107/</td>
<td>Augmented Reality</td>
<td>WS</td>
<td>1+2</td>
<td>4</td>
<td>Yes: Successful Participation In Exercise</td>
<td>oral ~ 20 min</td>
</tr>
<tr>
<td>GEOD-MWGI-8</td>
<td>6026108</td>
<td></td>
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<td>Scientific Applications of GNSS</td>
<td>6048209</td>
<td>Scientific Applications of GNSS</td>
<td>SS</td>
<td>0+2</td>
<td>3</td>
<td>No</td>
<td>other according to SPO RSGI §4/2</td>
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<td>Advanced Gravity Field Modelling</td>
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<td>1+1</td>
<td>3</td>
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### 4.3.4 Profile: Geoinformatics and Remote Sensing of the Atmosphere

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<th>CP</th>
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<th>Examination type and duration</th>
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<td>Remote Sensing of Aerosols and Clouds</td>
<td>SS</td>
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### 4.3.5 Profile: Geoinformatics and Environmental Geodesy

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<th>Course</th>
<th>Sem.</th>
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<th>CP</th>
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<th>Examination type and duration</th>
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</tr>
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<td>6042204</td>
<td>Mass Variations</td>
<td>WS</td>
<td>1+1</td>
<td>5</td>
<td>Yes: Successful participation in both exercises</td>
<td>oral 30 min.</td>
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<tr>
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<td>6019404</td>
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<td>SS</td>
<td>1+1</td>
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</tr>
<tr>
<td>Mobile GIS / Location Based Services</td>
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<td>1+1</td>
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<td>oral 20 min.</td>
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<td>Scientific Applications of GNSS</td>
<td>SS</td>
<td>0+2</td>
<td>3</td>
<td>No</td>
<td>other according to SPO RSGI §4/2</td>
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<td>oral 20 min.</td>
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<td>oral 20 min.</td>
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<tr>
<td>Module</td>
<td>Course No</td>
<td>Course</td>
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### 4.3.6 Profile: Remote Sensing of the Atmosphere and Environmental Geodesy

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<th>CP</th>
<th>Condition for admission to examination</th>
<th>Examination type and duration</th>
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<tr>
<td>Remote Sensing of Atmospheric Temperature,</td>
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<td>Passive Remote Sensing of Atmospheric Temperature and Composition</td>
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<td>Yes: Successful participation in exercises of course 2</td>
<td>oral ~ 30 min.</td>
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<tr>
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<tr>
<td>Geodetic Earth Observation</td>
<td>6042204</td>
<td>Mass Variations</td>
<td>WS</td>
<td>1+1</td>
<td>5</td>
<td>Yes: Successful participation in both exercises</td>
<td>oral ~ 30 min.</td>
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<td>Deformation Processes</td>
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<td>2</td>
<td>No</td>
<td>oral ~ 30 min.</td>
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<td>Yes: successful participation in exercises</td>
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### 4.4 Supplementary Modules

Supplementary Modules enable individual subject-specific deepening of knowledge and competencies.

#### 4.4.1 Seminars

Each student shall successfully participate in at least one seminar. Those, who have no seminar in their profiles, can do this under “Supplementary Modules” as compulsory elective. Seminars offered by other faculties may be eligible. Approval by the examination commission is required.

#### 4.4.2 Programming Skills

Within the MSc degree program and the working area “Remote Sensing and Geoinformatics” programming skills are essential. In addition during the last years, the lecturers of “Remote Sensing and Geoinformatics” have noticed in recent years, that student’s performance in exercises often suffers from weak programming skills. Therefore, we have integrated lectures that address basic programming skills in an application-oriented manner. In particular, there are lectures on MATLAB and on Python. The lecturers of “Remote Sensing and Geoinformatics” strongly recommend every
student to reflect on their personal programming skills (e.g., based on the learning outcomes of the MATLAB and the Python lectures). To catch up on programming skills, both lectures should be taken at an early stage of the studies. At least one has to be taken as mandatory part of Mathematics and Beyond (see, Chapter 4.2).

4.4.3 Other

Supplementary modules from any profile of this master program or the other master programs of KIT-Department of Civil Engineering, Geo and Environmental Sciences for can be chosen. Modules from programs of other faculties or international summer/autumn/winter/spring schools can be chosen but need approval by the RSGI Examination Commission.

4.5 Lab Rotation

<table>
<thead>
<tr>
<th>Module</th>
<th>Course</th>
<th>Sem.</th>
<th>contact hours</th>
<th>CP</th>
<th>Condition for admission to examination</th>
<th>Examination type and duration</th>
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<td>Lab Rotation I</td>
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<td>other according to SPO RSGI §4/2</td>
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<td>10</td>
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</table>

4.6 Key Competences

Key Competences of the RSGI degree program have no effect on the grade of the degree program. They individually broaden existing Key Competences. A language course is highly recommended (see Section 2.2.3).

Please keep in mind, that at maximum, four credits can be credited within the module 'Key Competences'. Further, micromodules offered, for example, by the

- House of Competence (e.g., Scientific Writing),
- Language Center (SZ),
- Center for Applied Cultural Studies and Studium Generale (ZAK), and
- Academy for Responsible Research, Teaching, and Innovation (ARRTI), and
- Human Resources Development and Vocational Training (PEBA)

The successfully performed achievements are regularly uploaded as 'Not assigned grades' into the student's account of KIT's student portal (https://campus.studium.kit.edu/). As of winter semester 2021/22, Key Competences acquired at the above-mentioned KIT units are to be entered by the students themselves in the individual course scheme. Here, Bricks labeled 'SelfAssignment-MScRSI*' are provided for ungraded resp. graded achievements. The title and credit points of the achievement are automatically transferred. Hereby, students have to decide whether a graded achievement is assigned to a graded or to an ungraded Brick. Only graded Bricks guarantee that a grade is available in the Transcript of Records. For crediting of achievements that could not be
assigned, please provide the form *FormAssignmentKC*.pdf to Study Program Service at KIT’s Department of Civil Engineering, Geo and Environmental Science.

### 4.7 Master Thesis

<table>
<thead>
<tr>
<th>Module</th>
<th>Course</th>
<th>Sem.</th>
<th>CP</th>
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<th>Examination type and duration</th>
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<td>WS/SS</td>
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<td>70 CPs (see SPO for details)</td>
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</tbody>
</table>

The number of contact hours of the Master Thesis have to be individually fixed between the supervisor and the student.

### 4.8 Additional Examinations

In Additional Examinations, learning achievements, which are not taken into account in previous sections of this chapter, can be booked, in order to provide this additional information to the reader of the transcript of records. In Chapter 5.8, exemplary modules are listed. The weight of modules listed in Additional Examinations on the final grade is zero.
5 Field of study structure

<table>
<thead>
<tr>
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<td>Profiles</td>
<td>20 CR</td>
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<td>Lab Rotations</td>
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<tr>
<td>Remote Sensing</td>
<td>23 CR</td>
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<td>Mathematics and Beyond</td>
<td>15 CR</td>
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<td>Supplementary Modules</td>
<td>8 CR</td>
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<tr>
<td>Key Competences</td>
<td>4 CR</td>
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| Voluntary                                      |         |
| Additional Examinations                       |         |
| This field will not influence the calculated grade of its parent. |         |

5.1 Master's Thesis

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## 5.2 Profiles

### Profile (Elective: 1 item)

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<td>Computer Vision and Remote Sensing of the Atmosphere</td>
<td>20 CR</td>
</tr>
<tr>
<td>Computer Vision and Environmental Geodesy</td>
<td>20 CR</td>
</tr>
<tr>
<td>Geoinformatics and Remote Sensing of the Atmosphere</td>
<td>20 CR</td>
</tr>
<tr>
<td>Geoinformatics and Environmental Geodesy</td>
<td>20 CR</td>
</tr>
<tr>
<td>Remote Sensing of the Atmosphere and Environmental Geodesy</td>
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### 5.2.1 Profile: Computer Vision and Geoinformatics

#### Part of: Profiles

<table>
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<td>M-BGU-104531</td>
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#### Compulsory Elective Modules (Elective: at least 10 credits)

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<th>Course Name</th>
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<td>3D / 4D GIS</td>
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<td>M-BGU-101045</td>
<td>Mobile GIS / Location Based Services</td>
</tr>
<tr>
<td>M-BGU-101047</td>
<td>Augmented Reality</td>
</tr>
<tr>
<td>M-BGU-101052</td>
<td>Tomographic Laser- and Radar Sensing</td>
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<tr>
<td>M-BGU-101057</td>
<td>Seminar Topics of Image Analysis</td>
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<tr>
<td>M-BGU-101099</td>
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<td>M-BGU-106343</td>
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<td>M-BGU-104436</td>
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### 5.2.2 Profile: Computer Vision and Remote Sensing of the Atmosphere

#### Part of: Profiles

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<tr>
<th>Course Code</th>
<th>Course Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>M-BGU-104531</td>
<td>Advanced Topics in Computer Vision</td>
</tr>
<tr>
<td>M-BGU-104532</td>
<td>Remote Sensing of Atmospheric Temperature, Trace Gases, Clouds and Aerosols</td>
</tr>
</tbody>
</table>

#### Compulsory Elective Modules (Elective: at least 10 credits)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>M-BGU-101047</td>
<td>Augmented Reality</td>
</tr>
<tr>
<td>M-BGU-101052</td>
<td>Tomographic Laser- and Radar Sensing</td>
</tr>
<tr>
<td>M-BGU-101057</td>
<td>Seminar Topics of Image Analysis</td>
</tr>
<tr>
<td>M-BGU-101099</td>
<td>Active Sensors for Computer Vision</td>
</tr>
<tr>
<td>M-BGU-104533</td>
<td>Atmospheric Spectroscopy and Middle Atmospheric Research</td>
</tr>
<tr>
<td>M-BGU-106343</td>
<td>Deep Learning for Computer Vision and Remote Sensing</td>
</tr>
<tr>
<td>M-BGU-104437</td>
<td>Module Wildcard 1 Profile ComVisRemSen</td>
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</tbody>
</table>
## 5.2.3 Profile: Computer Vision and Environmental Geodesy

### Part of: Profiles

### Credits

<table>
<thead>
<tr>
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<th>Course Title</th>
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<tbody>
<tr>
<td>M-BGU-104531</td>
<td>Advanced Topics in Computer Vision</td>
<td>5 CR</td>
</tr>
<tr>
<td>M-BGU-104536</td>
<td>Geodetic Earth Observation</td>
<td>5 CR</td>
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### Compulsory Elective Modules (Election: at least 10 credits)

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<th>Course Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>M-BGU-101047</td>
<td>Augmented Reality</td>
<td>4 CR</td>
</tr>
<tr>
<td>M-BGU-101051</td>
<td>Hyperspectral Remote Sensing</td>
<td>3 CR</td>
</tr>
<tr>
<td>M-BGU-101052</td>
<td>Tomographic Laser- and Radar Sensing</td>
<td>3 CR</td>
</tr>
<tr>
<td>M-BGU-101054</td>
<td>Seminar Topics of Remote Sensing</td>
<td>2 CR</td>
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<tr>
<td>M-BGU-101057</td>
<td>Seminar Topics of Image Analysis</td>
<td>2 CR</td>
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<tr>
<td>M-BGU-101099</td>
<td>Active Sensors for Computer Vision</td>
<td>3 CR</td>
</tr>
<tr>
<td>M-BGU-101765</td>
<td>Recent Earth Observation Programs and Systems</td>
<td>2 CR</td>
</tr>
<tr>
<td>M-BGU-104537</td>
<td>Advanced Gravity Field Modelling</td>
<td>4 CR</td>
</tr>
<tr>
<td>M-BGU-104557</td>
<td>Seminar Environmental Geodesy</td>
<td>2 CR</td>
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<tr>
<td>M-BGU-104561</td>
<td>Geodetic Sensor Fusion</td>
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<td>M-BGU-104586</td>
<td>SAR and InSAR Remote Sensing</td>
<td>3 CR</td>
</tr>
<tr>
<td>M-BGU-104566</td>
<td>Scientific Applications of GNSS</td>
<td>3 CR</td>
</tr>
<tr>
<td>M-BGU-106343</td>
<td>Deep Learning for Computer Vision and Remote Sensing</td>
<td>5 CR</td>
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*First usage possible from 4/1/2023.*

<table>
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</tr>
</thead>
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<tr>
<td>M-BGU-104438</td>
<td>Module Wildcard 1 Profile ComVisEnvGeo</td>
<td>10 CR</td>
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</table>

## 5.2.4 Profile: Geoinformatics and Remote Sensing of the Atmosphere

### Part of: Profiles

### Credits

<table>
<thead>
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<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>M-BGU-101041</td>
<td>GeoDB</td>
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</tr>
<tr>
<td>M-BGU-104532</td>
<td>Remote Sensing of Atmospheric Temperature, Trace Gases, Clouds and Aerosols</td>
<td>5 CR</td>
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</table>

### Compulsory Elective Modules (Election: at least 10 credits)

<table>
<thead>
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<th>Course Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>M-BGU-101042</td>
<td>3D / 4D GIS</td>
<td>4 CR</td>
</tr>
<tr>
<td>M-BGU-101045</td>
<td>Mobile GIS / Location Based Services</td>
<td>3 CR</td>
</tr>
<tr>
<td>M-BGU-104533</td>
<td>Atmospheric Spectroscopy and Middle Atmospheric Research</td>
<td>4 CR</td>
</tr>
<tr>
<td>M-BGU-104439</td>
<td>Module Wildcard 1 Profile GeoinfRemS</td>
<td>10 CR</td>
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</table>
### 5.2.5 Profile: Geoinformatics and Environmental Geodesy

**Part of:** Profiles  
**Credits:** 20

<table>
<thead>
<tr>
<th>Mandatory</th>
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</thead>
</table>
| M-BGU-101041 | GeoDB  
| M-BGU-104536 | Geodetic Earth Observation  
|  
| **Compulsory Elective Modules (Election: at least 10 credits)** |  
| M-BGU-101042 | 3D / 4D GIS  
| M-BGU-101045 | Mobile GIS / Location Based Services  
| M-BGU-101051 | Hyperspectral Remote Sensing  
| M-BGU-101054 | Seminar Topics of Remote Sensing  
| M-BGU-101765 | Recent Earth Observation Programs and Systems  
| M-BGU-104537 | Advanced Gravity Field Modelling  
| M-BGU-104557 | Seminar Environmental Geodesy  
| M-BGU-104561 | Geodetic Sensor Fusion  
| M-BGU-104566 | Scientific Applications of GNSS  
| M-BGU-104586 | SAR and InSAR Remote Sensing  
| M-BGU-104440 | Module Wildcard 1 Profile GeoinfEnvGeo  

### 5.2.6 Profile: Remote Sensing of the Atmosphere and Environmental Geodesy

**Part of:** Profiles  
**Credits:** 20

<table>
<thead>
<tr>
<th>Mandatory</th>
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</table>
| M-BGU-104532 | Remote Sensing of Atmospheric Temperature, Trace Gases, Clouds and Aerosols  
| M-BGU-104536 | Geodetic Earth Observation  
|  
| **Compulsory Elective Modules (Election: at least 10 credits)** |  
| M-BGU-101051 | Hyperspectral Remote Sensing  
| M-BGU-101054 | Seminar Topics of Remote Sensing  
| M-BGU-101765 | Recent Earth Observation Programs and Systems  
| M-BGU-104533 | Atmospheric Spectroscopy and Middle Atmospheric Research  
| M-BGU-104537 | Advanced Gravity Field Modelling  
| M-BGU-104557 | Seminar Environmental Geodesy  
| M-BGU-104561 | Geodetic Sensor Fusion  
| M-BGU-104566 | Scientific Applications of GNSS  
| M-BGU-104586 | SAR and InSAR Remote Sensing  
| M-BGU-104441 | Module Wildcard 1 Profile RemSenEnvGeo  

### 5.3 Lab Rotations

**Part of:** Profiles  
**Credits:** 20

<table>
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</table>
| M-BGU-104588 | Lab Rotation I  
| M-BGU-104589 | Lab Rotation II  

### 5.4 Remote Sensing

#### Credits: 23

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<tr>
<td>M-BGU-104517 Computer Vision and Remote Sensing</td>
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<tr>
<td>M-BGU-104524 Remote Sensing of the Atmosphere</td>
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<td>5 CR</td>
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<tr>
<td>M-BGU-104553 Fundamentals of Environmental Geodesy</td>
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### 5.5 Mathematics and Beyond

#### Credits: 15

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<td>M-BGU-104530 Scientific Programming</td>
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<td>3 CR</td>
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5.6 Supplementary Modules

<table>
<thead>
<tr>
<th>Supplementary Modules (Election: at least 8 credits)</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>M-BGU-101051 Hyperspectral Remote Sensing</td>
<td>3 CR</td>
</tr>
<tr>
<td>M-BGU-101057 Seminar Topics of Image Analysis</td>
<td>2 CR</td>
</tr>
<tr>
<td>M-BGU-101042 3D / 4D GIS</td>
<td>4 CR</td>
</tr>
<tr>
<td>M-BGU-101045 Mobile GIS / Location Based Services</td>
<td>3 CR</td>
</tr>
<tr>
<td>M-BGU-101099 Active Sensors for Computer Vision</td>
<td>3 CR</td>
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<tr>
<td>M-BGU-101105 Real Estate Valuation II</td>
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<tr>
<td>M-BGU-101107 Cartography II</td>
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<tr>
<td>M-BGU-101765 Recent Earth Observation Programs and Systems</td>
<td>2 CR</td>
</tr>
<tr>
<td>M-BGU-104557 Seminar Environmental Geodesy</td>
<td>2 CR</td>
</tr>
<tr>
<td>M-BGU-101047 Augmented Reality</td>
<td>4 CR</td>
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<td>M-BGU-104586 SAR and InSAR Remote Sensing</td>
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<tr>
<td>M-BGU-104566 Scientific Applications of GNSS</td>
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<tr>
<td>M-BGU-101021 Visualization of Geodata in 2D, 3D and 4D</td>
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<td>M-BGU-104536 Geodetic Earth Observation</td>
<td>5 CR</td>
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<td>M-BGU-101037 Geodetic Application of SAR Interferometry</td>
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<tr>
<td>M-BGU-106199 Introduction to Python</td>
<td>3 CR</td>
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<tr>
<td>M-BGU-106343 Deep Learning for Computer Vision and Remote Sensing</td>
<td>5 CR</td>
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<tr>
<td>M-BGU-101054 Seminar Topics of Remote Sensing</td>
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<td>M-BGU-101041 GeoDE</td>
<td>5 CR</td>
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<tr>
<td>M-BGU-101052 Tomographic Laser- and Radar Sensing</td>
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<tr>
<td>M-BGU-104531 Advanced Topics in Computer Vision</td>
<td>5 CR</td>
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<tr>
<td>M-BGU-104532 Remote Sensing of Atmospheric Temperature, Trace Gases, Clouds and Aerosols</td>
<td>5 CR</td>
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<tr>
<td>M-BGU-104537 Advanced Gravity Field Modelling</td>
<td>3 CR</td>
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<tr>
<td>M-BGU-104561 Geodetic Sensor Fusion</td>
<td>3 CR</td>
</tr>
<tr>
<td>M-BGU-104944 Wildcard 1 Supplementary Modules</td>
<td>8 CR</td>
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</table>

5.7 Key Competences

<table>
<thead>
<tr>
<th>Key Competences: Elective Modules (Election: at least 4 credits)</th>
<th>Credits</th>
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<tr>
<td>M-BGU-104711 Further Key Competences</td>
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<tr>
<td>M-BGU-104712 Further Key Competences</td>
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<tr>
<td>M-BGU-104943 Wildcard Key Competences 1</td>
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</table>
### 5.8 Additional Examinations

<table>
<thead>
<tr>
<th>Additional Modules (Election: at most 30 credits)</th>
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<tbody>
<tr>
<td>M-BGU-104713</td>
</tr>
<tr>
<td>M-BGU-101042</td>
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<tr>
<td>M-BGU-101028</td>
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<td>M-BGU-101051</td>
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<td>M-BGU-101107</td>
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<td>M-BGU-104586</td>
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<td>M-BGU-104557</td>
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<tr>
<td>M-BGU-106343</td>
</tr>
<tr>
<td>M-BGU-106199</td>
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<tr>
<td>M-ZAK-106099</td>
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<tr>
<td>M-ZAK-106235</td>
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</tbody>
</table>
6 Modules

6.1 Module: 3D / 4D GIS (GEOD-MPGI-2) [M-BGU-101042]

**Responsible:** Prof. Dr. Martin Breunig

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

**Part of:**
- Profiles / Profile: Computer Vision and Geoinformatics (Compulsory Elective Modules)
- Profiles / Profile: Geoinformatics and Remote Sensing of the Atmosphere (Compulsory Elective Modules)
- Profiles / Profile: Geoinformatics and Environmental Geodesy (Compulsory Elective Modules)
- Supplementary Modules (Usage from 2/17/2021)

**Additional Examinations**

**Credits:** 4

**Grading scale:** Grade to a tenth

**Recurrence:** Each summer term

**Duration:** 1 term

**Language:** German/English

**Level:** 4

**Version:** 2

**Mandatory**

<table>
<thead>
<tr>
<th>Credits</th>
<th>Grading scale</th>
<th>Recurrence</th>
<th>Duration</th>
<th>Language</th>
<th>Level</th>
<th>Version</th>
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<tbody>
<tr>
<td>T-BGU-101781</td>
<td>3D / 4D GIS, Prerequisite</td>
<td>Each summer term</td>
<td>1 term</td>
<td>German/English</td>
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<tr>
<td>T-BGU-101760</td>
<td>3D / 4D GIS</td>
<td>Each summer term</td>
<td>1 term</td>
<td>German/English</td>
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</tbody>
</table>

**Competence Certificate**

- T-BGU-101781 3D / 4D GIS, Vorleistung
- T-BGU-101760 3D / 4D GIS

For details on the assessments to be performed, see the details for the partial achievements.

**Prerequisites**

None

**Competence Goal**

The students explain the problems of space and time-related issues for the development and application of 3D/4D geoinformation systems. They are able to analyze spatio-temporal extensions to existing geometric and topological data models, spatial data standards, spatial databases and geographic information systems and develop them by themselves. In particular, the students are able to devise solutions for space- and time-related issues by their own and implement them in a programming language. They are able to transfer the learned knowledge to new spatio-temporal applications.

**Content**

In the module relevant spatio-temporal concepts and implementations are presented for 3D/4D geoinformation systems. This concerns for example the geometric and topological data modeling, geo-data standardization, geo-data management and geo-data analysis. The concepts are considered with reference to 3D/4D geo-scientific applications. Furthermore, current research issues in the field of 3D/4D geoinformation systems are discussed. Finally, the introduced concepts are engrossed in programming exercises in the practical part of the module.

**Module grade calculation**

The grade of the module is the grade of the oral exam in T-BGU-101760 3D / 4D GIS

**Annotation**

None

**Workload**

**Total workload:** 120 hours

**Contact hours:** 45 hours
- courses plus course-related examination

**Self-study:** 75 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
Recommendation
Knowledge in GIS and object-oriented programming is helpful.

Literature
None
6.2 Module: Active Sensors for Computer Vision (GEOD-MWEB-3) [M-BGU-101099]

**Responsible:** apl. Prof. Dr. Boris Jutzi

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

**Part of:** Profiles / Profile: Computer Vision and Geoinformatics (Compulsory Elective Modules)
Profiles / Profile: Computer Vision and Remote Sensing of the Atmosphere (Compulsory Elective Modules)
Profiles / Profile: Computer Vision and Environmental Geodesy (Compulsory Elective Modules)
Supplementary Modules (Usage from 2/17/2021)

<table>
<thead>
<tr>
<th>Credits</th>
<th>Grading scale</th>
<th>Recurrence</th>
<th>Duration</th>
<th>Language</th>
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<td>German/English</td>
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</table>

**Mandatory**

| T-BGU-101840 | Active Sensors for Computer Vision | 3 CR | Jutzi |

**Competence Certificate**

- T-BGU-101840 Active Sensors for Computer Vision

For details on the assessments to be performed, see the details for the partial achievement.

**Prerequisites**

None

**Competence Goal**

Students reproduce the fundamentals of active sensing in Computer Vision. They describe the basic vision processing techniques. Students are able to use their knowledge and transfer it to other fields of applications.

**Content**

This module provides an overview on basic vision processing techniques: introduction to active sensing, measurement technique (atmosphere, navigation, puls-CW, surface & LASER beam), laserscanning (Full-Waveform, quality aspects & system), range imaging (function & systems), triangulation procedures, data pre-processing (registration of point clouds, image-based registration (SIFT)), analyses of point clouds (model and daten-driven approaches, plane detection, RANSAC, building modeling), applications.

**Module grade calculation**

The grade of the module is the grade of the oral exam in T-BGU-101840 Active Sensors for Computer Vision

**Annotation**

None

**Workload**

- Total workload: 90 hours
- Contact hours: 30 hours
  - courses plus course-related examination
- Self-study: 60 hours
  - consolidation of subject by recapitulation of lectures
  - consolidation of subject by use of references and by own inquiry
  - preparations for exam

**Recommendation**

None

**Literature**

None
Module: Advanced Gravity Field Modelling (RSGI-MPEG-4) [M-BGU-104537]

**Responsible:** Dr. Kurt Seitz

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

**Part of:**
- Profiles / Profile: Computer Vision and Environmental Geodesy (Compulsory Elective Modules)
- Profiles / Profile: Geoinformatics and Environmental Geodesy (Compulsory Elective Modules)
- Profiles / Profile: Remote Sensing of the Atmosphere and Environmental Geodesy (Compulsory Elective Modules)

**Supplementary Modules** (Usage from 10/1/2023)

<table>
<thead>
<tr>
<th>Credits</th>
<th>Grading scale</th>
<th>Recurrence</th>
<th>Duration</th>
<th>Language</th>
<th>Level</th>
<th>Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Grade to a tenth</td>
<td>Each winter term</td>
<td>1 term</td>
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**Mandatory**

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Prerequisite</th>
<th>CR</th>
<th>Instructor</th>
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<tr>
<td>T-BGU-109289</td>
<td>Advanced Gravity Field Modelling, Prerequisite</td>
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<td>T-BGU-109290</td>
<td>Advanced Gravity Field Modelling, Examination</td>
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<td>1 CR</td>
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</table>

**Competence Certificate**
oral (ca. 20 min.)

**Prerequisites**
None

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

1. The course T-BGU-109328 - Fundamentals of Environmental Geodesy Part A must have been passed.

**Competence Goal**
The students are able to describe the fields of application of highly precise regional modelling of the Earth's gravity field. They explain systems of local base functions used for representation of regional geoid or quasi-geoid models. The students are able to discuss the characteristics of the theories of Stokes and Molodenskii and the related height systems. The students are able to explain the essential reductions which have to be applied to the observations according to the theory of Stokes, in terms of the vectorial as well as the scalar free variant. In this context they are able to describe standard modifications of the Stokes kernel function. The students explain the formulation of the geodetic boundary value problem starting from the non-linear boundary condition to linearization and several levels of approximation. The students are familiar with modern techniques within high-precision geoid and quasi-geoid determination (Remove-Compute-Restore Technique, Residual Terrain Modelling, combination of terrestrial gravity anomalies and geopotential models, high resolution DHM). The students have reflected the challenges within setting up the data basis and collecting different data types. When dealing with different data sources they are sensitized for the impact of various geodetic datums. The students are able to explain the fundamental differences between regional and global gravity field modelling.

**Content**
This module provides advanced insight into the modelling of regional height reference surfaces of orthometric and normal heights. The respective theories of Stokes and Molodenskii are discussed considering their advantages and drawbacks. The reductions which have to be applied to the observations according to the theory of Stokes are presented and the respective hypotheses are explained. Different approaches of discretising topographic and isostatic masses are presented. The tesseral
d-method, which was developed at the Geodetic Institute of the KIT, is presented in detail. Modifications of the Stokes function are explained. Their impact on the numerical solution of the disturbing potential is evaluated during a tutorial on this topic. The use of different types of gravity anomalies is discussed. Links to global gravity field modelling are pointed out. The mathematical formalism, on which the geodetic boundary value problem is based, will be explained in detail: non-linear boundary condition, linearization, explanation of several levels of approximation. Non-linear and ellipsoidal effects, as well as the impact of spherical approximation on the solution of the boundary value problem are quantified by the students within exercises. The challenge of data acquisition (digital elevation models, gravity values and anomalies, density models) is discussed. An insight into regional gravity field modelling is provided by presenting current research activities of the institute.

**Annotation**
In mutual agreement with the students the lectures and exercises will be presented either in English or in German.
**Workload**
Total workload: 90 hours

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

Self-study: 60 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

**Recommendation**
Basics of Physical Geodesy. Profile: Any, including the subprofile Environmental Geodesy. Compulsory module: Geodetic Earth Observation
6.4 Module: Advanced Topics in Computer Vision (RSGI-MPCV-1) [M-BGU-104531]

**Responsible:** Dr.-Ing. Martin Weinmann

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

**Part of:**
- Profiles / Profile: Computer Vision and Geoinformatics (mandatory)
- Profiles / Profile: Computer Vision and Remote Sensing of the Atmosphere (mandatory)
- Profiles / Profile: Computer Vision and Environmental Geodesy (mandatory)

**Supplementary Modules (Usage from 10/1/2023)**

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**Mandatory**

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**Competence Certificate**

oral (ca. 20 min.)

**Prerequisites**

None

**Competence Goal**

The students are able to describe advanced topics in computer vision that are also of great interest for a variety of applications in remote sensing. This includes that the students are able to explain fundamentals of feature extraction, texture analysis, pattern recognition, segmentation, object detection, object tracking, mosaicking, 3D reconstruction, scene analysis, building modeling and change detection. Furthermore, the students are able to discuss recent challenges in machine learning and explain areas of application of techniques from traditional classification approaches to modern deep learning techniques. With the exercise, the students are able to use their knowledge and transfer it to other fields of applications.

**Content**

This module addresses a variety of advanced topics in computer vision:
- feature extraction (e.g. shape, texture and local features), texture analysis (e.g. co-occurrence matrix, Laws filter and Gabor filter), pattern recognition (feature matching), segmentation (e.g. watershed transformation, mean-shift segmentation, normalized cuts), object detection (e.g. cars, road networks or people), object tracking (e.g. cars or people), mosaicking (e.g. creation of aerial mosaic images), 3D reconstruction (e.g. city models), scene analysis (e.g. 3D scene interpretation), change detection (e.g. land-cover and land-use monitoring) and machine learning (e.g. traditional classification approaches, deep learning techniques).

**Module grade calculation**

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

**Workload**

Total Workload: 150 hours

Contact hours: 60 hours
- courses plus course-related examination
- short presentations regarding the insights obtained during the exercises

Self-study: 90 hours
- consolidation of subject by recapitulation of lectures
- consolidation and preparation of subject by use of references and by own inquiry
- preparations for exam
Module: Atmospheric Spectroscopy and Middle Atmospheric Research (RSGI-MPRA-3) [M-BGU-104533]

**Responsible:** apl. Prof. Dr. Thomas Clarmann von Clarenau
PD Dr. Frank Hase

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

**Part of:**
- Profiles / Profile: Computer Vision and Remote Sensing of the Atmosphere (Compulsory Elective Modules)
- Profiles / Profile: Geoinformatics and Remote Sensing of the Atmosphere (Compulsory Elective Modules)
- Profiles / Profile: Remote Sensing of the Atmosphere and Environmental Geodesy (Compulsory Elective Modules)

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**Credits:** 4

**Grading scale:** Grade to a tenth

**Recurrence:** Each summer term

**Duration:** 1 term

**Language:** English

**Level:** 4

**Version:** 1

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**Competence Certificate**
oral (ca. 30 min.)

**Prerequisites**
None

**Competence Goal**

**Course 1 Atmospheric Spectroscopic Measurements:**
Students know and are able to explain the fundamentals of atmospheric remote sensing using spectrometric techniques. Strong emphasis is given to the technique of Fourier Transform Spectroscopy, a workhorse for infrared remote sensing of the atmosphere.

**Course 2 The Middle Atmosphere: Processes and Research Methods:**
The students know the most relevant processes in the middle atmosphere and explain how related key parameters can be measured by remote sensing methods. Further, the students are familiar with related research methods, particular those involving inverse theory. They can explain the basic applications of inverse theory to atmospheric sciences; they are able to judge which method is adequate for which purpose.

**Content**

**Course 1 Atmospheric Spectroscopic Measurements:**
- required fundamentals of electromagnetic theory and technical (/imaging) optics;
- spectroscopic tools: gratings, prisms, heterodyne techniques, interferometers;
- Fourier transform spectroscopy:
  - Fourier transforms, useful relations;
  - theory of the ideal Fourier spectrometer;
  - discrete sampling, FFT, and spectral data processing;
  - non-ideal interferograms;
  - effects of noise;
  - imaging Fourier spectrometer.

**Course 2 The Middle Atmosphere: Processes and Research Methods:**
An introduction into stratospheric chemistry, the circulation of the middle atmosphere and radiative processes will be given. Remote sensing retrieval, data assimilation, source modelling and the direct inversion of the transport equation are identified as the typical applications of inverse techniques in atmospheric sciences. The mathematical structure of the problem and the interpretation of the variables are discussed in each of the applications. Examples from practical atmospheric sciences are presented.
Workload

Course 1 Atmospheric Spectroscopic Measurements:
Total Workload: 60 hours
Contact hours: 30 hours
Self study: 30 hours
- recapitulation and consolidation by own study
- preparation of exam

Course 2 The Middle Atmosphere: Processes and Research Methods:
Total workload: 60 hours
Contact hours: 20 hours
- courses plus course-related examination

Self-study: 40 hours
- consolidation of subject by recapitulation of lectures
- consolidation of subject by use of references and by own inquiry
- preparations for exam

Total workload of both courses: 120 hours
### Module: Augmented Reality (GEOD-MWGI-8) [M-BGU-101047]

**Responsible:** Dr.-Ing. Sven Wursthorn  
**Organisation:** KIT Department of Civil Engineering, Geo and Environmental Sciences  
**Part of:**  
- Profiles / Profile: Computer Vision and Geoinformatics (Compulsory Elective Modules)  
- Profiles / Profile: Computer Vision and Remote Sensing of the Atmosphere (Compulsory Elective Modules)  
- Profiles / Profile: Computer Vision and Environmental Geodesy (Compulsory Elective Modules)  
- Supplementary Modules

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**Competence Certificate**

- T-BGU-101717 Augmented Reality, Prerequisite  
- T-BGU-101716 Augmented Reality

For details on the assessments to be performed, see the details for the partial achievements.

**Prerequisites**

None

**Competence Goal**

The students reflect and deepen their previous knowledge of positioning, orientation, photogrammetry and geo information systems in the field of augmented reality.

**Content**


**Module grade calculation**

The grade of the module is the grade of the oral exam in T-BGU-101716 Augmented Reality

**Annotation**

None

**Workload**

Total workload: 120 hours  
**Contact hours:** 45 hours  
- courses plus course-related examination

**Self-study:** 75 hours  
- consolidation of subject by recapitulation of lectures  
- consolidation of subject by use of references and by own inquiry  
- preparations for exam

**Recommendation**

None

**Literature**

None

**Responsible:**
- Prof. Dr. Jan Cermak
- PD Dr. Frank Hase
- Prof. Dr.-Ing. Stefan Hinz

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

**Part of:** Mathematics and Beyond

**Credits:** 6

**Grading scale:** Grade to a tenth

**Recurrence:** Each term

**Duration:** 2 terms

**Language:** English

**Level:** 4

**Version:** 4

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**Competence Certificate**
- T-BGU-106633 - Data Analysis in Geoscience Remote Sensing Projects, Vorleistung
- T-BGU-111186 - Basics of Estimation Theory, Prerequisite

For details on the assessments to be performed, see the details for the partial achievements.

**Prerequisites**
- M-BGU-101015 - Estimation Theory
- M-BGU-103314 - Data Analysis in Geoscience Remote Sensing Projects

have not been started

**Competence Goal**
Students explain the theoretical basics and important aspects of detection, classification and parameter estimation. They apply the concepts and methods of estimation theory and deformation analysis to data recorded by geodetic, geophysical or remote sensing sensors. Students explain the application of estimation theory to data analysis problems in the geosciences. Students relate how methods in geoscientific remote sensing are developed, applied and validated. By working self-organized and reflectively the students deepen their knowledge in soft skills, e.g., organization, collaboration and communication.

**Content**
Contents of the module include
- an introduction into stochastic modelling (starting with the Bayes-Theorem)
- theoretical models and applied methods of detection of events in signals
- theoretical models and applied methods of classification of events in signals
- a variety of methods for parameter estimation, e.g. least-squares estimation, transformation of probability density and integration of a-priori knowledge about parameters and observations
- application of estimation theory explained on examples from the geosciences. Possible contents:
  - Lidar remote sensing of aerosol properties
  - Passive imager remote sensing cloud microphysics
  - Fourier-transform infrared spectroscopy for trace gas remote sensing
  - Multi-instrument land surface cover classification
  - Vegetation remote sensing and validation
  - Land surface temperature estimation and validation
  - Radar remote sensing of precipitation

**Module grade calculation**
The grade of the module is the grade of the oral exam.
Workload
Total workload: 180 hours

Contact hours: 75 hours
- courses plus course-related examination

Self-study: 105 hours
- consolidation of subject by recapitulation of lectures
- consolidation of subject by use of references and by own inquiry
- data analysis and data processing
- preparations for exam

Recommendation
Knowledge in statistics, parameter estimation and numerical mathematics are helpful.
Module: Cartography II (GEOD-MWER-6) [M-BGU-101107]

**Responsible:** Prof. Dr. Jan Cermak
Dipl.-Ing. Christoph Hermann

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

**Part of:** Supplementary Modules (Usage from 2/17/2021)

**Additional Examinations**

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**Mandatory**

| T-BGU-101662 | Cartography II | 1 CR | Cermak, Hermann |

**Prerequisites**

none
Module: Computer Vision and Remote Sensing (RSGI-MRCR) [M-BGU-104517]

**Responsible:** Prof. Dr.-Ing. Stefan Hinz
apl. Prof. Dr. Boris Jutzi
Dr.-Ing. Martin Weinmann

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

**Part of:** Remote Sensing

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<td>T-BGU-109269</td>
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**Competence Certificate**

oral (ca. 40 min.)

**Prerequisites**

None

**Competence Goal**

**Course 1 Methods of Remote Sensing:**

Students are able to explain the fundamentals of multispectral remote sensing, namely the basics of pixel- and segment-based classification approaches, their communalities and their differences. Students are able to use their knowledge and transfer it to other fields of applications.

**Course 2 Image Processing and Computer Vision:**

Students are able to explain the fundamentals of image processing and computer vision. They describe the basic approaches and concepts including robust techniques and are able to use their knowledge and transfer it to other fields of applications.

**Course 3 Sensors and Signals in Computer Vision and Remote Sensing:**

Students reproduce the fundamentals of sensors and signals in Computer Vision and Remote Sensing. They describe the basic signal processing techniques. Students are able to use their knowledge and transfer it to other fields of applications.

**Content**

**Course 1 Methods of Remote Sensing:**

This course provides an overview of multispectral remote sensing. It introduces to concepts of data processing, also including sensor aspects where required. Based on a selection of applications like land cover/use classification and change detection / monitoring approaches are presented and compared. The module consists of lectures and labs.

**Course 2 Image Processing and Computer Vision:**

This course provides an overview of basic approaches of image processing and computer vision, starting from image filters like linear and non-linear filters, gradient and curvature operators and leading to concepts of object extraction based on point, line and segment extraction and their applications. The module consists of lectures and labs.

**Course 3 Sensors and Signals in Computer Vision and Remote Sensing:**

This course provides an overview on basic signal processing techniques: Mathematical principles, Systems and signals, Fourier-series, Delta function, Convolution, Fourier-Transformation, LTI-systems and modulation, Digital signal processing, Random Signals, Signal reconstruction, Interpolation, Multi-dimensional system theory.

**Module grade calculation**

The grade of the module is the grade of the oral exam.
Workload

Course 1 Methods of Remote Sensing:
Total workload: 90 hours
Contact hours: 30 hours
- courses plus course-related examination
Self-Study: 60 hours
- consolidation of subject by recapitulation of lectures
- consolidation of subject by use of references and by own inquiry
- preparation for exam

Course 2 Image Processing and Computer Vision:
Total workload: 90 hours
Contact hours: 45 hours
- courses plus course-related examination
Self-Study: 45 hours
- consolidation of subject by recapitulation of lectures
- consolidation of subject by use of references and by own inquiry
- preparation for exam

Course 3 Sensors and Signals in Computer Vision and Remote Sensing:
Total workload: 60 hours
Contact hours: 30 hours
- courses plus course-related examination
Self-Study: 45 hours
- consolidation of subject by recapitulation of lectures
- consolidation of subject by use of references and by own inquiry
- preparation for exam

Total workload of all three courses: 240 hours
Module: Deep Learning for Computer Vision and Remote Sensing (GEOD-MWCV-12) [M-BGU-106343]

Responsible: Dr.-Ing. Martin Weinmann
Organisation: KIT Department of Civil Engineering, Geo and Environmental Sciences

Part of:
- Profiles / Profile: Computer Vision and Geoinformatics (Compulsory Elective Modules) (Usage from 4/1/2023)
- Profiles / Profile: Computer Vision and Remote Sensing of the Atmosphere (Compulsory Elective Modules) (Usage from 4/1/2023)
- Profiles / Profile: Computer Vision and Environmental Geodesy (Compulsory Elective Modules) (Usage from 4/1/2023)
- Supplementary Modules (Usage from 4/1/2023)
- Additional Examinations

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<td>3 CR</td>
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Competence Certificate
Details regarding the exam can be found in the description of brick T-BGU-112865 – Deep Learning for Computer Vision and Remote Sensing, Exam.

Prerequisites
none

Competence Goal
Students are able to explain the fundamentals of deep learning regarding a diversity of computer vision and remote sensing applications. They are able to use their knowledge and transfer it to other fields of applications.

Content
This module addresses a variety of advanced topics related to deep learning in the context of a diversity of computer vision and remote sensing applications, such as

- Image (patch) classification
- Image segmentation
- 3D point cloud segmentation
- 3D reconstruction
- Object detection
- Object inspection
- 6D object pose estimation
- Data fusion
- Time series analysis
- Change detection

Module grade calculation
The grade of the module is the grade of the exam T-BGU-112865 – Deep Learning for Computer Vision and Remote Sensing, Exam.

Workload
Total Workload: 150 hours

- Contact hours: 60 hours
  - courses plus course-related examination
  - short presentations regarding the insights obtained during the exercises
- Self-study: 90 hours
  - consolidation of subject by recapitulation of lectures
  - consolidation and preparation of subject by use of references and by own inquiry
  - preparations for exam
Recommendation
Basics on computer vision as e.g. provided in the following lectures

- Digitale Bildverarbeitung [MSc GuG]
- Image Processing and Computer Vision [MSc RSGI]
- Basic programming skills in Matlab / Python

Learning type
Lectures and exercises
Module: Fundamentals of Environmental Geodesy (RSGI-MRFE) [M-BGU-104553]

**Responsible:**
Prof. Dr.-Ing. Hansjörg Kutterer  
Dr.-Ing. Michael Mayer  
Dr. Kurt Seitz

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

**Part of:** Remote Sensing

**Credits:** 5  
**Grading scale:** Grade to a tenth  
**Recurrence:** Each term  
**Duration:** 2 terms  
**Language:** English  
**Level:** 4  
**Version:** 4

**Mandatory**

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**Competence Certificate**
oral examination (30 minutes) wrt T-BGU-109330 - Fundamentals of Environmental Geodesy, Examination

**Prerequisites**
None

**Competence Goal**
The students understand the basic principles of geodetic satellite missions. They know geodetic reference systems as well as the mathematical representation of the Earth's gravity field and are aware of their specific characteristics and research-related problems. The learners know the basic concepts of GNSS positioning and are able to familiarize themselves with new GNSS-related topics. They analyze data from gravity field missions like GRACE-FO and discuss the interactions of the various gravity satellite missions. The students work autonomous and self-organized in the field of environmental geodesy and have communicative as well as organizational competences with respect to collaboration, presentation and discussion. The students understand how geodetic and geo-scientific observation systems and techniques contribute to environmental geodesy.

**Content**
The courses 1 and 2 focus on the role of geodetic observation systems in environmental geodesy.

**Course 1:**
- Mathematical representation of the gravity field of the Earth as well as its fundamental characteristics;
- Geodetic gravity missions like GRACE, GRACE-FO, GOCE, ICEsat;
- Orbit parameters, resolution, accuracy;

**Course 2:**
- Theoretical basics and research as well as praxis orientated principles of important satellite missions like GNSS, VLBI, SLR, DORIS;
- Geodetic reference frames and systems, plate tectonics;
- GNSS positioning;
- InSAR;

**Module grade calculation**
The grade of the module is the grade of the examination (20 minutes) of T-BGU-109330 - Fundamentals of Environmental Geodesy, Examination.

**Annotation**
Course 1: Fundamentals of Environmental Geodesy Part A (WS)  
Course 2: Fundamentals of Environmental Geodesy Part B (SS)
Workload
Total workload Course 1: 75 hours

- Contact hours: 25 hours
  - course plus course-related examination
- Self-study: 50 hours
  - consolidation of subject by recapitulation of lectures
  - processing of exercises
  - consolidation of subject by use of references and by own inquiry
  - exercises and scientific bulletin
  - preparations for the examination

Total workload Course 2: 75 hours

- Contact hours: 25 hours
  - Course plus course-related examination
- Self-study: 50 hours
  - consolidation of subject by recapitulation of lectures
  - consolidation of subject by use of references and by own inquiry
  - exercises and presentation
  - preparations for the examination

Total workload of both courses: 150 hours
### 6.12 Module: Further Examinations [M-BGU-104713]

**Organisation:** KIT Department of Civil Engineering, Geo and Environmental Sciences  
**Part of:** Additional Examinations

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Further Examinations (Election: at most 30 credits)

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6.13 Module: Further Key Competences [M-BGU-104711]

**Organisation:** KIT Department of Civil Engineering, Geo and Environmental Sciences  
**Part of:** Key Competences

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Further Key Competences (Election: at least 4 credits)

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**Prerequisites**

none
6.14 Module: Further Key Competences [M-BGU-104712]

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

**Part of:** Key Competences

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Further Key Competences (Election: at least 2 credits)

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**Prerequisites**
none
6.15 Module: GeoDB (GEOD-MPGI-1) [M-BGU-101041]

**Responsible:** Prof. Dr. Martin Breunig

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

**Part of:**
- Profiles / Profile: Computer Vision and Geoinformatics (mandatory)
- Profiles / Profile: Geoinformatics and Remote Sensing of the Atmosphere (mandatory)
- Profiles / Profile: Geoinformatics and Environmental Geodesy (mandatory)

**Supplementary Modules (Usage from 10/1/2023):**

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**Competence Certificate**

- T-BGU-101754 GeoDB, Vorleistung
- T-BGU-101753 GeoDB

For details on the assessments to be performed, see the details for the partial achievements.

**Prerequisites**

None

**Competence Goal**

The students explain the basic concepts of spatial data management. They are able to analyze object-oriented spatial data models, the structure and algorithms of spatial access methods. They know how to use geo-database management systems in theory and in practice. They are able to apply the mediated concepts and implementations to related problems. The students are able to transfer the learned knowledge to advanced topics such as 3D or spatio-temporal geo-databases.

**Content**

The module provides students with an insight into the essential concepts and the state of the art in geo-data management. Standardized geospatial data models are introduced. The effect of multi-dimensional indexing of spatial data is explained and the structure and algorithms of specific spatial access methods are explained (e.g. quadtree, grid files, R trees, Generalized Search Tree). The theoretical aspects are implemented in practical exercises, for example, using object-relational spatial database systems (e.g. PostGIS). Finally, the module refers to more advanced topics (e.g. topological databases) and current research in the field of geo-databases.

**Module grade calculation**

The grade of the module is the grade of the oral exam in T-BGU-101753 GeoDB.

**Annotation**

None

**Workload**

**Total workload: 120 hours**

- **Contact hours:** 45 hours
  - courses plus course-related examination

- **Self-study:** 75 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

**Recommendation**

Knowledge in database systems is helpful.

**Literature**

None
### 6.16 Module: Geodetic Application of SAR Interferometry (GEOD-MWG-4) [M-BGU-101037]

**Responsible:** Prof. Dr.-Ing. Stefan Hinz  
Dr. Malte Westerhaus

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

**Part of:** Supplementary Modules

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#### Competence Certificate

- T-BGU-103501 Geodetic Application of SAR Interferometry, Vorleistung  
- T-BGU-101711 Geodetic Application of SAR Interferometry

For details on the assessments to be performed, see the details for the individual Teilleistungen.

#### Prerequisites

The module M-BGU-101828 Interferometric and Tomographic Laser- and Radar Sensing must not have started.

#### Competence Goal

The students describe the basic principles as well as advanced concepts of SAR-interferometry. They are able to explain the deterministic and stochastic constituents of the interferometric phase. They explain the fundamental philosophy and the different approaches of multi-temporal SAR-interferometry (i.e. persistent scatterer SAR-interferometry, PSI). The students gained practical experience with the PS-interferometric software package StaMPS. They name important processing parameters and are able to assess their impact on the results. They perform a SAR-interferometric project, evaluate and present the essential results in a proper way. The students are able to discuss the strengths and weaknesses of the method and to address current research questions.

#### Content

The module elaborates the basic principles imparted in the module SAR- and InSAR remote sensing. It provides the students with a detailed insight into the concepts of multitemporal SAR-interferometry. Persistent scatterer approaches with special attention to the processing software StaMPS are in the focus of the module. Further aspects of SAR-interferometry like atmospheric corrections, unwrapping, geocoding and DEM-generation are deepened. Current research topics and projects conducted at GIK/IPF are included into the subject matter. The practical part of the course consists of a project-like PSI exercise with a geodynamical focus (e.g. postseismic and volcanic deformations in central Chile). The students' project covers 50% of the contact hours. Report and presentation of the main results including a discussion of the chosen processing steps are an integral part of the final exam.

#### Module grade calculation

The grade of the module is the grade of the oral exam in T-BGU-101711 Geodetic Application of SAR Interferometry

#### Annotation

Basics of SAR und InSAR-Fernerkundung are helpful.

#### Workload

**Total workload:** 120 hours  
**Contact hours:** 45 hours  
- courses plus course-related examination  
**Self-study:** 75 hours  
- unsupervised processing of an InSAR-project  
- consolidation of subject by recapitulation of lectures  
- consolidation of subject by use of references and by own inquiry  
- preparations for exam
6.17 Module: Geodetic Earth Observation (RSGI-MPEG-1) [M-BGU-104536]

**Responsible:** Prof. Dr.-Ing. Hansjörg Kutterer

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

**Part of:**
- Profiles / Profile: Computer Vision and Environmental Geodesy (mandatory)
- Profiles / Profile: Geoinformatics and Environmental Geodesy (mandatory)
- Profiles / Profile: Remote Sensing of the Atmosphere and Environmental Geodesy (mandatory)

**Supplementary Modules**
- Mass Variations
- Deformation Processes
- Geodetic Earth Observation, Examination

**Credits** 5

**Grading scale** Grade to a tenth

**Recurrence** Each term

**Duration** 2 terms

**Language** English

**Level** 4

**Version** 3

**Mandatory**
- T-BGU-109287 Mass Variations 2 CR Kutterer, Seitz
- T-BGU-109404 Deformation Processes 2 CR Kutterer, Westerhaus
- T-BGU-109288 Geodetic Earth Observation, Examination 1 CR Kutterer, Seitz, Westerhaus

**Competence Certificate**
oral (ca. 30 min.)

**Prerequisites**
None

**Competence Goal**
The students have a deepened knowledge about the mathematical representation of the gravity field of the Earth and its temporal variations. They know how to process and to analyze relevant terrestrial or satellite data and are familiar with fundamental methods to derive models for changing environmental parameters. The students understand active deformation processes of the ‘rigid’ Earth as a prominent source of changes in the Earth system. They know the special demands on measurement techniques and the basic methods to derive reliable estimations of surface displacements. In the exercises the students use real data examples to model system response functions as well as source signals, and they assess the results. They are able to apply the imparted concepts to related problems and to transfer the learned knowledge to other research topics (e.g., sensing the atmosphere).

**Content**
Course 1 Mass Variations:
- Investigation of temporal gravity variations
- Derivation of mass variations in the Earth system
- Geodetic contribution in the field of environmental changes with a focus on ground water storage
- Accompanying methods like Radar altimetry

Course 2 Deformation Processes:
- Deformation processes of the Earth
- Interseismic, coseismic and postseismic deformations at plate margins;
- Anthropogenic surface displacements due to mining activities and fluid extraction;
- Advanced methods of deformation measurements (e.g., SAR interferometry, GNSS)
- Properties and challenges of the International Terrestrial Reference Frame (ITRF)

**Module grade calculation**
The grade of the module is the grade of the oral exam. Thereby both courses are weighted equally.

**Annotation**
In mutual agreement with the students the lectures and exercises will be presented either in English or in German.
**Workload**
Total workload Course 1 Mass Variations: 75 hours

Contact hours: 25 hours
- courses plus course-related examination

Self-study: 50 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

Total workload Course 2 Deformation Processes: 75 hours

Contact hours: 25 hours
- courses plus course-related examination

Self-study: 50 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

Total workload of both courses: 150 hours

**Recommendation**
Course 1 Mass Variations: Fundamentals of Environmental Geodesy (Part A)
Course 2 Deformation Processes: Fundamentals of Environmental Geodesy (Part B)
6.18 Module: Geodetic Sensor Fusion (RSGI-MPEG-7) [M-BGU-104561]

**Responsible:** Prof. Dr.-Ing. Hansjörg Kutterer

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

**Part of:**
- Profiles / Profile: Computer Vision and Environmental Geodesy (Compulsory Elective Modules)
- Profiles / Profile: Geoinformatics and Environmental Geodesy (Compulsory Elective Modules)
- Profiles / Profile: Remote Sensing of the Atmosphere and Environmental Geodesy (Compulsory Elective Modules)
- Supplementary Modules (Usage from 10/1/2023)

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**Competence Certificate**

oral (ca. 20 min.)

**Prerequisites**

None

**Competence Goal**

The students discuss the strengths and weaknesses of different geodetic observation methods. They understand and evaluate strategies to derive improved products from a multi sensor fusion which is an important field of recent and future geodetic research. Students apply their knowledge and transfer it to other fields of applications. They sharpen their research interests with respect to topics to be worked upon during Lab Rotations and master thesis.

**Content**

- Integration of physical and geometrical sensors and observations
- Multi-technique approaches
- Theory of interpolation and collocation
- Global Geodetic Observing System (GGOS)
- International Terrestrial Reference Frame (multi-techniques geodesy and geodynamics)

**Module grade calculation**

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

**Workload**

Total workload: 90 hours

- Contact hours: 21 hours
  - course plus course-related examination
- Self-study: 69 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

**Recommendation**

Fundamentals of Environmental Geodesy, Part A+B
Module: Geoinformatics (GEOD-MAGI-2) [M-BGU-101011]

**Responsible:** Prof. Dr. Martin Breunig

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

**Part of:** Remote Sensing

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**Competence Certificate**

- T-BGU-101742 Geoinformatics
- T-BGU-110322 Geoinformatics, Prerequisite WiSe
- T-BGU-110321 Geoinformatics, Prerequisite SoSe

For details on the assessments to be performed, see the details for the partial achievements.

**Prerequisites**
The module M-BGU-101010 must not have startet.

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

1. The following conditions have to be fulfilled:

**Competence Goal**
The students explain the fundamental concepts of Geoinformatics and their implementations, i.e. they penetrate them in theory and practice. Furthermore, they transform them to geo-applications. In particular, geo-data models and methods for geo-data management are analyzed. The students transfer the learned content on advanced topics of Geoinformatics.

**Content**
The module provides students with an insight into concepts and practical methods of Geoinformatics based on data models, geo-referenced data structures and algorithms, database systems, access methods, etc. In the practical part, the proposed methods are implemented in a programming language using relevant tools of Geoinformatics.

**Module grade calculation**
The grade of the module is the grade of the oral exam in T-BGU-101742 Geoinformatics.

**Annotation**
None

**Workload**

**Total workload:** 150 hours

- **Contact hours:** 60 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

**Literature**
None
### 6.20 Module: Geometric Object Modelling in 2D, 3D and 4D (GEOD-MWIP-6) [M-BGU-101028]

**Responsible:**
Prof. Dr.-Ing. Stefan Hinz  
Prof. Dr.-Ing. Markus Ulrich

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

**Part of:**  
Additional Examinations

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**Prerequisites**

none
Module: Hyperspectral Remote Sensing (GEOD-MPEA-1) [M-BGU-101051]

**Responsible:** Dr.-Ing. Uwe Weidner

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

**Part of:**
- Profiles / Profile: Computer Vision and Environmental Geodesy (Compulsory Elective Modules)
- Profiles / Profile: Geoinformatics and Environmental Geodesy (Compulsory Elective Modules)
- Profiles / Profile: Remote Sensing of the Atmosphere and Environmental Geodesy (Compulsory Elective Modules)
- Supplementary Modules (Usage from 2/15/2021)

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**Competence Certificate**

- T-BGU-101721 Hyperspectral Remote Sensing, Prerequisite
- T-BGU-101720 Hyperspectral Remote Sensing

For details on the assessments to be performed, see the details for the partial achievements.

**Prerequisites**

none

**Competence Goal**

Students are able to explain the fundamentals of hyperspectral remote sensing, its possibilities and challenges with respect to multispectral remote sensing, including data processing specifically designed for hyperspectral data. Students are able to use their knowledge and transfer it to other fields of applications.

**Content**

This module provides an overview of hyperspectral remote sensing. It introduces students to sensor systems and concepts of data processing. A selection of approaches is presented and compared to classical approaches for the processing and classification of multispectral data. The module consists of lectures and labs.

**Module grade calculation**

The grade of the module is the grade of the oral exam in T-BGU-101720 Hyperspectral Remote Sensing.

**Workload**

Total workload: 90 hours

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

- **Self-study:** 60 hours
  - consolidation of subject by recapitulation of lectures
  - consolidation of subject by use of references and by own inquiry
  - preparations for exam

**Recommendation**

Knowledge in multispectral remote sensing is recommended.
6.22 Module: Introduction to Python (RSGI-MMCE-2) [M-BGU-106199]

**Responsibility:** Prof. Dr. Jan Cermak

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

**Part of:** Supplementary Modules (Usage from 10/1/2022)
Additional Examinations (Usage from 10/1/2023)

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**Competence Certificate**
The assessment of success takes place in the form of a course achievement (§ 4 para. 3 SPO).

**Prerequisites**
None

**Competence Goal**
The aim of this course is providing knowledge on the basic syntax and structure of the programming language Python. Students can adapt and write basic Python code following a workflow in their individual working environment. By the end of this course students are capable implementing simple algorithms and visualizing scientific data in Python.

**Content**
- Setup a working environment in Python (installation, virtual environments)
- Python fundamentals (syntax, data types, control flow, functions, objects)
- Working with and visualizing scientific datasets in Python

**Module grade calculation**
Ungraded course achievement (§ 4 para. 3 SPO) related to T-BGU-112598 – Introduction to Python. Further details will be communicated in the lecture.

**Annotation**
None

**Workload**
Total workload: 90 hours
- Contact hours: 20 hours
- Self-study: 70 hours
  - consolidation of subject by recapitulation of lectures, by use of references and by own inquiry (20 hours)
  - working on exercises (30 hours)
  - preparation of take-home exam (20 hours)

**Base for**
Programming in Python is of fundamental importance in the field of 'Remote Sensing and Geoinformatics'. Therefore, in various lectures (e.g., Data Analysis in Geoscience Remote Sensing Projects) Python will be applied.
6.23 Module: Lab Rotation I (RSGI-ML-1) [M-BGU-104588]

**Responsible:**  Prof. Dr. Martin Breunig  
Prof. Dr. Jan Cermak  
Prof. Dr.-Ing. Stefan Hinz  
apl. Prof. Dr. Boris Jutzi  
Prof. Dr.-Ing. Hansjörg Kutterer  
Prof. Dr.-Ing. Markus Ulrich

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

**Part of:**  Lab Rotations

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**Mandatory**

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<th>Lab Rotation I</th>
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</table>

**Competence Certificate**

Other according to SPO RSGI §4/2

**Prerequisites**

At least 45 CP shall have been acquired before a lab rotation is started.

**Competence Goal**

The student will get insight in lab work, will learn to work in a selforganized way. Further the student will deepen his or her knowledge in the topic of choice and will then be better qualified to select the topic and the research groups which fits best to his or her personal interest.

**Content**

The student works on a selected topic in one of the research groups of the involved institutes. Lab rotations at external institutions are allowable. The selection of the topic is made in agreement of the supervisor and the student. The student familiarizes his or herself with the topic, carries out the lab work, and prepares a report.

**Module grade calculation**

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

**Workload**

Total workload: 300 hours

- Literature study: 50 hours
- Lab work: 190 hours
- Preparation of report and presentation: 60 hours
6.24 Module: Lab Rotation II (RSGI-ML-1) [M-BGU-104589]

**Responsible:** Prof. Dr. Jan Cermak
Prof. Dr.-Ing. Stefan Hinz
apl. Prof. Dr. Boris Jutzi
Prof. Dr.-Ing. Hansjörg Kutterer
Prof. Dr.-Ing. Markus Ulrich

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

**Part of:** Lab Rotations

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**Mandatory**

| T-BGU-109413 | Lab Rotation II | 10 CR |

**Competence Certificate**

Other according to SPO RSGI §4/2

**Prerequisites**

At least 45 CP shall have been acquired before a lab rotation is started.

**Competence Goal**

The student will get insight in lab work, will learn to work in a selforganized way. Further the student will deepen his or her knowledge in the topic of choice and will then be better qualified to select the topic and the research groups which fits best to his or her personal interest.

**Content**

The student works on a selected topic in one of the research groups of the involved institutes. Lab rotations at external institutions are allowable. The selection of the topic is made in agreement of the supervisor and the student. The student familiarizes his or herself with the topic, carries out the lab work, and prepares a report.

**Module grade calculation**

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

**Workload**

Total workload: 300 hours

- Literature study: 50 hours
- Lab work: 190 hours
- Preparation of report and presentation: 60 hours
6.25 Module: Master's Thesis (RSGI-M) [M-BGU-104549]

Responsible: Prof. Dr. Jan Cermak
Organisation: KIT Department of Civil Engineering, Geo and Environmental Sciences
Part of: Master's Thesis

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Mandatory

T-BGU-109321 Master's Thesis 30 CR Cermak

Competence Certificate
Written

Prerequisites
At least 70 CP shall have been acquired before the master thesis is started.

Modeled Conditions
The following conditions have to be fulfilled:

1. You need to have earned at least 70 credits in the following fields:
   - Key Competences
   - Lab Rotations
   - Mathematics and Beyond
   - Profiles
   - Remote Sensing
   - Supplementary Modules

Competence Goal
The student gets further insight in lab work and will learn to work in a self-organized way. The student analyzes the given task, understands related problems, evaluates available methods to solve these problems and applies the method finally chosen. With this, the student will deepen his/her knowledge in the topic of choice and will then be better qualified to select the topic and the research groups which fits best to his/her personal interest.
Learning outcomes:

- Application of the subject-specific knowledge and methods learned during the studies.
- Self-organized conception and independent execution of a scientific project.
- Explanation and analysis of results.
- Interpretation and communication of the obtained results in written form.

Content
Execution of a scientific project under supervision.

Module grade calculation
The thesis will be evaluated by the supervisor and another examiner of the faculty. One of these must be professor or junior professor. In the case of disagreeing grades the arithmetic mean is calculated. The grade of the module is the grade of the thesis.

Workload
Total workload: 6 months, appr. 900 hours
Module: Mobile GIS / Location Based Services (GEOD-MWGI-2) [M-BGU-101045]

Responsibility: Prof. Dr. Martin Breunig  
Dr.-Ing. Paul Vincent Kuper

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

Part of:  
- Profiles / Profile: Computer Vision and Geoinformatics (Compulsory Elective Modules)  
- Profiles / Profile: Geoinformatics and Remote Sensing of the Atmosphere (Compulsory Elective Modules)  
- Profiles / Profile: Geoinformatics and Environmental Geodesy (Compulsory Elective Modules)  
- Supplementary Modules (Usage from 2/17/2021)

Credits 3  
Grading scale pass/fail  
Recurrence Each summer term  
Duration 1 term  
Language German/English  
Level 4  
Version 4

Mandatory  

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<td>Mobile GIS / Location Based Services, Prerequisite</td>
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Breunig, Kuper, Landgraf

Competence Certificate  

- T-BGU-101713 Mobile GIS / Location Based Services, Prerequisite

For details of the performance assessment to be carried out, see the information provided with achievement.

Prerequisites  

none

Competence Goal  
The students explain the basics of mobile GIS and Location Based Services (LBS) including suitable transaction concepts. In practical use, they can, for example, acquire geodata with different hardware, manage them in a mobile database and synchronize them with a central database. Furthermore, students are able to develop an exemplary LBS application.

Content  
The project-oriented module elaborates and discusses the history and basics of mobile GIS and Location Based Services. The corresponding techniques are applied in practical use with different hardware. Examples are mobile geodata acquisition and mobile geodata management as well as synchronization with a central database. Furthermore, the students learn about the principles of exemplary developments and to apply them in practice.

Module grade calculation  
The grade of the module is identical with the grade of the exam in T-BGU-101713 Mobile GIS / Location Based Services, Prerequisite.

Annotation  
In mutual agreement with the students the lecture will be presented either in English or in German.

Workload  

Total amount of work: 90 hours  
Attendance time: 20 hours  
- Courses

Self study: 760 hours  
- Deepening of the study contents by reworking the lecture content at home  
- Processing of exercises and preparation of status presentations  
- Deepening of the study contents on the basis of suitable literature and internet research
Literature


Module: Module Wildcard 1 Profile ComVisEnvGeo [M-BGU-104438]

Organisation: University
Part of: Profiles / Profile: Computer Vision and Environmental Geodesy (Compulsory Elective Modules)

Credits 10
Grading scale Grade to a tenth
Recurrence Each term
Duration 2 terms
Language German
Level 4
Version 1

Wildcard (Election: at least 1 item)

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Prerequisites
None
6.28 Module: Module Wildcard 1 Profile ComVisGeoinf [M-BGU-104436]

**Organisation:** University  
**Part of:** Profiles / Profile: Computer Vision and Geoinformatics (Compulsory Elective Modules)

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**Prerequisites**
None
**6.29 Module: Module Wildcard 1 Profile ComVisRemSen [M-BGU-104437]**

**Organisation:** University  
**Part of:** Profiles / Profile: Computer Vision and Remote Sensing of the Atmosphere (Compulsory Elective Modules)

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**Prerequisites**
None
### 6.30 Module: Module Wildcard 1 Profile GeoinfEnvGeo [M-BGU-104440]

**Organisation:**  University  
**Part of:**  Profiles / Profile: Geoinformatics and Environmental Geodesy (Compulsory Elective Modules)

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<td>T-BGU-109075</td>
<td>Wildcard 2 Profile 5</td>
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**Prerequisites**  
None
Module: Module Wildcard 1 Profile GeoinfRemS [M-BGU-104439]

Organisation: University
Part of: Profiles / Profile: Geoinformatics and Remote Sensing of the Atmosphere (Compulsory Elective Modules)

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Prerequisites
None
6.32 Module: Module Wildcard 1 Profile RemSenEnvGeo [M-BGU-104441]

Organisation: University
Part of: Profiles / Profile: Remote Sensing of the Atmosphere and Environmental Geodesy (Compulsory Elective Modules)

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Wildcard (Election: at least 1 item)

| T-BGU-109076 | Wildcard 1 Profile 6 | 0 CR |
| T-BGU-109077 | Wildcard 2 Profile 6 | 10 CR |

Prerequisites
None
6.33 Module: Numerical Mathematics (GEOD-MANM-2) [M-BGU-101013]

**Responsible:** Dr. rer. nat. Patrick Erik Bradley  
**Organisation:** KIT Department of Civil Engineering, Geo and Environmental Sciences  
**Part of:** Mathematics and Beyond

<table>
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**Mandatory**

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<td>Numerical Mathematics, Exam</td>
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**Competence Certificate**

- T-BGU-111175 – Numerical Mathematics, Exam
- T-BGU-111174 – Numerical Mathematics, Prerequisite

For details on the assessment to be performed, see the details for the partial achievement.

**Prerequisites**
The module M-BGU-101012 must not have started.

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

1. The following conditions have to be fulfilled:

**Competence Goal**

Students can explain the basics of numerical mathematics as well as name, formally describe, critically evaluate and apply basic numerical methods.

**Content**

This module provides an overview of basic numerical methods like floating point arithmetic, non-linear equations, polynomials, linear algebra, topology, approximation, partial differential equations, and numerical integration. Some applications in various disciplines are shown. The module consists of lectures and exercise sessions.

**Module grade calculation**
The grade of the module is the grade of the oral exam T-BGU-111175 – Numerical Mathematics, Exam.

**Annotation**
None

**Workload**

Total workload: 180 hours  
Contact hours: 60 hours

- courses plus course-related examination

**Self-study:** 120 hours

- consolidation of subject by recapitulation of lectures  
- consolidation of subject by use of references and by own inquiry  
- preparations for exam

**Literature**
None
6.34 Module: Real Estate Valuation II (GEOD-MWER-4) [M-BGU-101105]

**Responsible:** Prof. Dr. Jan Cermak
Prof. Dr.-Ing. Erwin Drixler

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

**Part of:** Supplementary Modules (Usage from 2/17/2021)

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**Mandatory**

| T-BGU-101660 | Real Estate Valuation II | 4 CR | Cermak, Drixler |

**Prerequisites**

none
M 6.35 Module: Recent Earth Observation Programs and Systems (GEOD-MWCV-7) [M-BGU-101765]

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<td>Recent Earth Observation Programs and Systems</td>
<td>2 CR</td>
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**Competence Certificate**

- T-BGU-103407 Recent Earth Observation Programs and Systems

For details on the assessments to be performed, see the details for partial achievement.

**Prerequisites**
The module M-BGU-101824 Missions and Methods of Remote Sensing must not have started.

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

1. The following conditions have to be fulfilled:

**Competence Goal**
Students are aware of recent and planned Earth observation missions and able to relate the programs and sensors to each other, but also to former Earth observation programs and systems.

**Content**
This module provides an introduction to recent and planned Earth observation programs and systems. The module addresses aspects of the sensors, but also planned and possible applications.

**Module grade calculation**
The grade of the module is the grade of the oral exam in T-BGU-103407 Recent Earth Observation Programs and Systems.

**Annotation**
Knowledge in remote sensing sensors is recommended.

**Workload**

**Total workload: 60 hours**

- **Contact hours: 15 hours**
  - courses plus course-related examination

- **Self-study: 45 hours**
  - consolidation of subject by recapitulation of lectures
  - consolidation of subject by use of references and by own inquiry
  - preparations for exam
Module: Remote Sensing of Atmospheric Temperature, Trace Gases, Clouds and Aerosols (RSGI-MPRA) [M-BGU-104532]

**M 6.36 Module: Remote Sensing of Atmospheric Temperature, Trace Gases, Clouds and Aerosols (RSGI-MPRA) [M-BGU-104532]**

**Responsible:** Prof. Dr. Jan Cermak
apl. Prof. Dr. Thomas Clarmann von Clarenau

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

**Part of:** Profiles / Profile: Computer Vision and Remote Sensing of the Atmosphere (mandatory)
Profiles / Profile: Geoinformatics and Remote Sensing of the Atmosphere (mandatory)
Profiles / Profile: Remote Sensing of the Atmosphere and Environmental Geodesy (mandatory)

Supplementary Modules (Usage from 10/1/2023)

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**Mandatory**

- **T-BGU-111184** Remote Sensing of Aerosols and Clouds, Prerequisite
  
  This item will not influence the grade calculation of this parent.
  
  1 CR Cermak

- **T-BGU-109282** Remote Sensing of Atmospheric Temperature, Trace Gases, Clouds and Aerosols, Examination
  
  4 CR Cermak, Clarmann von Clarenau

**Competence Certificate**

- T-BGU-111184 - Remote Sensing of Aerosols and Clouds, Prerequisite
- T-BGU-109282 - Remote Sensing of Atmospheric Temperature, Trace Gases, Clouds and Aerosols, Examination (oral ca. 30 min.)

For details on the assessments to be performed, see the details for the partial achievements.

**Prerequisites**

None

**Competence Goal**

Course 1 Passive Remote Sensing of Atmospheric Temperature and Composition:

The students can explain the basics of passive remote sensing of atmospheric temperature and composition and the underlying radiative transfer principles. They know the advantages and drawbacks of different observation geometries, frequency ranges, and technical realizations. They know the common methods of data analysis and data characterization. Knowledge of the technical terminology enables them to read technical literature, to participate in related discussions and to prepare a master thesis in this field.

Course 2 Remote Sensing of Aerosols and Clouds:

Students explain techniques used in remote sensing of aerosols and clouds, and their specific advantages. They relate how remote sensing assessments help improve the understanding of processes involving aerosols and clouds. Students independently choose and apply methods and data sets suited for the analysis of aerosols and clouds.

**Content**

Course 1 Passive Remote Sensing of Atmospheric Temperature and Composition:

The use of remote sensing techniques for atmospheric measurements will be motivated. An introduction into the technical terminology is given. Measurement geometries (nadir, upward, limb, in emission and absorption) are presented and discussed. The fundamentals of radiative transfer will be recapitulated. Advantages and drawbacks of different spectral regions (UV, visible, infrared, microwave) are discussed. Exemplar satellite missions are presented. Data analysis by inverse methods applied to ill-posed problems is explained, as well as data characterization in terms of uncertainties and spatial resolution. Validation approaches are presented. An overview over career opportunities in this field is given.

Course 2 Remote Sensing of Aerosols and Clouds:

- Passive-sensor remote sensing of aerosols
- Passive-sensor remote sensing of clouds
- Active-sensor remote sensing of aerosols
- Active-sensor remote sensing of clouds
- Assessment of cloud processes and aerosol-cloud interactions

**Module grade calculation**

The grade of the module is the grade of oral exam.
**Workload**
Total workload course 1 Passive Remote Sensing of Atmospheric Temperature and Composition: 75 hours

Contact hours: 40 hours
- courses plus course-related examination

Self-study: 35 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

Total workload course 2 Remote Sensing of Aerosols and Clouds: 75 hours

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

Self-study: 45 hours
- consolidation of subject by preparation of presentations
- consolidation of subject by use of references and by own inquiry
- processing of exercises
- preparations for exam

**Recommendation**
Basics of physics and basics of matrix algebra are required. Knowledge in geosciences/climate and statistics are helpful.
Module: Remote Sensing of the Atmosphere (RSGI-MRRA) [M-BGU-104524]

**6.37 Module: Remote Sensing of the Atmosphere (RSGI-MRRA) [M-BGU-104524]**

**Responsible:** Prof. Dr. Jan Cermak  
**Organisation:** KIT Department of Civil Engineering, Geo and Environmental Sciences

**Part of:** Remote Sensing

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**Mandatory**

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<tr>
<td>T-BGU-110304</td>
<td>Satellite Climatology: Remote Sensing of a Changing Climate, Prerequisite</td>
<td>1 CR</td>
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<td>T-BGU-111185</td>
<td>Atmospheric Remote Sensing Infrastructures, Prerequisite</td>
<td>1 CR</td>
<td>Cermak</td>
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<tr>
<td>T-BGU-109274</td>
<td>Remote Sensing of the Atmosphere, Examination</td>
<td>3 CR</td>
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**Competence Certificate**

- T-BGU-110304 - Satellite Climatology: Remote Sensing of a Changing Climate, Prerequisite  
- T-BGU-111185 - Atmospheric Remote Sensing Infrastructures, Prerequisite  
- T-BGU-109274 - Remote Sensing of the Atmosphere, Examination

For details on the assessments to be performed, see the details for the partial achievements.

**Prerequisites**

- M-BGU-103313 - Remote Sensing of a Changing Climate

have not been started

**Competence Goal**

Students explain the contribution of remote sensing to the assessment of climate change and its consequences in time and space. They relate how remote sensing assessments help further the understanding of processes driving global change. Students independently choose and apply methods and data sets suited for the analysis of specific aspects of global change.

**Content**

- Basics of global change: Mechanisms and patterns
- Remote sensing approaches to analysing patterns of global change:
  - Land and ocean surface
  - Atmosphere
- Remote sensing approaches to analysing mechanisms of global change:
  - Land and ocean surface
  - Atmosphere
- Links between remote sensing and other methods in global change research
- Infrastructures and systems for atmospheric remote sensing

**Module grade calculation**

The grade of the module is the grade of the exam.
**Workload**
Total workload: 150 hours
Contact hours: 55 hours

- courses plus course-related examination
- visits of atmospheric remote sensing infrastructures

Self-study: 95 hours

- consolidation of subject matters by recapitulation of lectures
- consolidation of subject matters by use of references and by own inquiry
- data analysis and data processing
- preparations for exam

**Recommendation**
Knowledge in geosciences/climate and statistics are helpful.
Module: SAR and InSAR Remote Sensing (RSGI-MPEG-6) [M-BGU-104586]

**Responsible:** Prof. Dr.-Ing. Stefan Hinz
Dr. Malte Westerhaus

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

**Part of:**
- Profiles / Profile: Computer Vision and Environmental Geodesy (Compulsory Elective Modules)
- Profiles / Profile: Geoinformatics and Environmental Geodesy (Compulsory Elective Modules)
- Profiles / Profile: Remote Sensing of the Atmosphere and Environmental Geodesy (Compulsory Elective Modules)
- Supplementary Modules
- Additional Examinations

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<tr>
<td>T-BGU-109409</td>
<td>SAR and InSAR Remote Sensing, Prerequisite</td>
<td>2 CR</td>
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<td>T-BGU-109410</td>
<td>SAR and InSAR Remote Sensing, Examination</td>
<td>1 CR</td>
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</table>

**Competence Certificate**
oral (ca. 20 min.).

**Prerequisites**
None

**Competence Goal**
The students understand the basic concepts of SAR remote sensing as well as SAR interferometry. They explain important aspects of SAR image generation with special focus on synthetic aperture and signal focusing. They are familiar with the basics of the interferometric processing of SAR images with public domain tools like SNAP. They know important applications of SAR and are able to identify and interpret fundamental signatures caused by deformations of the Earth's surface or moving objects. The students know the different characteristics of frequency bands used by the three satellite based SAR systems (X-, C- and L-band) and assess their fields of application. They are familiar with the ordering procedure of SAR scenes via the ESA or TerraSAR-X archives. With this lecture, the learners acquire the necessary knowledge to conduct a SAR/InSAR project from the planning phase until the interpretation of results.

**Content**
The module delivers basic knowledge about the use of radar satellite imagery in the frame of Remote Sensing and Geodesy. The contents reach from technical aspects concerning image generation until the evaluation of results. Focus of the lectures and exercises is the whole processing chain, including signal focusing, interferometric processing and geocoding. Further emphasis is put on the "reading" of amplitude and phase images as well as the interpretation of different signal contributions. The theoretical concepts are accompanied by practical exercises with a total fraction of 50%, which foster the ability of the learners to process and visualize SAR data. Recent and former SAR missions whose data archives form the basis of most researchand application-orientated projects, are discussed. In the frame of a praxis-orientated scenario, the students gain insight into the ordering process of SAR scenes via the software EOLI-AS which is provided by the European Space Agency (ESA).

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

**Annotation**
In mutual agreement with the students the lectures and exercises will be presented either in English or in German.
Workload
Total workload: 90 hours

Contact hours: 21 hours
  • course plus course-related examination

Self-study: 69 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

Recommendation
Basics of signal processing (Fourier-Transformation, digital filters)
Module: Scientific Applications of GNSS (RSGI-MPEG-3) [M-BGU-104566]

Responsible: Dr.-Ing. Hael Sumaya
Organisation: KIT Department of Civil Engineering, Geo and Environmental Sciences
Part of: Profiles / Profile: Computer Vision and Environmental Geodesy (Compulsory Elective Modules)
Profiles / Profile: Geoinformatics and Environmental Geodesy (Compulsory Elective Modules)
Profiles / Profile: Remote Sensing of the Atmosphere and Environmental Geodesy (Compulsory Elective Modules)
Supplementary Modules

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Mandatory
T-BGU-109349 Scientific Applications of GNSS, Examination 3 CR Mayer

Competence Certificate
ever according to SPO RSGI x4/2

Prerequisites
None

Competence Goal
Subject-related competencies:

- The students are enabled to process GNSS data using scientific software (e.g., Bernese GNSS software) and to evaluate derived results.
- The learners are aware of characteristics of scientific GNSS software, especially in contrast to non-scientific software resp. online services. Therefore, they are able to adequately problem-orientated choose the most suitable software.
- The students are sensitized to datum-related GNSS aspects within Scientific Applications of GNSS (e.g. products, antenna modelling) and enabled to estimate their effects results-orientated.
- The learners realize recent research related to scientific GNSS data processing within regional GNSS networks.

Multi-disciplinary competencies:

- The learners are enabled to work self-organized, independently and reflectively. They have a good command of communication and organization skills, especially related to collaboration, presentation and discussion.
- The students recognize, re-order and explain complex GNSS contexts from a general perspective.
- The learners handle, organize and analyze large data sets.

Content
The main goal of this module is to generate deep insight into the processing of GNSS data of regional networks using scientific GNSS software. Therefore, basic fundamentals of geodetic datum in the context of products and antenna modelling are treated. The effects of selected modelling and processing strategies are analyzed in the coordinate domain with respect to strongly correlated parameters, such as tropospheric parameters.

Module grade calculation
The grade of the module is the grade of the assessment of success of other type.

Annotation
In mutual agreement with the students the lectures and exercises will be presented either in English or in German.
Workload
Total workload: 90 hours
Classroom lectures: 7.5 hours
Taking the subject-related competencies of the students into account, in the beginning of the module the recent status of Scientific Applications of GNSS is presented in order to establish a fundamental basis for the project work.

Self-study: 20 hours
Taking the individual GNSS knowledge of the learners into account, scientific papers are used to deepen and advance the subject-related knowledge. Therefore, the students have to carry out individually
- consolidation by recapitulation of lectures,
- consolidation by use of references and by own inquiry.

Project meetings: 4.5 hours
During the project work, team meetings are regularly held in order to give status reports and discuss recent challenges. These meetings are of fundamental importance regarding scrutiny and systematic collaborative progress of the project.

Project work: 58 hours
The main workload is on the joint project dealing with a scientific question related to the scope of the module.

Learning type
The fundamental requirement for the assessment is the significant contribution to the project work carried out in the framework of the module. The project is conducted in teams (head count per team: max. 3). The assessment takes into account individual (in particular portfolio-based reflection) and team-related (in particular joint research project) achievements. The results of the project work have to be presented and discussed constructively (Audience: Academic staff).
### 6.40 Module: Scientific Programming (RSGI-MMCE-1) [M-BGU-104530]

**Responsible:** Prof. Dr. Jan Cermak  
**Organisation:** KIT Department of Civil Engineering, Geo and Environmental Sciences  
**Part of:** Mathematics and Beyond

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| Mandatory | T-BGU-106765 | Introduction to Matlab | 3 CR | Ehret |

**Prerequisites**
None

**Competence Goal**
The students know the syntax and structure of the selected programming language and are apply it in the sense of programming scientific algorithms.

**Recommendation**
It is recommended to select a programming language which is actually used in the groups where lab rotation or master thesis in made, if such courses are available.
Module: Seminar Environmental Geodesy (RSGI-MPEG-2) [M-BGU-104557]

**Responsibility:** Prof. Dr.-Ing. Hansjörg Kutterer

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

**Part of:** Profiles / Profile: Computer Vision and Environmental Geodesy (Compulsory Elective Modules)
Profiles / Profile: Geoinformatics and Environmental Geodesy (Compulsory Elective Modules)
Profiles / Profile: Remote Sensing of the Atmosphere and Environmental Geodesy (Compulsory Elective Modules)
Supplementary Modules (Usage from 2/17/2021)
Additional Examinations

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</table>

**Mandatory**

| T-BGU-109338 | Seminar Environmental Geodesy, Exam | 2 CR | Kutterer |

**Competence Certificate**
other according to SPO RSGI x4/2; The assessment consists in the independent thorough scientific treatment of a recent research topic within the field of Earth system observation. Starting from a seminal article in a scientific journal the student acquires new topical competences and presents these in a didactically adequate manner, e.g. as an oral presentation of 20-25 minutes to the other students and the scientific staff. It follows a defense of the content of the presentation. Further, active participation in seminar events of this module is compulsory (e.g., documented attendance at six presentations).

**Prerequisites**
None

**Competence Goal**
Subject-related competences:

- The students describe fundamental recent concepts of Earth observation and are aware of the width of this research field.
- The students are able to explore detailed technical literature with different foci, collect and structure the information provided, and are able to explain its content.
- The students contribute to the learning outcome of the seminar group by subject-specific arguments.

Inter-disciplinary competences:

- The students are able to self-responsibly organize their work and to carry it out in an independent and selfcritical manner.
- They have communication and organization skills in the fields of presentation and discussion.
- The students are able to rate the presentation skills of other team members and can give and receive constructive criticism.
- The students are able to understand and analyze technical literature in English language.

**Content**
This course provides detailed and focused insight to the student in recent fields of Earth system observation. To achieve this, the students participate in a series of scientific seminars. The field of Earth system observation is of high current relevance, leading to a rapid change of the foci of research. This dynamical characteristic is accounted for and the most up-to-date issues find their way into the seminar which can vary from semester to semester. The topical focus will be agreed with the student and is of the fields of global navigation satellite systems (GNSS), gravity field missions, and geodynamics (e.g. InSAR) with a special focus on environmental geodesy.

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

**Annotation**
In mutual agreement with the students the seminar will be held either in English of in German.
Workload
Total workload: 60 hours

- Contact time: 15 hours
  - During the contact hours individually selected topics will be explored and presented to the other students. Active participation in the seminars is compulsory.
- Self-study: 45 hours
  - Independent and focused assessment of the content; preparation and presentation of a seminar talk including defense.

Recommendation
The students shall hold advanced knowledge in at least one topic (space-borne geodesy, physical geodesy, geodynamics).
Module: Seminar Topics of Image Analysis (GEOD-MWEB-1) [M-BGU-101057]

**Responsible:** Dr. Susanne Benz  
Prof. Dr.-Ing. Stefan Hinz

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

**Part of:**  
Profiles / Profile: Computer Vision and Geoinformatics (Compulsory Elective Modules)  
Profiles / Profile: Computer Vision and Remote Sensing of the Atmosphere (Compulsory Elective Modules)  
Profiles / Profile: Computer Vision and Environmental Geodesy (Compulsory Elective Modules)  
Supplementary Modules (Usage from 2/15/2021)

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</table>

**Mandatory**

| T-BGU-101725 | Seminar Topics of Image Analysis | 2 CR | Benz, Hinz |

**Competence Certificate**

- T-BGU-101725 Seminar Topics of Image Analysis

For details on the assessment to be performed, see the details for the partial achievement.

**Prerequisites**

none

**Competence Goal**

At the end of the seminar, students will be able to:

- Search, read, and understand scientific articles related to image analysis  
- Compile the essential methods described in those articles  
- Compare and assess these methods regarding different aspects (e.g., applicability, performance, transferability, runtime)  
- Apply software tools and testing methods of image analysis  
- Design a didactically well-structured presentation  
- Give and receive constructive feedback

**Content**

Contents of the module include

- introduction into selected topic  
- Introduction to scientific communication and discussions  
- investigating and selecting important literature  
- condensing the nucleus of the respective topic  
- preparing hand-out and oral presentation

**Module grade calculation**

The grade of the module is the grade of the oral exam in T-BGU-101725 Seminar Topics of Image Analysis.

**Annotation**

None

**Workload**

**Total workload:** 60 hours  
**Contact hours:** 15 hours

- introductory courses  
- course-related examination  
- presentations of other participants

**Self-study:** 45 hours

- consolidation of subject by recapitulation of introductory lectures  
- consolidation and preparation of subject by use of references and by own inquiry  
- preparations for individual exam
Recommendation
None

Literature
None
Module: Seminar Topics of Remote Sensing (GEOD-MWEA-1) [M-BGU-101054]

**Responsible:** Dr.-Ing. Uwe Weidner

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

**Part of:**
- Profiles / Profile: Computer Vision and Environmental Geodesy (Compulsory Elective Modules)
- Profiles / Profile: Geoinformatics and Environmental Geodesy (Compulsory Elective Modules)
- Profiles / Profile: Remote Sensing of the Atmosphere and Environmental Geodesy (Compulsory Elective Modules)

**Supplementary Modules**

**Credits:** 2

**Grading scale:** Grade to a tenth

**Recurrence:** Each summer term

**Duration:** 1 term

**Language:** German/English

**Level:** 4

**Version:** 2

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**Mandatory**

| T-BGU-101722 | Seminar Topics of Remote Sensing | 2 CR | Weidner |

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**Competence Certificate**

- T-BGU-101722 Seminar Topics of Remote Sensing

For details on the assessment to be performed, see the details for the partial achievement.

**Prerequisites**

None

**Competence Goal**

Students are able to prepare a subject on their own based on introductory lectures, given references and their own inquiry.

**Content**

This module gives insight in selected topics of remote sensing. Topics are close to actual research topics of interest and recent research of the Institute.

**Module grade calculation**

The grade of the module is the grade of the exam in T-BGU-101722 Seminar Topics of Remote Sensing.

**Annotation**

Knowledge of fundamentals in remote sensing sensors is recommended.

**Workload**

**Total workload:** 60 hours

**Contact hours:** 8 hours

- introductory courses plus course-related examination
- presentations

**Self-study:** 52 hours

- consolidation of subject by recapitulation of introductory lectures
- consolidation and preparation of subject by use of references and by own inquiry
- preparations for exam

**Recommendation**

None

**Literature**

None
6.44 Module: Supplementary Studies on Culture and Society [M-ZAK-106235]

Responsible: Dr. Christine Mielke
Christine Myglas

Organisation: 
Part of: Additional Examinations (Usage from 4/1/2023)

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**Election notes**

With the exception of the final oral exam and the practice module, students have to self-record the achievements obtained in the Supplementary Studies on Culture and Society in their study plan. ZAK records the achievements as "non-assigned" under "ÜQ/SQ-Leistungen". Further instructions on self-recording of achievements can be found in the FAQ at https://campus.studium.kit.edu/ and on the ZAK homepage at https://www.zak.kit.edu/begleitstudium-bak.php. The title of the examination and the amount of credits override the modules placeholders.

If you want to use ZAK achievements **both for your interdisciplinary qualifications and for the supplementary studies**, please record them in the interdisciplinary qualifications first. You can then get in contact with the ZAK study services (stg@zak.kit.edu) to also record them in your supplementary studies.

In the in-depth module, achievements have to be obtained in three different areas. The areas are as follows:

- Technology & Responsibility
- Doing Culture
- Media & Aesthetics
- Spheres of Life
- Global Cultures

You have to obtain two achievements with 3 credits each and one achievement with 5 credits. To self-record achievements in the in-depth module, you first have to elect the matching partial achievement.

**Note:** If you registered for the Supplementary Studies on Sustainable Development before April 1st, 2023, self-recording an achievement in this module counts as a request in the sense of §20 (2) of the regulations for the Supplementary Studies on Culture and Society. Your overall grade for the supplementary studies will thus be calculated as the average of the examination grades, not as the average of the module grades.

### Mandatory

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<th>Basics Module - Self Assignment BAK</th>
<th>3 CR</th>
<th>Mielke, Myglas</th>
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### In-depth Module (Election: 3 items)

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<tr>
<th>T-ZAK-112654</th>
<th>In-depth Module - Technology &amp; Responsibility - Self Assignment BAK</th>
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<td>In-depth Module - Doing Culture - Self Assignment BAK</td>
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<td>T-ZAK-112658</td>
<td>In-depth Module - Global Cultures - Self Assignment BAK</td>
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### Mandatory

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<td>Oral Exam - Supplementary Studies on Culture and Society</td>
<td>4 CR</td>
<td>Mielke, Myglas</td>
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**Competence Certificate**

The monitoring is explained in the respective partial achievement.

They are composed of:

- minutes
- presentations
- a seminar paper
- an internship report
- an oral examination

After successful completion of the supplementary studies, the graduates receive a graded certificate and a KIT certificate.
Prerequisites
The offer is study-accompanying and does not have to be completed within a defined period of time. Enrolment or acceptance for graduation must be present when registering for the final examination.

KIT students register for the supplementary studies by selecting this module in the student portal and self-checking a performance. In addition, registration for the individual courses is necessary, which is possible shortly before the beginning of each semester.

The course catalogue, statutes (study regulations), registration form for the oral exam, and guides for preparing the various written performance requirements can be found as downloads on the ZAK homepage at www.zak.kit.edu/begleitstudium-bak.

Competence Goal
Graduates of the Supplementary Studies on Culture and Society demonstrate a sound basic knowledge of conditions, procedures and concepts for analysing and shaping fundamental social development tasks in connection with cultural topics. They have gained a well-founded theoretical and practical insight into various cultural studies and interdisciplinary topics in the field of tension between culture, technology and society in the sense of an expanded concept of culture.

They are able to place the contents selected from the specialization module in the basic context as well as to analyse and evaluate the contents of the selected courses independently and exemplarily and to communicate about them scientifically in written and oral form. Graduates are able to analyse social topics and problem areas and critically reflect on them in a socially responsible and sustainable perspective.

Content
The Supplementary Studies on Culture and Society can be started from the 1st semester and is not limited in time. It comprises at least 3 semesters. The supplementary studies are divided into 3 modules (basics, in-depth studies, practice). A total of 22 credit points (ECTS) are earned.

The thematic elective areas of the supplementary studies are divided into the following 5 modules and their sub-topics:

Block 1Technology & Responsibility
Value change / ethics of responsibility, technology development / history of technology, general ecology, sustainability

Block 2Doing Culture
Cultural studies, cultural management, creative industries, cultural institutions, cultural policy

Block 3Media & Aesthetics
Media communication, cultural aesthetics

Block 4Spheres of Life
Cultural sociology, cultural heritage, architecture and urban planning, industrial science

Block 5Global Cultures
Multiculturalism / interculturalism / transculturalism, science and culture

Module grade calculation
The overall grade of the supplementary studies is calculated as an average of the grades of the examination performances weighted with credit points.

In-depth Module

- presentation 1 (3 ECTS)
- presentation 2 (3 ECTS)
- seminar paper incl. presentation (5 ECTS)
- oral examination (4 ECTS)

Annotation
With the Supplementary Studies on Culture and Society, KIT provides a multidisciplinary study offer as an additional qualification, with which the respective specialized study program is supplemented by interdisciplinary basic knowledge and interdisciplinary orientation knowledge in the field of cultural studies, which is becoming increasingly important for all professions.

Within the framework of the supplementary studies, students acquire in-depth knowledge of various cultural studies and interdisciplinary subject areas in the field of tension between culture, technology and society. In addition to high culture in the classical sense, other cultural practices, common values and norms as well as historical perspectives of cultural developments and influences are considered.

In the courses, conditions, procedures and concepts for the analysis and design of fundamental social development tasks are acquired on the basis of an expanded concept of culture. This includes everything created by humans - also opinions, ideas, religious or other beliefs. The aim is to develop a modern concept of cultural diversity. This includes the cultural dimension of education, science and communication as well as the preservation of cultural heritage. (UNESCO, 1982)

According to § 16 of the statutes, a reference and a certificate are issued by the ZAK for the supplementary studies. The achievements are also shown in the transcript of records of the degree program and, upon request, in the certificate. They can also be recognized in the interdisciplinary qualifications (see elective information).
Workload
The workload is made up of the recommended number of hours for the individual modules:

- basic module approx. 90 h
- in-depth module approx. 340 h
- practical module approx. 120 h

total: approx. 550 h

Learning type

- lectures
- seminars
- workshops
- practical course

Literature
Recommended reading of primary and specialized literature will be determined individually by each instructor.
6.45 Module: Supplementary Studies on Sustainable Development [M-ZAK-106099]

**Responsible:** Dr. Christine Mielke
Christine Myglas

**Organisation:**
Part of: Additional Examinations (Usage from 4/1/2023)

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<tr>
<td>Each term</td>
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</table>

**Election notes**
With the exception of the final oral exam, students have to self-record the achievements obtained in the Supplementary Studies on Sustainable Development in their study plan. ZAK records the achievements as "non-assigned" under "ÜQ/SQ-Leistungen". Further instructions on self-recording of achievements can be found in the FAQ at https://campus.studium.kit.edu/ and on the ZAK homepage at https://www.zak.kit.edu/begleitstudium-bene. The title of the examination and the amount of credits override the modules placeholders.

If you want to use ZAK achievements both for your interdisciplinary qualifications and for the supplementary studies, please record them in the interdisciplinary qualifications first. You can then get in contact with the ZAK study services (stg@zak.kit.edu) to also record them in your supplementary studies.

In the elective module, you need to obtain 6 credits worth of achievements in two of the four areas:

- Sustainable Cities & Neighbourhoods
- Sustainable Assessment of Technology
- Subject, Body, Individual: The Other Side of Sustainability
- Sustainability in Culture, Economy & Society

Usually, two achievements with 3 credits each have to be obtained. To self-record achievements in the elective module, you first have to elect the matching partial achievement.

**Note:** If you register for the Supplementary Studies on Sustainable Development before April 1st, 2023, self-recording an achievement in this module counts as a request in the sense of §19 (2) of the regulations for the Supplementary Studies on Sustainable Development. Your overall grade for the supplementary studies will thus be calculated as the average of the examination grades, not as the average of the module grades.

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<td>T-ZAK-112351</td>
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**Competence Certificate**
The monitoring is explained in the respective partial achievement.

They are composed of:

- protocols
- a reflection report
- presentations
- presentations
- the elaboration of a project work
- an individual term paper

Upon successful completion of the supplementary studies, graduates receive a graded report and a certificate issued by ZAK.
Prerequisites
The course is offered during the course of study and does not have to be completed within a defined period of time. Enrolment is required for all performance assessments of the modules of the supplementary studies. Participation in the supplementary studies is regulated by § 3 of the statutes.

KIT students register for the supplementary studies by selecting this module in the student portal and self-book a performance. Registration for courses, performance assessments and examinations is regulated by § 6 of the Statutes and is usually possible shortly before the beginning of the semester.

The course catalogue, statutes (study regulations), registration form for the oral exam and guidelines for preparing the various written performance requirements can be found as downloads on the ZAK homepage at http://www.zak.kit.edu/begleitstudium-bene.

Competence Goal
Graduates of the supplementary studies in sustainable development acquire additional practical and professional competencies. Thus, the supplementary study program enables the acquisition of basics and initial experience in project management, trains teamwork skills, presentation skills and self-reflection, and also creates a fundamental understanding of sustainability that is relevant for all professional fields.

Graduates are able to analyse social topics and problem areas and critically reflect on them in a socially responsible and sustainable perspective. They are able to place the contents selected from the modules "Elective" and "Advanced" in the basic context as well as to independently and exemplarily analyse and evaluate the contents of the selected courses and to scientifically communicate about them in written and oral form.

Content
The supplementary study program Sustainable Development can be started from the 1st semester and is not limited in time. The wide range of courses offered by ZAK makes it possible to complete the program usually within three semesters. The supplementary studies comprise 19 credit points (LP). It consists of three modules: Basic Module, Elective Module and Advanced Module.

The thematic elective areas of the supplementary studies are divided into the following 4 modules and their subtopics in Module 2 (elective module):

Block 1  Sustainable Cities and Neighbourhoods
The courses provide an overview of the interaction of social, ecological, and economic dynamics in the microcosm of the city.

Block 2  Sustainability Assessment of Technology
Mostly based on ongoing research activities, methods and approaches of technology assessment are elaborated.

Block 3  Subject, Body, Individual: The other Side of Sustainability
Different approaches are presented to the individual perception, experience, shaping and responsibility of relationships to the environment and to oneself.

Block 4  Sustainability in Culture, Economy & Society
Courses usually have an interdisciplinary approach, but may also focus on one of the areas of culture, economics or society, both in application and in theory.

The core of the supplementary studies is a case study in the specialization area. In this project seminar, students conduct sustainability research with practical relevance themselves. The case study is supplemented by an oral examination with two topics from module 2 (elective module) and module 3 (in-depth module).

Module grade calculation
The overall grade of the supplementary studies is calculated as an average of the grades of the examination performances weighted with credit points.

Elective module
- Presentation 1 (3 ECTS)
- Presentation 2 (3 ECTS)

Advanced module
- individual term paper (6 ECTS)
- oral examination (4 ECTS)
Annotation
The Supplementary Studies on Sustainable Development at KIT is based on the conviction that a long-term socially and ecologically compatible coexistence in the global world is only possible if knowledge about necessary changes in science, economy and society is acquired and applied.

The interdisciplinary and transdisciplinary Studies on Sustainable Development enables diverse access to transformation knowledge as well as basic principles and application areas of sustainable development. According to the statutes § 16, a certificate is issued by the ZAK for the complementary studies.

The achievements are also shown in the transcript of records of the degree program and, upon request, in the certificate. They can also be recognized in the interdisciplinary qualifications (see elective information).

In the specialised studies, modules and partial achievements can be recognised within the framework of the additional achievements or e.g. the interdisciplinary qualifications. This must be regulated via the respective subject study programme.

The focus is on experience- and application-oriented knowledge and competences, but theories and methods are also learned. The aim is to be able to represent one's own actions as a student, researcher and later decision-maker as well as an individual and part of society under the aspect of sustainability.

Sustainability is understood as a guiding principle to which economic, scientific, social and individual actions should be oriented. According to this, the long-term and socially just use of natural resources and the material environment for a positive development of global society can only be addressed by means of integrative concepts. Therefore, "education for sustainable development" in the sense of the United Nations programme plays just as central a role as the goal of promoting "cultures of sustainability". For this purpose, practice-centred and research-based learning of sustainability is made possible and the broad concept of culture established at ZAK is used, which understands culture as habitual behaviour, lifestyle and changing context for social actions.

The supplementary study programme conveys the basics of project management, trains teamwork skills, presentation skills and self-reflection. Complementary to the specialised studies at KIT, it creates a fundamental understanding of sustainability, which is important for all professional fields. Integrative concepts and methods are essential: in order to use natural resources in the long term and to shape the global future in a socially just way, not only different disciplines, but also citizens, practitioners and institutions must work together.

Workload
The workload is made up of the number of hours of the individual modules:

- Basic module approx. 180 h
- Elective module approx. 150 h
- Consolidation module approx. 180 h

Total: approx. 510 h

Learning type

- lectures
- seminars
- workshops

Literature
Recommended reading of primary and specialist literature is determined individually by the respective lecturer.
6.46 Module: Tomographic Laser- and Radar Sensing (GEOD-MWCV-8) [M-BGU-101052]

**Responsible:** Prof. Dr.-Ing. Stefan Hinz  
Dr.-Ing. Andreas Schenk

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

**Part of:**  
Profiles / Profile: Computer Vision and Geoinformatics (Compulsory Elective Modules)  
Profiles / Profile: Computer Vision and Remote Sensing of the Atmosphere (Compulsory Elective Modules)  
Profiles / Profile: Computer Vision and Environmental Geodesy (Compulsory Elective Modules)  
Supplementary Modules (Usage from 10/1/2023)

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**Mandatory**

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| T-BGU-101724 | Tomographic Laser- and Radar Sensing, Prerequisite  
This item will not influence the grade calculation of this parent. | 1 CR | Hinz, Schenk |
| T-BGU-101723 | Tomographic Laser- and Radar Sensing | 2 CR | Hinz, Schenk |

**Competence Certificate**

- T-BGU-101724 Tomographic Laser- and Radar Sensing, Vorleistung  
- T-BGU-101723 Tomographic Laser- and Radar Sensing

For details on the assessments to be performed, see the details for the partial achievements.

**Prerequisites**
The module M-BGU-101828 Interferometric and Tomographic Laser- and Radar Sensing must not have started

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

1. The following conditions have to be fulfilled:

**Competence Goal**

Students can describe the basics of tomography applied to remote sensing data. They understand how (quasi-)volumetric scattering are reconstructed from remote sensing data. Further, they understand the advanced processing of Synthetic Aperture Radar (SAR) data and multi-echo or full waveform Laser data applied to tasks like automatic object characterization, atmospheric sounding and forest parameter estimation.

**Content**

Contents of the module include
- introduction into tomography  
- SAR-Tomography  
- GNSS-Tomography  
- Full waveform Laserscanning  
- 3D atmospheric sounding

The theoretical aspects are applied to best-practise examples during labs and home work.

**Module grade calculation**
The grade of the module is the grade of the oral exam in T-BGU-101723 Tomographic Laser- and Radar Sensing

**Annotation**

None
Workload
Total workload: 90 hours
Contact hours: 30 hours
- introductory courses plus course-related examination
- presentations
Self-study: 60 hours
- consolidation of subject by recapitulation of introductory lectures
- consolidation and preparation of subject by use of references and by own inquiry
- preparations for exam

Literature
None
6.47 Module: Visualization of Geodata in 2D, 3D and 4D (GEOD-MWCV-5) [M-BGU-101021]

Responsible: Dr.-Ing. Sven Wursthorn
Organisation: KIT Department of Civil Engineering, Geo and Environmental Sciences
Part of: Supplementary Modules

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Competence Certificate

- T-BGU-101703 Visualisierung von Geodaten in 2D, 3D und 4D, Vorleistung
- T-BGU-101702 Visualisierung von Geodaten in 2D, 3D und 4D

For details on the assessments to be performed, see the details for the partial achievements.

Prerequisites
Module M-BGU-101096: Visualization of Spatial Data in 2D, 3D and 4D must not have started.

Competence Goal

The students describe the visualization basics and possibilities of two and three dimensional spatial data and objects. For this purpose, they use design means such as color or transparency in addition to lighting and shading models. Furthermore, they explain and implement markup languages for 3D models and programming interfaces for developing 2D as well as 3D visualizations. The students are familiar with the basic concepts of representing temporal profiles (4D). The impart knowledge of visualization concepts and methods can transferred by the students on new issues.

Content

The module provides students an overview of the main concepts in the field of visualization of two and three dimensional spatial objects. The effects of lighting and shading models will mediated. The module focuses on the use and application of programming interfaces such as OpenGL for 2D and 3D representation. Based on OpenGL skills, the module introduces the Web Graphics Library (WebGL) for a browser-based visualization of spatial objects. Above that an markup language for 3D models (e.g. X3D) as well as the rendering process at all (e.g. OGC Styled Layer Descriptor (SLD) for 2D, Blender for 3D and 4D) will introduced. The theoretical aspects are put into practice by concrete applications and examples and work on a small project.

Module grade calculation

The grade of the module is the grade of the oral exam in T-BGU-101702 Visualisierung von Geodaten in 2D, 3D und 4D

Annotation

Programming skills as well as knowledge of projective geometry and markup languages, such as XML, are helpful.

Workload

Total workload: 90 hours
Contact hours: 30 hours
- courses plus course-related examination
Self-study: 60 hours
- consolidation of subject by recapitulation of lectures
- consolidation of subject by use of references and by own inquiry
- work on a project
- preparations for exam

Recommendation
None

Literature
None
### 6.48 Module: Wildcard 1 Supplementary Modules [M-BGU-104944]

**Organisation:** University  
**Part of:** Supplementary Modules

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**PH 1 Supplementary Modules (Election: at least 1 item)**

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<td>Wildcard 1.1 Supplementary Modules</td>
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6.49 Module: Wildcard Key Competences 1 [M-BGU-104943]

Organisation: KIT Department of Civil Engineering, Geo and Environmental Sciences
Part of: Key Competences

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Election notes
SelfAssignment included

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Prerequisites
none
### 7 Courses

#### 7.1 Course: 3D / 4D GIS [T-BGU-101760]

**Responsible:** Prof. Dr. Martin Breunig  
**Organisation:** KIT Department of Civil Engineering, Geo and Environmental Sciences  
**Part of:** M-BGU-101042 - 3D / 4D GIS

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**Events**

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<td>3D/4D GIS, Exercises</td>
<td>1 SWS</td>
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<td>Breunig</td>
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Legend: 🖥 Online, ☰ Blended (On-Site/Online), 🗣 On-Site, ❌ Cancelled

**Competence Certificate**

Oral exam (about 20 min.) according § 4 para. 2 No. 2 SPO M.Sc. Geodäsie und Geoinformatik.

**Prerequisites**

The part T-BGU-101781 3D / 4D GIS, Vorleistung must be passed.

**Modeled Conditions**

The following conditions have to be fulfilled:

1. The course T-BGU-101781 - 3D / 4D GIS, Prerequisite must have been passed.

**Recommendation**

Knowledge in GIS and object-oriented programming is helpful.
### 7.2 Course: 3D / 4D GIS, Prerequisite [T-BGU-101781]

**Responsible:** Prof. Dr. Martin Breunig  
**Organisation:** KIT Department of Civil Engineering, Geo and Environmental Sciences  
**Part of:** M-BGU-101042 - 3D / 4D GIS  
**Prerequisite for:** T-BGU-101760 - 3D / 4D GIS

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#### Events

| ST 2023 | 6026201  | 3D/4D GIS | 2 SWS | Lecture / 🗣 | Breunig  |
| ST 2023 | 6026202  | 3D/4D GIS, Exercises | 1 SWS | Practice / 🗣 | Breunig  |

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

**Competence Certificate**  
The assessment consists of a coursework according § 4 para. 3 SPO M.Sc. Geodäsie und Geoinformatik based on elaboration of exercise sheets.

**Prerequisites**  
none

**Recommendation**  
Knowledge in GIS and object-oriented programming is helpful.

**Annotation**  
None
7.3 Course: Active Sensors for Computer Vision [T-BGU-101840]

**Responsible:** apl. Prof. Dr. Boris Jutzi

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

**Part of:** M-BGU-101099 - Active Sensors for Computer Vision

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**Competence Certificate**
The assessment consists of an oral exam (about 20 min.) according § 4 para. 2 No. 2 SPO M.Sc. Geodäsie und Geoinformatik.

**Prerequisites**
none

**Annotation**
Depending on the number of participants, the type of the exam can be changed from oral to written.
7 COURSES
Course: Advanced Gravity Field Modelling, Examination [T-BGU-109290]

7.4 Course: Advanced Gravity Field Modelling, Examination [T-BGU-109290]

<table>
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<tr>
<th>Responsible</th>
<th>Dr. Kurt Seitz</th>
</tr>
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<tbody>
<tr>
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<td>KIT Department of Civil Engineering, Geo and Environmental Sciences</td>
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Competence Certificate
oral (ca. 20 min.)

Prerequisites
Successfully completed exercises as prerequisite

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-BGU-109289 - Advanced Gravity Field Modelling, Prerequisite must have been passed.
7.5 Course: Advanced Gravity Field Modelling, Prerequisite [T-BGU-109289]

**Responsible:** Dr. Kurt Seitz  
**Organisation:** KIT Department of Civil Engineering, Geo and Environmental Sciences  
**Part of:** M-BGU-104537 - Advanced Gravity Field Modelling  
**Prerequisite for:** T-BGU-109290 - Advanced Gravity Field Modelling, Examination

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**Prerequisites**

None
7.6 Course: Advanced Topics in Computer Vision, Examination [T-BGU-109280]

Responsible: Dr.-Ing. Martin Weinmann
Organisation: KIT Department of Civil Engineering, Geo and Environmental Sciences
Part of: M-BGU-104531 - Advanced Topics in Computer Vision

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**Competence Certificate**
oral (ca. 20 min.)

**Prerequisites**
Successful completion of the exercises

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

1. The course T-BGU-110748 - Advanced Topics in Computer Vision, Prerequisite must have been passed.

**Annotation**
Depending on the number of participants, the type of the exam can be changed from oral to written.
7.7 Course: Advanced Topics in Computer Vision, Prerequisite [T-BGU-110748]

**Responsible:** Prof. Dr.-Ing. Stefan Hinz  
Dr.-Ing. Martin Weinmann

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

**Part of:** M-BGU-104531 - Advanced Topics in Computer Vision

**Prerequisite for:** T-BGU-109280 - Advanced Topics in Computer Vision, Examination

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**Prerequisites**

None
7.8 Course: Atmospheric Remote Sensing Infrastructures, Prerequisite [T-BGU-111185]

**Responsible:** Prof. Dr. Jan Cermak  
**Organisation:** KIT Department of Civil Engineering, Geo and Environmental Sciences  
**Part of:** M-BGU-104524 - Remote Sensing of the Atmosphere  
**Prerequisite for:** T-BGU-109274 - Remote Sensing of the Atmosphere, Examination

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**Events**

| ST 2023 | 4052201 | Atmospheric Remote Sensing Infrastructures | 2 SWS | Lecture / 🗣 | Cermak, Handwerker |

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

**Competence Certificate**

The assessment consists of a coursework according § 4 para. 3 SPO M.Sc. Remote Sensing and Geoinformatics based on successfully completed exercises wrt Atmospheric Remote Sensing Infrastructures.

**Prerequisites**

none
7.9 Course: Atmospheric Spectroscopy and Middle Atmosphere Research, Examination [T-BGU-109284]

**Responsible:** apl. Prof. Dr. Thomas Clarmann von Clarenau  
PD Dr. Frank Hase

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

**Part of:** M-BGU-104533 - Atmospheric Spectroscopy and Middle Atmospheric Research

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**Prerequisites**  
None
7.10 Course: Augmented Reality [T-BGU-101716]

**Responsible:** Dr.-Ing. Sven Wursthorn

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

**Part of:** M-BGU-101047 - Augmented Reality

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

**Competence Certificate**
Oral exam (about 20 min.) according § 4 para. 2 No. 2 SPO M.Sc. Geodäsie und Geoinformatik.

**Prerequisites**
The part T-BGU-101717 Augmented Reality, Vorleistung must be passed.

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

1. The course T-BGU-101717 - Augmented Reality, Prerequisite must have been passed.
7.11 Course: Augmented Reality, Prerequisite [T-BGU-101717]

**Responsible:** Dr.-Ing. Sven Wursthorn

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

**Part of:** M-BGU-101047 - Augmented Reality

**Prerequisite for:** T-BGU-101716 - Augmented Reality

**Type**  | Completed coursework | **Credits** | **Grading scale** | **Recurrence** | **Version**
---|---|---|---|---|---
Completed coursework | | 2 | pass/fail | Each winter term | 2

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

**Competence Certificate**
Success is assessed in the form of a coursework (Section 4 (3) SPO) based in active participation in practical exercises as well as their elaboration during the lecture time. The exact conditions will be announced in the lecture.

**Prerequisites**
none

**Recommendation**
None

**Annotation**
None
7.12 Course: Basics Module - Self Assignment BAK [T-ZAK-112653]

**Responsible:** Dr. Christine Mielke
Christine Myglas

**Organisation:**

**Part of:** M-ZAK-106235 - Supplementary Studies on Culture and Society

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**Competence Certificate**
The monitoring in this module includes a course credit according to § 5 section 4 in the form of minutes of which two are to be handed in freely chosen topics of the lecture series "Introduction to Applied Studies on Culture and Society". Length: approx. 6,000 characters each (incl. spaces).

**Self service assignment of supplementary stdues**
This course can be used for self service assignment of grade aquired from the following study providers:

- Zentrum für Angewandte Kulturwissenschaft und Studium Generale
- ZAK Begleitstudium

**Recommendation**

**Annotation**
The Basic Module consists of the lecture "Introduction to Supplementary Studies on Culture and Society", which is offered only in the winter semester. It is therefore recommended that students start their studies in the winter semester and complete them before module 2.
### 7.13 Course: Basics Module - Self Assignment BeNe [T-ZAK-112345]

**Responsible:** Christine Myglas  
**Organisation:** Zentrum für Angewandte Kulturwissenschaft und Studium Generale  
**Part of:** M-ZAK-106099 - Supplementary Studies on Sustainable Development

#### Competence Certificate

The monitoring in this module includes a course credit according to § 5 section 4:

**Introduction to Sustainable Development** in the form of minutes of which two are to be handed in freely chosen topics of the lecture series "Introduction to Sustainable Development". Length: approx. 6,000 characters each (incl. spaces).

or

**Sustainability Spring Days at KIT** in the form of a reflection report on all components of the project days "Sustainability Spring Days at KIT". Length approx. 12,000 characters (incl. spaces).

#### Prerequisites

None

#### Self service assignment of supplementary stdues

This course can be used for self service assignment of grade acquired from the following study providers:

- Zentrum für Angewandte Kulturwissenschaft und Studium Generale  
- ZAK Begleitstudium

#### Recommendation


#### Annotation

Module Basics consists of the lecture "Introduction to Sustainable Development ", which is only offered in the summer semester or alternatively of the project days " Sustainability Spring Days at KIT ", which is only offered in the winter semester. It is recommended to complete the course before Elective Module an Specialisation Module.

In exceptional cases, Elective Module or Specialisation Module can also be completed simultaneously with Basics Module. However, the prior completion of the advanced modules Elective and Specialisation should be avoided.
7.14 Course: Basics of Estimation Theory and its Application in Geoscience
Remote Sensing, Examination [T-BGU-109952]

Responsible: Prof. Dr. Jan Cermak
PD Dr. Frank Hase
Prof. Dr.-Ing. Stefan Hinz

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


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<td>Each summer term</td>
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Competence Certificate
oral (ca. 30 min.)

Prerequisites
- T-BGU-106633 - Data Analysis in Geoscience Remote Sensing Projects, Vorleistung
- T-BGU-111186 - Basics of Estimation Theory, Prerequisite

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-BGU-106633 - Data Analysis in Geoscience Remote Sensing Projects, Prerequisite must have been passed.
2. The course T-BGU-111186 - Basics of Estimation Theory, Prerequisite must have been passed.
7.15 Course: Basics of Estimation Theory, Prerequisite [T-BGU-111186]

**Responsible:** PD Dr. Frank Hase  
Prof. Dr.-Ing. Stefan Hinz

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

**Part of:** M-BGU-104918 - Basics of Estimation Theory and its Application in Geoscience Remote Sensing

**Prerequisite for:** T-BGU-109952 - Basics of Estimation Theory and its Application in Geoscience Remote Sensing, Examination

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**Prerequisites**
None
7.16 Course: Cartography II [T-BGU-101662]

**Responsible:** Prof. Dr. Jan Cermak
Dipl.-Ing. Christoph Hermann

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

**Part of:** M-BGU-101107 - Cartography II

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**Prerequisites**
none
7.17 Course: Computer Vision and Remote Sensing, Examination [T-BGU-109269]

**Responsible:** Prof. Dr.-Ing. Stefan Hinz  
apl. Prof. Dr. Boris Jutzi  
Dr.-Ing. Martin Weinmann

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

**Part of:** M-BGU-104517 - Computer Vision and Remote Sensing

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<td>Each term</td>
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**Competence Certificate**  
oral (ca. 40 min.)

**Prerequisites**  
Successfully completed exercises in Methods of Remote Sensing as prerequisite

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

1. The course T-BGU-101759 - Methods of Remote Sensing, Prerequisite must have been passed.

**Annotation**  
Depending on the number of participants, the type of the exam can be changed from oral to written.
7.18 Course: Data Analysis in Geoscience Remote Sensing Projects, Prerequisite [T-BGU-106633]

**Responsible:** Hendrik Andersen
Prof. Dr. Jan Cermak

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

**Part of:** M-BGU-104918 - Basics of Estimation Theory and its Application in Geoscience Remote Sensing

**Prerequisite for:** T-BGU-109952 - Basics of Estimation Theory and its Application in Geoscience Remote Sensing, Examination

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**Competence Certificate**
The assessment consists of a coursework according § 4 para. 3 SPO M.Sc. Geodäsie und Geoinformatik based on a successful data analysis to address a geoscientific question. The analysis and the discussion of the results are submitted in a Jupyter Notebook. The detailed conditions will be announced in the lecture.

**Prerequisites**
None

**Recommendation**
None

**Annotation**
None


**Responsible:** Dr.-Ing. Martin Weinmann

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

**Part of:** M-BGU-106343 - Deep Learning for Computer Vision and Remote Sensing

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**Competence Certificate**
oral (duration ca. 30 minutes) according to SPO §4 (2) 2

**Prerequisites**
Completed prerequisites regarding T-BGU-112866 – Deep Learning for Computer Vision and Remote Sensing, Prerequisites

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

1. The course T-BGU-112866 - Deep Learning for Computer Vision and Remote Sensing, Prerequisites must have been passed.

**Annotation**
Depending on the number of participants, the type of the exam can be changed from oral to written.
7.20 Course: Deep Learning for Computer Vision and Remote Sensing, Prerequisites [T-BGU-112866]

**Responsible:** Dr.-Ing. Martin Weinmann

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

**Part of:** M-BGU-106343 - Deep Learning for Computer Vision and Remote Sensing

**Prerequisite for:** T-BGU-112865 - Deep Learning for Computer Vision and Remote Sensing, Exam

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**Competence Certificate**
Completed coursework according to SPO §4 (3). For the successful completion of work sheets, 50% of the achievable points are needed. More details will be clearly communicated in the exercises.

**Prerequisites**
none
7.21 Course: Deformation Processes [T-BGU-109404]

**Responsible:** Prof. Dr.-Ing. Hansjörg Kutterer
Dr. Malte Westerhaus

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

**Part of:** M-BGU-104536 - Geodetic Earth Observation

**Prerequisite for:** T-BGU-109288 - Geodetic Earth Observation, Examination

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**Events**

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

**Prerequisites**
None
7.22 Course: Elective Module - Subject, Body, Individual: the Other Side of Sustainability - Self Assignment BeNe [T-ZAK-112349]

Organisation:
Part of: M-ZAK-106099 - Supplementary Studies on Sustainable Development

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Competence Certificate
Examination of another kind according to § 7 section 7 in the form of a presentation in the selected course.

Prerequisites
Prerequisite for the ‘Oral Examination’ is the successful completion of Modules 1 and 3 and the required elective sections in Module 2.

Self service assignment of supplementary stdues
This course can be used for self service assignment of grade aquired from the following study providers:

- Zentrum für Angewandte Kulturwissenschaft und Studium Generale
- ZAK Begleitstudium

Recommendation
The content of the Basics Module is helpful.
### 7.23 Course: Elective Module - Sustainability Assessment of Technology - Self Assignment BeNe [T-ZAK-112348]

**Organisation:**
- **Part of:** M-ZAK-106099 - Supplementary Studies on Sustainable Development

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**Competence Certificate**
Examination of another kind according to § 7 section 7 in the form of a presentation in the selected course.

**Prerequisites**
Prerequisite for the ‘Oral Examination’ is the successful completion of Modules 1 and 3 and the required elective sections in Module 2.

**Self service assignment of supplementary studies**
This course can be used for self service assignment of grade acquired from the following study providers:

- Zentrum für Angewandte Kulturwissenschaft und Studium Generale
- ZAK Begleitstudium

**Recommendation**
The content of the Basics Module is helpful.
7.24 Course: Elective Module - Sustainability in Culture, Economy and Society - Self Assignment BeNe [T-ZAK-112350]

**Organisation:**
Part of: M-ZAK-106099 - Supplementary Studies on Sustainable Development

**Type**
Examination of another type

**Credits**
3

**Grading scale**
Grade to a third

**Version**
1

**Competence Certificate**
Examination of another kind according to § 7 section 7 in the form of a presentation in the selected course.

**Prerequisites**
Prerequisite for the ‘Oral Examination’ is the successful completion of Modules 1 and 3 and the required elective sections in Module 2.

**Self service assignment of supplementary studies**
This course can be used for self service assignment of grade acquired from the following study providers:

- Zentrum für Angewandte Kulturwissenschaft und Studium Generale
- ZAK Begleitstudium

**Recommendation**
The content of the Basics Module is helpful.
7.25 Course: Elective Module - Sustainable Cities and Neighbourhoods - Self Assignment BeNe [T-ZAK-112347]

**Organisation:** University

**Part of:** M-ZAK-106099 - Supplementary Studies on Sustainable Development

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**Competence Certificate**
Examination of another kind according to § 7 section 7 in the form of a presentation in the selected course.

**Prerequisites**
Prerequisite for the 'Oral Examination' is the successful completion of Modules 1 and 3 and the required elective sections in Module 2.

**Self service assignment of supplementary studies**
This course can be used for self service assignment of grade acquired from the following study providers:

- Zentrum für Angewandte Kulturwissenschaft und Studium Generale
- ZAK Begleitstudium

**Recommendation**
The content of the Basics Module is helpful.

**Responsible:** Prof. Dr.-Ing. Hansjörg Kutterer  
Dr. Kurt Seitz

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

**Part of:** M-BGU-104553 - Fundamentals of Environmental Geodesy

**Prerequisite for:**
- M-BGU-104537 - Advanced Gravity Field Modelling  
- T-BGU-109330 - Fundamentals of Environmental Geodesy, Examination

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**Competence Certificate**  
written scientific bulletin
## 7.27 Course: Fundamentals of Environmental Geodesy Part B [T-BGU-109329]

**Responsible:** Prof. Dr.-Ing. Hansjörg Kutterer  
Dr.-Ing. Michael Mayer  

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

**Part of:** M-BGU-104553 - Fundamentals of Environmental Geodesy  

**Prerequisite for:** T-BGU-109330 - Fundamentals of Environmental Geodesy, Examination

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### Events

| ST 2023 | 6020151 | Fundamentals of Environmental Geodesy - Part B | 2 SWS | Lecture / Practice ( / | Kutterer, Mayer |

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

**Competence Certificate**  
Successfully completed exercises; oral presentation

**Prerequisites**  
none
**7 Course: Fundamentals of Environmental Geodesy, Examination [T-BGU-109330]**

**Responsible:** Prof. Dr.-Ing. Hansjörg Kutterer  
Dr.-Ing. Michael Mayer  
Dr. Kurt Seitz

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

**Part of:** M-BGU-104553 - Fundamentals of Environmental Geodesy

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**Prerequisites**  
Successfully completed prerequisites of Fundamentals of Environmental Geodesy Part A and B

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

1. The course T-BGU-109328 - Fundamentals of Environmental Geodesy Part A must have been passed.
2. The course T-BGU-109329 - Fundamentals of Environmental Geodesy Part B must have been passed.
### 7.29 Course: GeoDB [T-BGU-101753]

**Responsible:** Prof. Dr. Martin Breunig  
**Organisation:** KIT Department of Civil Engineering, Geo and Environmental Sciences  
**Part of:** M-BGU-101041 - GeoDB

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

**Competence Certificate**  
Oral exam (about 20 min.) according § 4 para. 2 No. 2 SPO M.Sc. Geodäsie und Geoinformatik.

**Prerequisites**  
The part T-BGU-101754 - GeoDB, Vorleistung must be passed.

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

1. The course T-BGU-101754 - GeoDB, Prerequisite must have been passed.
7 COURSES

Course: GeoDB, Prerequisite [T-BGU-101754]

7.30 Course: GeoDB, Prerequisite [T-BGU-101754]

**Responsible:** Prof. Dr. Martin Breunig

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

**Part of:** M-BGU-101041 - GeoDB

**Prerequisite for:** T-BGU-101753 - GeoDB

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

**Prerequisites**

None
7.31 Course: Geodetic Application of SAR Interferometry [T-BGU-101711]

**Responsible:** Prof. Dr.-Ing. Stefan Hinz  
Dr. Malte Westerhaus

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

**Part of:** M-BGU-101037 - Geodetic Application of SAR Interferometry

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

**Competence Certificate**

Oral exam (about 20 min.) according § 4 para. 2 No. 2 SPO M.Sc. Geodäsie und Geoinformatik.

**Prerequisites**

The part T-BGU-103501 Geodetic Application of SAR Interferometry, Vorleistung must be passed.

**Modeled Conditions**

The following conditions have to be fulfilled:

1. The course T-BGU-103501 - Geodetic Application of SAR Interferometry, Prerequisite must have been passed.
# 7.32 Course: Geodetic Application of SAR Interferometry, Prerequisite [T-BGU-103501]

**Responsible:**  Prof. Dr.-Ing. Stefan Hinz  
Dr. Malte Westerhaus  

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

**Part of:**  M-BGU-101037 - Geodetic Application of SAR Interferometry  

**Prerequisite for:**  T-BGU-101711 - Geodetic Application of SAR Interferometry

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

**Competence Certificate**
The assessment consists of a coursework according § 4 para. 3 SPO M.Sc. Geodäsie und Geoinformatik. The students attend practical computer training and compile three scientific reports (length: approx. 10 pages). Depending on the number of participants, students either prepare, hold (duration: approx. 20 minutes) and defend (duration: approx. 10 minutes) a scientific presentation or compile a scientific report (length: approx. 15 pages).

**Prerequisites**
none

**Annotation**
Basic of SAR- and InSAR remote sensing are helpful.
7.33 Course: Geodetic Earth Observation, Examination [T-BGU-109288]

**Responsible:**  Prof. Dr.-Ing. Hansjörg Kutterer  
Dr. Kurt Seitz  
Dr. Malte Westerhaus

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

**Part of:**  M-BGU-104536 - Geodetic Earth Observation

**Type**  Oral examination  
**Credits**  1  
**Grading scale**  Grade to a third  
**Recurrence**  Each summer term  
**Version**  1

**Prerequisites**  
Successfully completed exercises

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

1. The course T-BGU-109287 - Mass Variations must have been passed.
2. The course T-BGU-109404 - Deformation Processes must have been passed.
7.34 Course: Geodetic Sensor Fusion, Examination [T-BGU-109344]

**Responsible:** Prof. Dr.-Ing. Hansjörg Kutterer

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

**Part of:** M-BGU-104561 - Geodetic Sensor Fusion

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**Competence Certificate**
oral (ca. 20 min.)

**Prerequisites**
None

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

1. The course T-BGU-109475 - Geodetic Sensor Fusion, Prerequisite must have been passed.
### Course: Geodetic Sensor Fusion, Prerequisite [T-BGU-109475]

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**Prerequisites**

None
### Course: Geoinformatics [T-BGU-101742]

**Responsible:** Prof. Dr. Martin Breunig  
**Organisation:** KIT Department of Civil Engineering, Geo and Environmental Sciences  
**Part of:** M-BGU-101011 - Geoinformatics

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

**Competence Certificate**  
The assessment consists of a oral exam (about 30 min.) according § 4 para. 2 No. 2 SPO M.Sc. Geodäsie und Geoinformatik.

**Prerequisites**  
The parts T-BGU-110321 - Geoinformatics, Prerequisite SoSe and T-BGU-110322 - Geoinformatics, Prerequisite WiSe must both be passed.

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

1. The course T-BGU-110321 - Geoinformatics, Prerequisite SoSe must have been passed.
2. The course T-BGU-110322 - Geoinformatics, Prerequisite WiSe must have been passed.
### 7.37 Course: Geoinformatics, Prerequisite SoSe [T-BGU-110321]

**Responsible:** Prof. Dr. Martin Breunig  
**Organisation:** KIT Department of Civil Engineering, Geo and Environmental Sciences  
**Part of:** M-BGU-101011 - Geoinformatics  
**Prerequisite for:** T-BGU-101742 - Geoinformatics

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**Competence Certificate**  
The assessment consists of a coursework according § 4 para. 3 SPO M.Sc. Geodäsie und Geoinformatik based on successfully completed exercises in Geoinformatics Part (B).

**Prerequisites**  
none
7.38 Course: Geoinformatics, Prerequisite WiSe [T-BGU-110322]

**Responsibility:** Prof. Dr. Martin Breunig

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

**Part of:** M-BGU-101011 - Geoinformatics

**Prerequisite for:** T-BGU-101742 - Geoinformatics

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**Competence Certificate**

The assessment consists of a coursework according § 4 para. 3 SPO M.Sc. Geodäsie und Geoinformatik based on successfully completed exercises in Geoinformatics Part (A).

**Prerequisites**

none
7.39 Course: Geometric Object Modelling in 2D, 3D and 4D [T-BGU-101707]

**Responsible:** Prof. Dr.-Ing. Stefan Hinz  
**Organisation:** KIT Department of Civil Engineering, Geo and Environmental Sciences  
**Part of:** M-BGU-101028 - Geometric Object Modelling in 2D, 3D and 4D

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

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

1. The course T-BGU-101708 - Geometric Object Modelling in 2D, 3D and 4D, Prerequisite must have been passed.
### 7.40 Course: Geometric Object Modelling in 2D, 3D and 4D, Prerequisite [T-BGU-101708]

**Responsible:** Prof. Dr.-Ing. Stefan Hinz  
**Organisation:** KIT Department of Civil Engineering, Geo and Environmental Sciences  
**Part of:** M-BGU-101028 - Geometric Object Modelling in 2D, 3D and 4D  
**Prerequisite for:** T-BGU-101707 - Geometric Object Modelling in 2D, 3D and 4D

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**Events**

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| ST 2023 | 6024209 | Geometric Object Modeling in 2D, 3D and 4D, Exercises | 1 SWS | Practice / 🗣 | Hinz, Ulrich |

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

**Prerequisites**

None
### Course: Hyperspectral Remote Sensing [T-BGU-101720]

**Responsible:** Dr.-Ing. Uwe Weidner  
**Organisation:** KIT Department of Civil Engineering, Geo and Environmental Sciences  
**Part of:** M-BGU-101051 - Hyperspectral Remote Sensing

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

**Competence Certificate**  
Oral exam (about 20 min.) according § 4 para. 2 No. 2 SPO M.Sc. Geodäsie und Geoinformatik.

**Prerequisites**  
The partial achievement T-BGU-101721 - Hyperspectral Remote Sensing, Prerequisite must be passed.

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

1. The course T-BGU-101721 - Hyperspectral Remote Sensing, Prerequisite must have been passed.

**Recommendation**  
Knowledge in multispectral remote sensing is recommended.

**Annotation**  
None
7.42 Course: Hyperspectral Remote Sensing, Prerequisite [T-BGU-101721]

Responsible: Dr.-Ing. Uwe Weidner
Organisation: KIT Department of Civil Engineering, Geo and Environmental Sciences
Part of: M-BGU-101051 - Hyperspectral Remote Sensing
Prerequisite for: T-BGU-101720 - Hyperspectral Remote Sensing

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Legend: 🖥 Online, 🪚 Blended (On-Site/Online), 🗣 On-Site, ☑️ Cancelled

Competence Certificate
The assessment consists of a coursework § 4 para. 3 SPO M.Sc. Geodäsie und Geoinformatik and is based on active participation in exercises and 5 min. presentation of recent paper related to a topic of the lecture. The detailed conditions will be announced in the lecture.

Prerequisites
None

Recommendation
None

Annotation
None
### 7.43 Course: In-depth Module - Doing Culture - Self Assignment BAK [T-ZAK-112655]

**Responsible:** Dr. Christine Mielke
Christine Myglas

**Organisation:**
Part of: M-ZAK-106235 - Supplementary Studies on Culture and Society

#### Type
Examination of another type

#### Credits
3

#### Grading scale
Grade to a third

#### Version
1

**Competence Certificate**
At least two presentations must be given: An examination of another kind according to § 5 section 3 (3) in the form of a presentation in one of the chosen courses (3 ECT).
In a third seminar, either (a) a presentation is held (preliminary study achievement) which remains not graded and a topic-related term paper is submitted or (b) a written exam is taken.
The three courses can be selected individually from the 5 thematic blocks or – in exceptional cases and according to the agreement with the responsible lecturer – all three courses can be selected from one block in the sense of a specialization.
In addition, an oral examination is taken, which relates to the content of two of the chosen three courses.

**Prerequisites**
Prerequisite for the ‘Oral Examination’ is the successful completion of Modules 1 and 3 and the required elective sections in Module 2.

**Self service assignment of supplementary stdues**
This course can be used for self service assignment of grade acquired from the following study providers:

- Zentrum für Angewandte Kulturwissenschaft und Studium Generale
- ZAK Begleitstudium

**Annotation**
The content of the Basic Modul is helpful.
7.44 Course: In-depth Module - Global Cultures - Self Assignment BAK [T-ZAK-112658]

**Responsible:** Dr. Christine Mielke
Christine Myglas

**Organisation:**
Part of: M-ZAK-106235 - Supplementary Studies on Culture and Society

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**Competition Certificate**
At least two presentations must be given: An examination of another kind according to § 5 section 3 (3) in the form of a presentation in one of the chosen courses (3 ECT).
In a third seminar, either (a) a presentation is held (preliminary study achievement) which remains not graded and a topic-related term paper is submitted or (b) a written exam is taken.
The three courses can be selected individually from the 5 thematic blocks or – in exceptional cases and according to the agreement with the responsible lecturer – all three courses can be selected from one block in the sense of a specialization.
In addition, an oral examination is taken, which relates to the content of two of the chosen three courses.

**Prerequisites**
Prerequisite for the ‘Oral Examination’ is the successful completion of Modules 1 and 3 and the required elective sections in Module 2.

**Self service assignment of supplementary studies**
This course can be used for self service assignment of grade acquired from the following study providers:

- Zentrum für Angewandte Kulturwissenschaft und Studium Generale
- ZAK Begleitstudium

**Annotation**
The content of the Basic Modul is helpful.
7.45 Course: In-depth Module - Media & Aesthetics - Self Assignment BAK [T-ZAK-112656]

**Responsible:** Dr. Christine Mielke
Christine Myglas

**Organisation:**
Part of: M-ZAK-106235 - Supplementary Studies on Culture and Society

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</table>

**Competence Certificate**
At least two presentations must be given: An examination of another kind according to § 5 section 3 (3) in the form of a presentation in one of the chosen courses (3 ECT).
In a third seminar, either (a) a presentation is held (preliminary study achievement) which remains not graded and a topic-related term paper is submitted or (b) a written exam is taken.
The three courses can be selected individually from the 5 thematic blocks or – in exceptional cases and according to the agreement with the responsible lecturer – all three courses can be selected from one block in the sense of a specialization.
In addition, an oral examination is taken, which relates to the content of two of the chosen three courses.

**Prerequisites**
Prerequisite for the ‘Oral Examination’ is the successful completion of Modules 1 and 3 and the required elective sections in Module 2.

**Self service assignment of supplementary stdues**
This course can be used for self service assignment of grade acquired from the following study providers:

- Zentrum für Angewandte Kulturwissenschaft und Studium Generale
- ZAK Begleitstudium

**Annotation**
The content of the Basic Modul is helpful.
### 7.46 Course: In-depth Module - Spheres of Life - Self Assignment BAK [T-ZAK-112657]

**Responsible:** Dr. Christine Mielke  
Christine Myglas

**Organisation:**  
Part of: M-ZAK-106235 - Supplementary Studies on Culture and Society

**Type**  
Examination of another type

**Credits**  
3

**Grading scale**  
Grade to a third

**Version**  
1

**Competence Certificate**  
At least two presentations must be given: An examination of another kind according to § 5 section 3 (3) in the form of a presentation in one of the chosen courses (3 ECT).  
In a third seminar, either (a) a presentation is held (preliminary study achievement) which remains not graded and a topic-related term paper is submitted or (b) a written exam is taken.  
The three courses can be selected individually from the 5 thematic blocks or – in exceptional cases and according to the agreement with the responsible lecturer – all three courses can be selected from one block in the sense of a specialization.  
In addition, an oral examination is taken, which relates to the content of two of the chosen three courses.

**Prerequisites**  
Prerequisite for the ‘Oral Examination’ is the successful completion of Modules 1 and 3 and the required elective sections in Module 2.

**Self service assignment of supplementary studies**  
This course can be used for self service assignment of grade acquired from the following study providers:

- Zentrum für Angewandte Kulturwissenschaft und Studium Generale
- ZAK Begleitstudium

**Annotation**  
The content of the Basic Modul is helpful.
7 COURSES

Course: In-depth Module - Technology & Responsibility - Self Assignment BAK [T-ZAK-112654]

7.47 Course: In-depth Module - Technology & Responsibility - Self Assignment BAK [T-ZAK-112654]

Responsible: Dr. Christine Mielke
Christine Myglas

Organisation:
Part of: M-ZAK-106235 - Supplementary Studies on Culture and Society

<table>
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Competence Certificate
At least two presentations must be given: An examination of another kind according to § 5 section 3 (3) in the form of a presentation in one of the chosen courses (3 ECT).
In a third seminar, either (a) a presentation is held (preliminary study achievement) which remains not graded and a topic-related term paper is submitted or (b) a written exam is taken.
The three courses can be selected individually from the 5 thematic blocks or – in exceptional cases and according to the agreement with the responsible lecturer – all three courses can be selected from one block in the sense of a specialization.
In addition, an oral examination is taken, which relates to the content of two of the chosen three courses.

Prerequisites
Prerequisite for the ‘Oral Examination’ is the successful completion of Modules 1 and 3 and the required elective sections in Module 2.

Self service assignment of supplementary stdues
This course can be used for self service assignment of grade acquired from the following study providers:

- Zentrum für Angewandte Kulturwissenschaft und Studium Generale
- ZAK Begleitstudium

Annotation
The content of the Basic Modul is helpful.
### 7.48 Course: Introduction to Matlab [T-BGU-106765]

**Responsible:** PD Dr.-Ing. Uwe Ehret  
**Organisation:** KIT Department of Civil Engineering, Geo and Environmental Sciences  
**Part of:** M-BGU-104530 - Scientific Programming

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<td>2 SWS</td>
<td>Lecture / Practice ( / )</td>
<td>Ehret, Wienhöfer</td>
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<td></td>
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</tbody>
</table>

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

**Competence Certificate**
Implementation of a Matlab code within a class exercise

**Prerequisites**
none

**Recommendation**
none

**Annotation**
The course is limited to 60 participants. Please register via the student portal (Studierendenportal). Only in case that this should not be possible: Please register via e-mail to the responsible lecturer. Participants are selected according to their progress of study considering the following order: students of Water Science and Engineering, then students of Civil Engineering with focus 'Water and Environment', then other students.
7.49 Course: Introduction to Python [T-BGU-112598]

**Responsible:** Prof. Dr. Jan Cermak  
Dr. Julia Fuchs

**Organisation:** KIT Department of Civil Engineering, Geo and Environmental Sciences  
Part of: M-BGU-106199 - Introduction to Python

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**Events**

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<th>Type</th>
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<td>2 SWS</td>
<td>Lecture / Practice /</td>
<td>Cermak</td>
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</table>

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

**Competence Certificate**
Successfully completed exercises focussing on implementation and documentation of a Python code.

**Prerequisites**
None

**Recommendation**
None

**Annotation**
The associated lecture is especially intended for students of the MSc Geodäsie und Geoinformatik and MSc Remote Sensing and Geoinformatics. External students may attend the course if there is sufficient capacity. External students communicate their individual interest to participate in this lecture at the latest one week before the start of the lectures via e-mail to anja.carle@kit.edu receive positive/ negative feedback regarding the possibility of participation.
7.50 Course: Lab Rotation I [T-BGU-109412]

Organisation: KIT Department of Civil Engineering, Geo and Environmental Sciences
Part of: M-BGU-104588 - Lab Rotation I

<table>
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<td>10</td>
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<td>Each term</td>
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</table>

Competence Certificate
Submission of Lab Rotation Report.
The student presents the content of the lab rotation report and answers related questions.

Prerequisites
at least 45 CP shall have been acquired before a lab rotation is started.

Modeled Conditions
The following conditions have to be fulfilled:

1. You need to have earned at least 45 credits in the following fields:
   - Key Competences
   - Mathematics and Beyond
   - Profiles
   - Remote Sensing
   - Supplementary Modules
7.51 Course: Lab Rotation II [T-BGU-109413]

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

**Part of:** M-BGU-104589 - Lab Rotation II

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**Competence Certificate**
Submission of Lab Rotation Report.
The student presents the content of the lab rotation report and answers related questions.

**Prerequisites**
At least 45 CP shall have been acquired before a lab rotation is started.

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

1. You need to have earned at least 45 credits in the following fields:
   - Key Competences
   - Mathematics and Beyond
   - Profiles
   - Remote Sensing
   - Supplementary Modules
7.52 Course: Mass Variations [T-BGU-109287]

**Responsible:** Prof. Dr.-Ing. Hansjörg Kutterer  
Dr. Kurt Seitz

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

**Part of:** M-BGU-104536 - Geodetic Earth Observation

**Prerequisite for:** T-BGU-109288 - Geodetic Earth Observation, Examination

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<td>pass/fail</td>
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**Prerequisites**
None
7.53 Course: Master's Thesis [T-BGU-109321]

**Responsible:** Prof. Dr. Jan Cermak

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

**Part of:** M-BGU-104549 - Master's Thesis

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<td>Each term</td>
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**Prerequisites**
At least 70 CP shall have been acquired before the master thesis is started.

**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
7.54 Course: Methods of Remote Sensing, Prerequisite [T-BGU-101759]

**Responsible:** Dr.-Ing. Uwe Weidner  
**Organisation:** KIT Department of Civil Engineering, Geo and Environmental Sciences  
**Part of:** M-BGU-104517 - Computer Vision and Remote Sensing  
**Prerequisite for:** T-BGU-109269 - Computer Vision and Remote Sensing, Examination

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<td>1 SWS</td>
<td>Lecture</td>
<td>Weidner</td>
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<td>/ 🗣 Weidner</td>
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Legend: 🖥 Online,  🎳 Blended (On-Site/Online), 🗣 On-Site, ⬇️ Cancelled

**Competence Certificate**  
Assessment of success is in the form of a coursework (§ 4 (3) SPO) based on active participation during exercises and performing a classification within the exercises. The exact conditions will be announced in the lecture.

**Prerequisites**  
none

**Recommendation**  
None

**Annotation**  
None
7.55 Course: Mobile GIS / Location Based Services, Prerequisite [T-BGU-101713]

**Responsible:** Prof. Dr. Martin Breunig
Dr.-Ing. Paul Vincent Kuper
Steven Landgraf

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

**Part of:** M-BGU-101045 - Mobile GIS / Location Based Services

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<td>3</td>
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| Events |  | Mobile GIS/Location Based Services | 1 SWS | Lecture / 🗣 | Breunig, Kuper, Landgraf |
|--------|  | Mobile GIS/Location Based Services, Exercises | 1 SWS | Practice / 🗣 | Kuper |

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

**Competence Certificate**
The control of success is carried out as an ungraded study achievement (§ 4 Abs. 3 SPO) based on the elaboration of exercise sheets (presentation:duration ca. 20 minutes / poster) during the lecture, further conditions will be announced in the lecture in detail.

**Prerequisites**
None

**Recommendation**
None

**Annotation**
None
7.56 Course: Numerical Mathematics, Exam [T-BGU-111175]

**Responsible:** Dr. rer. nat. Patrick Erik Bradley  
**Organisation:** KIT Department of Civil Engineering, Geo and Environmental Sciences  
**Part of:** M-BGU-101013 - Numerical Mathematics

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

**Competence Certificate**

The assessment consists of a written exam (duration 60 min.) according § 4 para. 2 No. 1 SPO M.Sc. Geodäsie und Geoinformatik resp. Remote Sensing and Geoinformatics.

**Prerequisites**

T-BGU-111174 – Numerical Mathematics, Prerequisite (Version 1)

**Modeled Conditions**

The following conditions have to be fulfilled:

1. The course T-BGU-111174 - Numerical Mathematics, Prerequisite must have been passed.
7.57 Course: Numerical Mathematics, Prerequisite [T-BGU-111174]

Responsible: Dr. rer. nat. Patrick Erik Bradley
Organisation: KIT Department of Civil Engineering, Geo and Environmental Sciences
Part of: M-BGU-101013 - Numerical Mathematics
Prerequisite for: T-BGU-111175 - Numerical Mathematics, Exam

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Events

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

Competence Certificate

The following prerequisites must be met in order to pass the assessment according to § 4 para. 3 1 SPO M.Sc. Geodäsie und Geoinformatik resp. M.Sc. Remote Sensing and Geoinformatics:

- At least 50% of the total score on the exercise sheets (incl. matlab tasks) must be achieved.
### 7.58 Course: Oral Exam - Supplementary Studies on Culture and Society [T-ZAK-112659]

**Responsible:** Dr. Christine Mielke  
Christine Myglas

**Organisation:**  
Part of: M-ZAK-106235 - Supplementary Studies on Culture and Society

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**Competence Certificate**  
An oral examination according to § 7 section 6 of approx. 45 minutes on the contents of two courses from In-depth Module.

**Prerequisites**  
Prerequisite for the ‘Oral Examination’ is the successful completion of Modules 1 and 3 and the required elective sections in Module 2.
7.59 Course: Oral Exam - Supplementary Studies on Sustainable Development [T-ZAK-112351]

**Organisation:**
Part of: M-ZAK-106099 - Supplementary Studies on Sustainable Development

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<td>Grade to a third</td>
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**Competence Certificate**
An oral examination according to § 7 section 6 of approx. 45 minutes on the contents of two courses from Elective Module.

**Prerequisites**
A requirement for the Supplementary Course: Oral examination is the successful completion of the modules Basics Module and Specialisation Module and the required electives of Elective Module.
### 7.60 Course: Practice Module [T-ZAK-112660]

**Responsible:** Dr. Christine Mielke  
Christine Myglas

**Organisation:**  
- **Part of:** M-ZAK-106235 - Supplementary Studies on Culture and Society

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<td>pass/fail</td>
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**Competence Certificate**

- Internship (3 ECT)
- Report within the framework of the practical training (Length approx. 18,000 characters (incl. spaces) (1 ECT)

**Prerequisites**

- none

**Annotation**

- Knowledge from the Basic Module and the Elective Module is helpful.
7.61 Course: Real Estate Valuation II [T-BGU-101660]

**Responsible:** Prof. Dr. Jan Cermak
Prof. Dr.-Ing. Erwin Drixler

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

**Part of:** M-BGU-101105 - Real Estate Valuation II

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**Prerequisites**

none
# Course: Recent Earth Observation Programs and Systems [T-BGU-103407]

**Responsible:** Dr.-Ing. Uwe Weidner  
**Organisation:** KIT Department of Civil Engineering, Geo and Environmental Sciences  
**Part of:** M-BGU-101765 - Recent Earth Observation Programs and Systems

<table>
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| Legend | Online, Blended (On-Site/Online), On-Site, C Cancelled |

**Competence Certificate**  
The assessment consists of an examination of another type according § 4 para. 2 No. 3 SPO M.Sc. Geodäsie und Geoinformatik. A short presentation (about 20-25 minutes) including a discussion about a given topic is the basis for the grading.

**Prerequisites**  
None

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

1. The following conditions have to be fulfilled:

**Recommendation**  
None

**Annotation**  
Knowledge of sensors and applications in remote sensing are recommended.
### 7.63 Course: Remote Sensing of Aerosols and Clouds, Prerequisite [T-BGU-111184]

**Responsible:** Prof. Dr. Jan Cermak  
**Organisation:** KIT Department of Civil Engineering, Geo and Environmental Sciences  
**Part of:** M-BGU-104532 - Remote Sensing of Atmospheric Temperature, Trace Gases, Clouds and Aerosols  
**Prerequisite for:** T-BGU-109282 - Remote Sensing of Atmospheric Temperature, Trace Gases, Clouds and Aerosols, Examination

<table>
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<th>Recurrence</th>
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<td>pass/fail</td>
<td>Each summer term</td>
<td>1 terms</td>
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**Prerequisites**
None
### 7.64 Course: Remote Sensing of Atmospheric Temperature, Trace Gases, Clouds and Aerosols, Examination [T-BGU-109282]

| **Responsible:** | Prof. Dr. Jan Cermak  
apl. Prof. Dr. Thomas Clarmann von Clarenau |
| **Organisation:** | KIT Department of Civil Engineering, Geo and Environmental Sciences |
| **Part of:** | M-BGU-104532 - Remote Sensing of Atmospheric Temperature, Trace Gases, Clouds and Aerosols |
| **Type** | Oral examination |
| **Credits** | 4 |
| **Grading scale** | Grade to a third |
| **Recurrence** | Each term |
| **Version** | 2 |

**Competence Certificate**
oral (ca. 30 min.)

**Prerequisites**
Successful completion of exercise of course 2

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

1. The course T-BGU-111184 - Remote Sensing of Aerosols and Clouds, Prerequisite must have been passed.
**7.65 Course: Remote Sensing of the Atmosphere, Examination [T-BGU-109274]**

**Responsible:** Prof. Dr. Jan Cermak  
**Organisation:** KIT Department of Civil Engineering, Geo and Environmental Sciences  
**Part of:** M-BGU-104524 - Remote Sensing of the Atmosphere

### Type
- Oral examination

### Credits
- 3

### Grading scale
- Grade to a third

### Recurrence
- Each term

### Version
- 4

**Competence Certificate**
- Oral (ca. 20 min.)

**Prerequisites**
- None

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

1. The course T-BGU-110304 - Satellite Climatology: Remote Sensing of a Changing Climate, Prerequisite must have been passed.
2. The course T-BGU-111185 - Atmospheric Remote Sensing Infrastructures, Prerequisite must have been passed.

**Annotation**
- If there are more than 15 students participating in this exam, there will be a written exam (duration: 90 minutes).
7.66 Course: SAR and InSAR Remote Sensing, Examination [T-BGU-109410]

**Responsible:** Prof. Dr.-Ing. Stefan Hinz  
Dr. Malte Westerhaus

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

**Part of:** M-BGU-104586 - SAR and InSAR Remote Sensing

<table>
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**Competence Certificate**
oral (ca. 20 min.).

**Prerequisites**
Prerequisite in SAR and InSAR Remote Sensing

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

1. **The course T-BGU-109409 - SAR and InSAR Remote Sensing, Prerequisite** must have been passed.
## 7.67 Course: SAR and InSAR Remote Sensing, Prerequisite [T-BGU-109409]

| Responsible:     | Prof. Dr.-Ing. Stefan Hinz  
| Dr. Malte Westerhaus |
| Organisation:    | KIT Department of Civil Engineering, Geo and Environmental Sciences |
| Part of:         | M-BGU-104586 - SAR and InSAR Remote Sensing |
| Prerequisite for:| T-BGU-109410 - SAR and InSAR Remote Sensing, Examination |

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**7.68 Course: Satellite Climatology: Remote Sensing of a Changing Climate, Prerequisite [T-BGU-110304]**

**Responsible:** Prof. Dr. Jan Cermak  
**Organisation:** KIT Department of Civil Engineering, Geo and Environmental Sciences  
**Prerequisite for:** T-BGU-109274 - Remote Sensing of the Atmosphere, Examination

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**Events**

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<td>Satellite Climatology: Remote Sensing of a Changing Climate, Exercises</td>
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**Legend:** 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

**Competence Certificate**

Elaboration (data analysis and evaluation) in the form of a commented Jupyter notebook. Success is assessed in the form of a coursework (§ 4 (3) SPO). The detailed conditions will be announced in the lecture.

**Prerequisites**

The parts T-BGU-106333 - Remote Sensing of a Changing Climate, Vorleistung and T-BGU-101732 - Image Processing and Computer Vision must not have started.
7.69 Course: Scientific Applications of GNSS, Examination [T-BGU-109349]

**Responsible:** Dr.-Ing. Michael Mayer

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

**Part of:** M-BGU-104566 - Scientific Applications of GNSS

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**Competence Certificate**
other according to SPO RSGI x4/2

**Prerequisites**
None
7.70 Course: SelfAssignment-MScRSGI-1-graded [T-BGU-111706]

Organisation: KIT Department of Civil Engineering, Geo and Environmental Sciences
Part of: M-BGU-104711 - Further Key Competences

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Competence Certificate
according to the assignment to be credited

Prerequisites
none

Self service assignment of supplementary stdues
This course can be used for self service assignment of grade aquired from the following study providers:

- House of Competence
- Sprachenzentrum
- Zentrum für Angewandte Kulturwissenschaft und Studium Generale
- Studienkolleg
- Personalentwicklung und Berufliche Ausbildung

Recommendation
none

Annotation
'Not assigned grades' can be assigned by the students themselves; title and credit points of the grades are transferred.
7.71 Course: SelfAssignment-MScRSGI-2-graded [T-BGU-111707]

Organisation: KIT Department of Civil Engineering, Geo and Environmental Sciences
Part of: M-BGU-104711 - Further Key Competences

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Competence Certificate
according to the assignment to be credited

Prerequisites
none

Self service assignment of supplementary stdues
This course can be used for self service assignment of grade acquired from the following study providers:

- House of Competence
- Sprachenzentrum
- Zentrum für Angewandte Kulturwissenschaft und Studium Generale
- Studienkolleg
- Personalentwicklung und Berufliche Ausbildung

Recommendation
none

Annotation
'Not assigned grades' can be assigned by the students themselves; title and credit points of the grades are transferred.
7.72 Course: SelfAssignment-MScRSGI-3-ungraded [T-BGU-111708]

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

**Part of:** M-BGU-104711 - Further Key Competences

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**Competence Certificate**
according to the assignment to be credited

**Prerequisites**
none

**Self service assignment of supplementary stdues**
This course can be used for self service assignment of grade aquired from the following study providers:

- House of Competence
- Sprachenzentrum
- Zentrum für Angewandte Kulturwissenschaft und Studium Generale
- Studienkolleg
- Personalentwicklung und Berufliche Ausbildung

**Recommendation**
none

**Annotation**
'Not assigned achievements' can be assigned by the students themselves; title and credit points of the grades are transferred.
### 7.73 Course: SelfAssignment-MScRSGI-4-ungraded [T-BGU-111709]

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**Competence Certificate**
- according to the assignment to be credited

**Prerequisites**
- none

**Self service assignment of supplementary stdues**
- This course can be used for self service assignment of grade aquired from the following study providers:
  - House of Competence
  - Sprachenzentrum
  - Zentrum für Angewandte Kulturwissenschaft und Studium Generale
  - Studienkolleg
  - Personalentwicklung und Berufliche Ausbildung

**Recommendation**
- none

**Annotation**
- 'Not assigned achievements' can be assigned by the students themselves; title and credit points of the grades are transferred.
Competence Certificate
The assessment consists in the independent thorough scientific treatment of a recent research topic within the field of Earth system observation. Starting from a seminal article in a scientific journal the student acquires new topical competences and presents these in a didactically adequate manner, e.g. as an oral presentation of 20-25 minutes to the other students and the scientific staff. It follows a defense of the content of the presentation. Further, active participation in seminar events of this module is compulsory (e.g., documented attendance at six presentations, 1/2 page each, obligatory criterion). The grade is determined based on:

- correctness & selection of presented information (30%)
- keeping in time (obligatory criterion)
- performance in discussion (20%)
- presentation in accordance with checklist (30%)
- scientific work during the preparation phase (10%)
- 2 page abstract of own topic (10%)
- active participating in discussion wrt (at least 1) presentation of other students (obligatory)

Prerequisites
none
7.75 Course: Seminar Topics of Image Analysis [T-BGU-101725]

**Responsible:** Dr. Susanne Benz
Prof. Dr.-Ing. Stefan Hinz

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

Part of: M-BGU-101057 - Seminar Topics of Image Analysis

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**Competence Certificate**
The assessment consists of a oral exam (about 20 min.) according § 4 para. 2 No. 2 SPO M.Sc. Geodäsie und Geoinformatik. A short presentation (about 20-25 minutes) including a discussion about a given topic is the basis for the grading. In addition, active participation in discussion of topics presented by other participants will be considered.

**Prerequisites**
none
### 7.76 Course: Seminar Topics of Remote Sensing [T-BGU-101722]

**Responsible:** Dr.-Ing. Uwe Weidner  
**Organisation:** KIT Department of Civil Engineering, Geo and Environmental Sciences  
**Part of:** M-BGU-101054 - Seminar Topics of Remote Sensing

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<td>Each summer term</td>
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**Competence Certificate**
The assessment consists of an examination of another type according § 4 para. 2 No. 3 SPO M.Sc. Geodäsie und Geoinformatik. A short presentation (about 20-25 minutes) including a discussion about a given topic is the basis for the grading. Details will be provided at beginning of seminar.

**Prerequisites**  
None

**Recommendation**  
None

**Annotation**  
Knowledge of fundamentals in remote sensing sensors is recommended.
### 7.77 Course: Specialisation Module - Self Assignment BeNe [T-ZAK-112346]

**Responsible:** Christine Myglas  
**Organisation:** Part of: M-ZAK-106099 - Supplementary Studies on Sustainable Development

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**Competence Certificate**

The monitoring occurs in the form of several supplementary courses, which usually comprise a presentation of the (group) project, a written elaboration of the (group) project as well as an individual term paper, if necessary with appendices (examination performances of other kind according to statutes § 5 section 3 No. 3 or § 7 section 7). The presentation is usually with the accompanying practice partners, as well as the written paper.

**Prerequisites**

Active participation in all three mandatory components.

**Self service assignment of supplementary studies**

This course can be used for self service assignment of grade acquired from the following study providers:

- Zentrum für Angewandte Kulturwissenschaft und Studium Generale
- ZAK Begleitstudium

**Recommendation**

Knowledge from ‘Basic Module’ and ‘Elective Module’ is helpful.
**7.78 Course: Tomographic Laser- and Radar Sensing [T-BGU-101723]**

**Responsible:** Prof. Dr.-Ing. Stefan Hinz  
Dr.-Ing. Andreas Schenk  

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

**Part of:** M-BGU-101052 - Tomographic Laser- and Radar Sensing  

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

**Competence Certificate**  
Oral exam (about 20 min.) according § 4 para. 2 No. 2 SPO M.Sc. Geodäsie und Geoinformatik.

**Prerequisites**  
The part T-BGU-101724 Tomographic Laser- and Radar Sensing, Prerequisite must be passed.

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

1. The course T-BGU-101724 - Tomographic Laser- and Radar Sensing, Prerequisite must have been passed.
### 7.79 Course: Tomographic Laser- and Radar Sensing, Prerequisite [T-BGU-101724]

**Responsible:** Prof. Dr.-Ing. Stefan Hinz  
Dr.-Ing. Andreas Schenk

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

**Part of:** M-BGU-101052 - Tomographic Laser- and Radar Sensing

**Prerequisite for:** T-BGU-101723 - Tomographic Laser- and Radar Sensing

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

**Competence Certificate**

The assessment consists of a coursework § 4 para. 3 SPO M.Sc. Geodäsie und Geoinformatik based on elaboration of one exercise sheet, a short presentation of a publication (10 min.), project word and presentation of the preproject work (10 min. incl. discussion). The detailed conditions will be announced in the lecture.

**Prerequisites**

None

**Recommendation**

None

**Annotation**

None
7.80 Course: Visualization of Geodata in 2D, 3D and 4D [T-BGU-101702]

**Responsible:** Dr.-Ing. Sven Wursthorn

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

**Part of:** M-BGU-101021 - Visualization of Geodata in 2D, 3D and 4D

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**Events**

| ST 2023 | 6043206 | Visualization of Geodatas in 2D, 3D and 4D | 1 SWS | Lecture / 🗣️ | Wursthorn |
| ST 2023 | 6043207 | Visualization of Geodatas in 2D, 3D and 4D, Exercises | 1 SWS | Practice / 🗣️ | Wursthorn |

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

**Competence Certificate**

Oral exam (about 20 min.) according § 4 para. 2 No. 2 SPO M.Sc. Geodäsie und Geoinformatik.

**Prerequisites**

The part T-BGU-101703 Visualisierung von Geodaten in 2D, 3D und 4D, Vorleistung must be passed.
7.81 Course: Visualization of Geodata in 2D, 3D and 4D, Prerequisite [T-BGU-101703]

**Responsible:** Dr.-Ing. Sven Wursthorn  
**Organisation:** KIT Department of Civil Engineering, Geo and Environmental Sciences  
**Part of:** M-BGU-101021 - Visualization of Geodata in 2D, 3D and 4D

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

**Competence Certificate**

The assessment consists of a coursework § 4 para. 3 SPO M.Sc. Geodäsie und Geoinformatik based on elaborations of exercise sheets. The detailed conditions will be announced in the lecture.

**Prerequisites**

None

**Recommendation**

None

**Annotation**

None
### 7.82 Course: Wildcard 1 Profile 1 [T-BGU-109066]

**Organisation:** University  
**Part of:** M-BGU-104436 - Module Wildcard 1 Profile ComVisGeoinf

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Remote Sensing and Geoinformatics Master 2018 (Master of Science (M.Sc.))  
Module Handbook as of 27/11/2023
### 7.83 Course: Wildcard 1 Profile 2 [T-BGU-109068]

**Organisation:** University  
**Part of:** M-BGU-104437 - Module Wildcard 1 Profile ComVisRemSen

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### 7.84 Course: Wildcard 1 Profile 3 [T-BGU-109070]

**Organisation:** University  
**Part of:** M-BGU-104438 - Module Wildcard 1 Profile ComVisEnvGeo

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7.85 Course: Wildcard 1 Profile 4 [T-BGU-109072]

Organisation: University
Part of: M-BGU-104439 - Module Wildcard 1 Profile GeoinfRemS

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### 7.86 Course: Wildcard 1 Profile 5 [T-BGU-109074]

**Organisation:** University  
**Part of:** M-BGU-104440 - Module Wildcard 1 Profile GeoinfEnvGeo

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### 7.87 Course: Wildcard 1 Profile 6 [T-BGU-109076]

**Organisation:** University  
**Part of:** M-BGU-104441 - Module Wildcard 1 Profile RemSenEnvGeo

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### 7.88 Course: Wildcard 1.1 Supplementary Modules [T-BGU-110049]

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7.89 Course: Wildcard 2 Profile 1 [T-BGU-109067]

Organisation: University
Part of: M-BGU-104436 - Module Wildcard 1 Profile ComVisGeoinf

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### 7.90 Course: Wildcard 2 Profile 2 [T-BGU-109069]

**Organisation:** University  
**Part of:** M-BGU-104437 - Module Wildcard 1 Profile ComVisRemSen

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Organisation: University
Part of: M-BGU-104438 - Module Wildcard 1 Profile ComVisEnvGeo
### 7.92 Course: Wildcard 2 Profile 4 [T-BGU-109073]

**Organisation:** University  
**Part of:** M-BGU-104439 - Module Wildcard 1 Profile GeoinfRemS

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### 7.93 Course: Wildcard 2 Profile 5 [T-BGU-109075]

**Organisation:** University  
**Part of:** M-BGU-104440 - Module Wildcard 1 Profile GeoinfEnvGeo

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## 7.94 Course: Wildcard 2 Profile 6 [T-BGU-109077]

**Organisation:** University  
**Part of:** M-BGU-104441 - Module Wildcard 1 Profile RemSenEnvGeo

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7.95 Course: Wildcard Additional Examinations 1 [T-BGU-109599]

Organisation: KIT Department of Civil Engineering, Geo and Environmental Sciences
Part of: M-BGU-104713 - Further Examinations

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7.97 Course: Wildcard Further Key Competences 1 ub [T-BGU-109594]

Organisation: University
Part of: M-BGU-104711 - Further Key Competences
M-BGU-104712 - Further Key Competences

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### T.98 Course: Wildcard Further Key Competences 2 ub [T-BGU-109595]

**Organisation:** University  
**Part of:**  
- M-BGU-104711 - Further Key Competences  
- M-BGU-104712 - Further Key Competences

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### 7.99 Course: Wildcard Further Key Competences 3 ub [T-BGU-109596]

- **Organisation:** University
- **Part of:** M-BGU-104711 - Further Key Competences

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### Course: Wildcard Further Key Competences 4 ub [T-BGU-109597]

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7.101 Course: Wildcard Further Key Competences 5 [T-BGU-111648]

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

Part of: M-BGU-104711 - Further Key Competences
       M-BGU-104712 - Further Key Competences

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7.102 Course: Wildcard Further Key Competences 6 [T-BGU-111649]

Organisation: University
Part of: M-BGU-104711 - Further Key Competences
              M-BGU-104712 - Further Key Competences

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**Organisation:** University

**Part of:** M-BGU-104943 - Wildcard Key Competences 1
### 7.104 Course: Wildcard Further Key Competences 8 [T-BGU-111651]

**Organisation:** University  
**Part of:** M-BGU-104943 - Wildcard Key Competences 1

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### 7.105 Course: Wildcard Key Competences 1.1 ub [T-BGU-110047]

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7.106 Course: Wildcard Key Competences 1.2 ub [T-BGU-110048]

Organisation: University
Part of: M-BGU-104943 - Wildcard Key Competences 1

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Chapter 8

Contacts

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For office hours see http://www.bgu.kit.edu/studiengangservice.php
email: studiengangservice@bgu.kit.edu; web: http://www.bgu.kit.edu/studiengangservice.php

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