Karlsruher Institut für Technologie

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

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KIT DEPARTMENT OF CIVIL ENGINEERING, GEO AND ENVIRONMENTAL SCIENCES

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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.

Editor:
KIT-Department of Civil Engineering, Geo and Environmental Sciences
Karlsruhe Institute of Technology (KIT)
76128 Karlsruhe
Institute of Photogrammetry and Remote Sensing (IPF)
Geodetic Institute (GIK)
Contact: michael.mayer@kit.edu

Chapter 2

Contents and Structure of the Master Program

2.1 The Master Program

The purpose of the master's degree program "Remote Sening and Geoinformatics" offered by the Karslruhe 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

Topic: **Remote Sensing**			
Module		CP	Examination mode
RSGI-MRCR	Computer Vision and Remote Sensing	8	oral, graded
GEOD-MAGI-2	Geoinformatics	5	oral, graded
RSGI-MRRA	Remote Sensing of the Atmosphere	5	oral, graded
RSGI-MRFE	Fundamentals of Environmental Geodesy	5	oral, graded

Topic: **Mathematics and Beyond**			
Module		CP	Examination mode
GEOD-MANM-2	Numerical Mathematics	6	written, graded
RSGI-MMCM-2	Basics of Estimation Theory and its Application in Geoscience Remote Sensing Projects	6	oral, graded
In addition, within the compulsory module 'Scientific Programming' a total of 3 or more CPs have to be acquired.			
RSGI-MMCE-1	Scientific Programming	3	not graded
RSGI-MMCE-2	Dummy[1]	3	tbd[2]

[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'.

Topic: **Profiles** (Choice of 1 out of 6)			
Module		CP	Examination mode
1: Computer Vision and Geoinformatics	2 compulsory modules plus ~ 3 compulsory elective modules	20	see module description
2: Computer Vision and Remote Sensing of the Atmosphere	2 compulsory modules plus ~ 3 compulsory elective modules	20	see module description
3: Computer Vision and Environmental Geodesy	2 compulsory modules plus ~ 4 compulsory elective modules	20	see module description
4: Geoinformatics and Remote Sensing of the Atmosphere	2 compulsory modules plus ~ 3 compulsory elective modules	20	see module description
5: Geoinformatics and Environmental Geodesy	2 compulsory modules plus ~ 3 compulsory elective modules	20	see module description
6: Remote Sensing of the Atmosphere and Environmental Geodesy	2 compulsory modules plus ~ 3 compulsory elective modules	20	see module description

In each profile, the required number of CPs is 10 for compulsory modules and 10 for compulsory elective modules.

Topic: **Supplementary Modules**			
Module		CP	Examination mode
Choice of modules summing up to 8 CP	$\sim 2-4$ elective modules	8	see module description

Topic: **Key Competences**			
Module		CP	Examination mode
Choice of modules summing up to 4 CP	~ 2 elective modules	4	see module description

Topic: **Lab Rotation**			
Module		CP	Examination mode
Choice of 2 Lab Rotations	2×10 CP	20	other according to SPO RSGI §4/2

Topic: **Master Thesis**			
Module		CP	Examination mode
Master Thesis	6 months	30	Thesis

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.

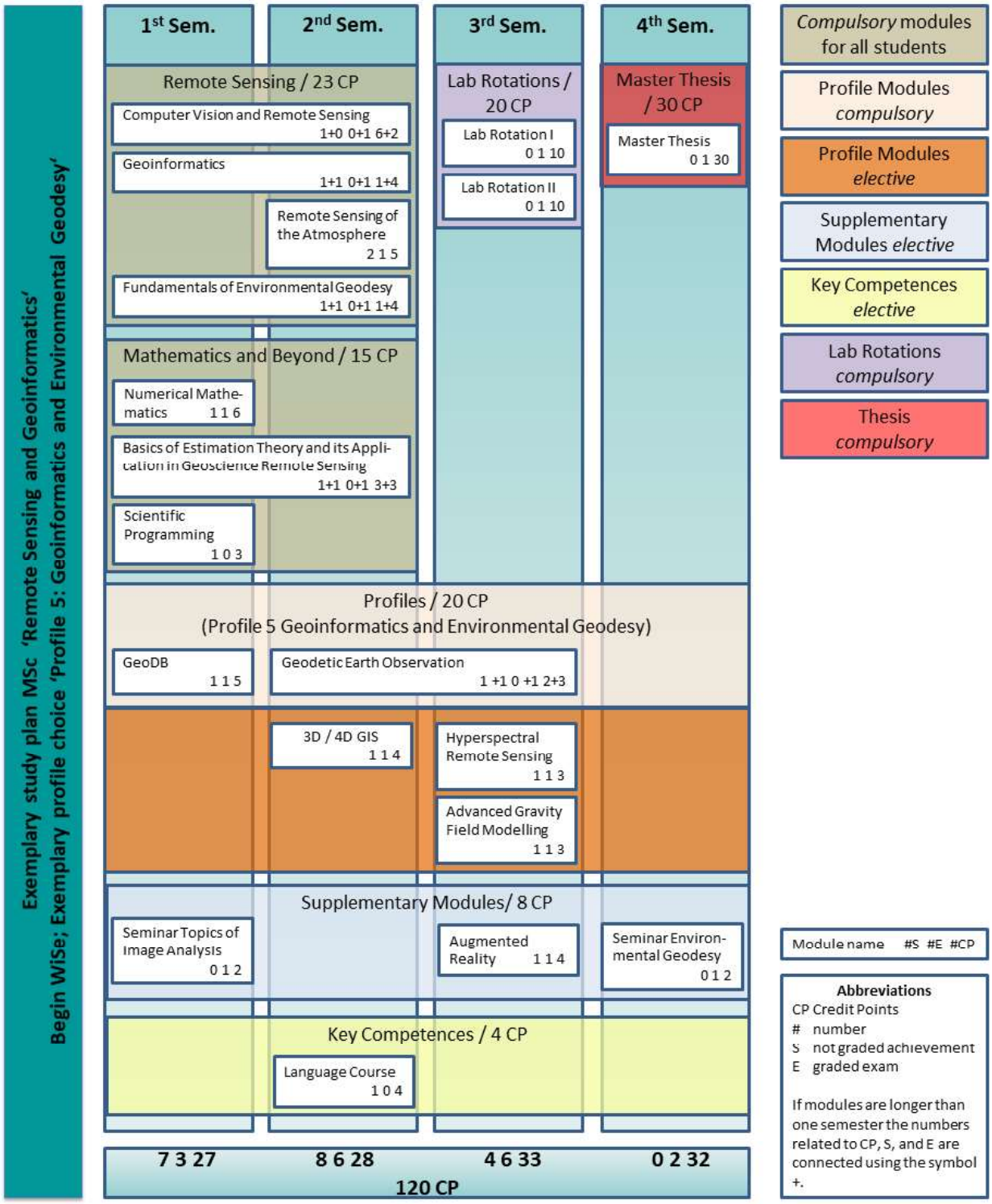
2.5.3 Study abroad during the programme

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 counseller 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 counseller 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 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



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: Qualifikationszielnummer

DQR	QZ-Nr.	Qualification targets on program level	Module
Subject-specific competences “Knowledge and Understanding”			
Subject-specific competence: broadening of knowledge	1	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	all
	2	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	all

		scientists.	
Subject-specific competence: deepening of knowledge	3	Based on broad basic knowledge the degree holder can identify, describe and tackle advanced scientific questions with innovation potential in the given subject area.	all, particularly modules of the profiles
	4	The student has actively developed the ability to methodically explore knowledge sources, is thus capable to acquaint themselves with advanced research problems.	all seminars lab rotations master thesis
Instrumental competence	5	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.	lab rotations master thesis
	6	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.	seminars lab rotations master thesis
	7	The student has the ability to put the knowledge gained to work both in their own field as well as in an interdisciplinary context.	all
System Competence	8	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.	all, particularly seminars
	9	The student can familiarize themselves independently with current research topics and complex problems and thoroughly analyze, interpret and evaluate them.	seminars lab rotations master thesis
	10	The student has the ability to develop and implement concepts to tackle problems.	seminars lab rotations master thesis
	11	The student classifies subject-specific and interdisciplinary tasks and identifies adequate methods of measurement, data analysis and data processing as well as data characterization.	lab rotations master thesis
	12	The student is able to extensively document, complile, illustrate and interpret results in a targeted manner.	seminars lab rotations scientific writing master thesis

	13	In the application of the topical knowledge the student considers societal, scientific and ethical aspects.	all
Communication skills	14	The student has the ability to work both independently or in teams and can take leadership in interdisciplinary projects.	projects lab rotations master thesis
	15	The student can thoroughly explore technical literature in the English language.	all
	16	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.	seminars

Chapter 4

Overview Over the Courses of the Modules and Modes of Examination

4.1 Remote Sensing

All modules are compulsory							
Module	Course No	Course	Sem.	Contact hours	CP	Condition for admission to examination	Examination type and duration
Computer Vision and Remote Sensing RSGI-MRCR	6048101/ 6048102	Methods of Remote Sensing	WS	1+1	3	Yes: Successful participation in exercise	oral ∼40 min.
	6042101/ 6042102	Image Processing and Computer Vision	WS	2+1	3	No	
	6042201	Sensors and Signals in Computer Vision and Remote Sensing	SS	2+0	2	No	
Geo-informatics GEOD-MAGI-2	6022105/ 6022106	Geoinformatics Part A	WS	1+1	5	Yes: Successful participation in both exercises	oral ∼30 min.
	6022205/ 6022206	Geoinformatics Part B	SS	1+1			
Remote Sensing of the Atmosphere RSGI-MRRA	6043106/ 6043107	Satellite Climatology: Remote Sensing of a Changing Climate	SS	2+1	3	Yes: Successful participation in both exercises	oral ∼20 min.
	6020247	Atmospheric Remote Sensing Infrastructures	SS	1	2		
Fundamentals of Environmental Geodesy RSGI-MRFE	6021201/ 6021202	Fundamentals of Environmental Geodesy Part A	WS	1+1	5	Yes: Successful participation in both exercises	oral ∼30 min.
	6020150	Fundamentals of Environmental Geodesy Part B	SS	1+1			

4.2 Mathematics and Beyond

Module	Course No	Course	Sem.	contact hours	CP	Condition for Admission to Examination	Examination Type and Duration
All modules are compulsory; particular courses within 'Scientific Programming' are elective							
Numerical Mathematics GEOD-MANM-2	6062101/ 6062102	Numerical Mathematics	WS	3+1	6	Yes: Successful participation in exercises	written 60 min.
Basics of Estimation Theory and its Application in Geoscience Remote Sensing RSGI-MMCM-2	6022208	Basics of Estimation Theory	SS	1+1	3	Yes: Successfully participation in both exercises	oral ∼30 min.
	6043210/ 6043211	Data Analysis in Geoscience Remote Sensing Projects	WS	1+2	3		
Scientific Programming RSGI-MMCE-1	6224907	Introduction to Matlab	WS	2	3	course achievement	not graded

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.

4.3.1 Profile: Computer Vision and Geoinformatics

Module	Course No	Course	Sem.	Contact hours	CP	Condition for admission to examination	Examination type and duration
RSGI-M-P-CV							
Compulsory Modules							
Advanced Topics in Computer Vision RSGI-MPCV-1	6042103	Advanced Topics in Computer Vision	WS	4	5	Yes: Successful participation in exercises	oral $\sim$ 20 min
GeoDB GEOD-MPGI-1	6026101/ 6026102	GeoDB	WS	2+1	5	Yes: Successful participation in exercises	oral $\sim$ 20 min.
Compulsory Elective Modules							
Seminar Topics of Image Analysis GEOD-MWEB-1	6042201	Seminar Topics of Image Analysis	WS	1+0	2	No	oral $\sim$ 20 min
Active Sensors for Computer Vision GEOD-MWEB-3	6043205	Active Sensors for Computer Vision	SS	2+0	3	No	oral $\sim$ 20 min
Tomographic Laser- and Radar Sensing GEOD-MWCV-8	6043212/ 6043213	Tomographic Laser- and Radar Sensing	SS	1+1	3	Yes: Successful Participation In Exercise	oral $\sim$ 20 min
Augmented Reality GEOD-MWGI-8	6026107/ 6026108	Augmented Reality	WS	1+2	4	Yes: Successful Participation In Exercise	oral $\sim$ 20 min
3D / 4D GIS GEOD-MPGI-2	6026201/ 6026202	3D / 4D GIS	SS	2+1	4	Yes: Successful participation in exercises	oral $\sim$ 20 min.
Mobile GIS / Location Based Services GEOD-MWGI-2	6026206/ 6026207	Mobile GIS / Location Based Services	SS	1+1	3	Yes: Successful participation in exercises	oral $\sim$ 20 min.
Deep Learning for Computer Vision and Remote Sensing GEOD-MWCV-12	6041202/ 6041203	Deep Learning for Computer Vision and Remote Sensing	SS	2+2	5	Yes: Successful participation in exercises	oral $\sim$ 30 min.

4.3.2 Profile: Computer Vision and Remote Sensing of the Atmosphere

Module	Course No	Course	Sem.	Contact hours	CP	Condition for admission to examination	Examination type and duration
RSGI-M-P-CV							
Compulsory Modules							
Advanced Topics in Computer Vision RSGI-MPCV-1	6042103	Advanced Topics in Computer Vision	WS	4	5	Yes: Successful participation in exercises	oral $\sim$ 20 min
Remote Sensing of Atmospheric Temperature, Trace Gases, Clouds, and Aerosols RSGI-MPRA	6042202	Passive Remote Sensing of Atmospheric Temperature and Composition	WS	1.5+ 0.5	2	Yes: Successful participation in exercises of course 2	oral ~ 30 min.
	6020250	Remote Sensing of Aerosols and Clouds	SS	1+1	3		
Compulsory Elective Modules							
Seminar Topics of Image Analysis GEOD-MWEB-1	6042201	Seminar Topics of Image Analysis	WS	1+0	2	No	oral $\sim$ 20 min
Active Sensors for Computer Vision GEOD-MWEB-3	6043205	Active Sensors for Computer Vision	SS	2+0	3	No	oral $\sim$ 20 min
Tomographic Laser- and Radar Sensing GEOD-MWCV-8	6043212/ 6043213	Tomographic Laser- and Radar Sensing	SS	1+1	3	Yes: Successful Participation In Exercise	oral $\sim$ 20 min
Augmented Reality GEOD-MWGI-8	6026107/ 6026108	Augmented Reality	WS	1+2	4	Yes: Successful Participation In Exercise	oral $\sim$ 20 min
Deep Learning for Computer Vision and Remote Sensing GEOD-MWCV-12	6041202/ 6041203	Deep Learning for Computer Vision and Remote Sensing	SS	2+2	5	Yes: Successful participation in exercises	oral ~ 30 min.

Module	Course No	Course	Sem.	Contact hours	CP	Condition for admission to examination	Examination type and duration
Compulsory Elective Modules continued							
Atmospheric Spectroscopy and Middle Atmospheric Research RSGI-MPRA-3		Atmospheric Spectroscopic Measurements	SS	2	2	No	oral ~ 30 min.
	4052071	Atmospheric Radiation	SS	2	2		

4.3.3 Profile: Computer Vision and Environmental Geodesy

Module	Course No	Course	Sem.	Contact hours	CP	Condition for admission to examination	Examination type and duration
RSGI-M-P-CV							
Compulsory Modules							
Advanced Topics in Computer Vision RSGI-MPCV-1	6042103	Advanced Topics in Computer Vision	WS	4	5	Yes: Successful participation in exercises	oral $\sim$ 20 min
Geodetic Earth Observation RSGI-MPEG-1	6042204	Mass Variations	WS	1+1	5	Yes: Successful participation in both exercises	oral ~ 30 min.
	6019404	Deformation Processes	SS	1+1			
Compulsory Elective Modules							
Seminar Topics of Image Analysis GEOD-MWEB-1	6042201	Seminar Topics of Image Analysis	WS	1+0	2	No	oral $\sim$ 20 min
Active Sensors for Computer Vision GEOD-MWEB-3	6043205	Active Sensors for Computer Vision	SS	2+0	3	No	oral $\sim$ 20 min
Tomographic Laser- and Radar Sensing GEOD-MWCV-8	6043212/ 6043213	Tomographic Laser- and Radar Sensing	SS	1+1	3	Yes: Successful Participation In Exercise	oral $\sim$ 20 min
Augmented Reality GEOD-MWGI-8	6026107/ 6026108	Augmented Reality	WS	1+2	4	Yes: Successful Participation In Exercise	oral $\sim$ 20 min
Scientific Applications of GNSS RSGI-MPEG-3	6048209	Scientific Applications of GNSS	SS	0+2	3	No	other according to SPO RSGI §4/2
Advanced Gravity Field Modelling RSGI-MPEG-4	6042205	Advanced Gravity Field Modelling	WS	1+1	3	Yes: successful participation in exercises	oral ~ 20 min.
SAR and InSAR Remote Sensing RSGI-MPEG-6	6025201/ 6025202	SAR and InSAR Remote Sensing	SS	1+1	3	Yes: successful participation in exercises	oral ~ 20 min.

Module	Course No	Course	Sem.	Contact hours	CP	Condition for admission to examination	Examination type and duration
Compulsory Elective Modules continued							
Geodetic Sensor Fusion RSGI-MPEG-7	6042206	Geodetic Sensor Fusion	WS	1+1	3	Yes: successful participation in exercises	oral ~ 20 min.
Recent Earth Observation Programs and Systems GEOD-MWCV-7	6048201	Recent Earth Observation Programs and Systems	SS	1+0	2	No	other according to SPO RSGI §4/2
Hyperspectral Remote Sensing GEOD-MPEA-1	6047101/ 6047102	Hyperspectral Remote Sensing	WS	1+1	3	Yes: Successful participation in exercises	oral ~ 20 min
Seminar Topics of Remote Sensing GEOD-MWEA-1	6047203	Seminar Topics of Remote Sensing	SS	1+0	2	No	oral ~ 20 min
Seminar Environmental Geodesy RSGI-MPEG-2	6048208	Seminar Environmental Geodesy	SS	0+2	2	No	other according to SPO RSGI §4/2
Deep Learning for Computer Vision and Remote Sensing GEOD-MWCV-12	6041202/ 6041203	Deep Learning for Computer Vision and Remote Sensing	SS	2+2	5	Yes: Successful participation in exercises	oral ~ 30 min.

4.3.4 Profile: Geoinformatics and Remote Sensing of the Atmosphere

Module	Course No	Course	Sem.	Contact hours	CP	Condition for admission to examination	Examination type and duration
RSGI-M-P-GI							
Compulsory Modules							
GeoDB GEOD-MPGI-1	6026101/ 6026102	GeoDB	WS	2+1	5	Yes: Successful participation in exercises	oral ~ 20 min.
Remote Sensing of Atmospheric Temperature, Trace Gases, Clouds, and Aerosols RSGI-MPRA	6042202	Passive Remote Sensing of Atmospheric Temperature and Composition	WS	1.5+ 0.5	2	Yes: Successful participation in exercises of course 2	oral ~ 30 min.
	6020250	Remote Sensing of Aerosols and Clouds	SS	1+1	3		
Compulsory Elective Modules							
3D / 4D GIS GEOD-MPGI-2	6026201/ 6026202	3D / 4D GIS	SS	2+1	4	Yes: Successful participation in exercises	oral ~ 20 min.
Mobile GIS / Location Based Services GEOD-MWGI-2	6026206/ 6026207	Mobile GIS / Location Based Services	SS	1+1	3	Yes: Successful participation in exercises	oral ~ 20 min.
Atmospheric Spectroscopy and Middle Atmospheric Research RSGI-MPRA-3		Atmospheric Spectroscopic Measurements	SS	2	2	No	oral ~ 30 min.
	4052071	Atmospheric Radiation	SS	2	2		

4.3.5 Profile: Geoinformatics and Environmental Geodesy

Module	Course No	Course	Sem.	Contact hours	CP	Condition for admission to examination	Examination type and duration
RSGI-M-P-GI							
Compulsory Modules							
GeoDB GEOD-MPGI-1	6026101/ 6026102	GeoDB	WS	2+1	5	Yes: Successful participation in exercises	oral ~ 20 min.
Geodetic Earth Observation RSGI-MPEG-1	6042204	Mass Variations	WS	1+1	5	Yes: Successful participation in both exercises	oral ~ 30 min.
	6019404	Deformation Processes	SS	1+1			
Compulsory Elective Modules							
3D / 4D GIS GEOD-MPGI-2	6026201/ 6026202	3D / 4D GIS	SS	2+1	4	Yes: Successful participation in exercises	oral ~ 20 min.
Mobile GIS / Location Based Services GEOD-MWGI-2	6026206/ 6026207	Mobile GIS / Location Based Services	SS	1+1	3	Yes: Successful participation in exercises	oral ~ 20 min.
Scientific Applications of GNSS RSGI-MPEG-3	6048209	Scientific Applications of GNSS	SS	0+2	3	No	other according to SPO RSGI §4/2
Advanced Gravity Field Modelling RSGI-MPEG-4	6042205	Advanced Gravity Field Modelling	WS	1+1	3	Yes: successful participation in exercises	oral ~ 20 min.
SAR and InSAR Remote Sensing RSGI-MPEG-6	6025201/ 6025202	SAR and InSAR Remote Sensing	SS	1+1	3	Yes: successful participation in exercises	oral ~ 20 min.
Geodetic Sensor Fusion RSGI-MPEG-7	6042206	Geodetic Sensor Fusion	WS	1+1	3	Yes: successful participation in exercises	oral ~ 20 min.
Hyperspectral Remote Sensing GEOD-MPEA-1	6047101/ 6047102	Hyperspectral Remote Sensing	WS	1+1	3	Yes: Successful participation in exercises	oral ~ 20 min

Module	Course No	Course	Sem.	Contact hours	CP	Condition for admission to examination	Examination type and duration
Compulsory Elective Modules continued							
Recent Earth Observation Programs and Systems GEOD-MWCV-7	6048201	Recent Earth Observation Programs and Systems	SS	1+0	2	No	other according to SPO RSGI §4/2
Seminar Topics of Remote Sensing GEOD-MWEA-1	6047203	Seminar Topics of Remote Sensing	SS	1+0	2	No	oral ~ 20 min
Seminar Environmental Geodesy RSGI-MPEG-2	6048208	Seminar Environmental Geodesy	SS	0+2	2	No	other according to SPO RSGI §4/2

4.3.6 Profile: Remote Sensing of the Atmosphere and Environmental Geodesy

Module	Course No	Course	Sem.	Contact hours	CP	Condition for admission to examination	Examination type and duration
RSGI-M-P-RA							
Compulsory Modules							
Remote Sensing of Atmospheric Temperature, Trace Gases, Clouds, and Aerosols RSGI-MPRA	6042202	Passive Remote Sensing of Atmospheric Temperature and Composition	WS	1.5+ 0.5	2	Yes: Successful participation in exercises of course 2	oral ~ 30 min.
	6020250	Remote Sensing of Aerosols and Clouds	SS	1+1	3		
Geodetic Earth Observation RSGI-MPEG-1	6042204	Mass Variations	WS	1+1	5	Yes: Successful participation in both exercises	oral ~ 30 min.
	6019404	Deformation Processes	SS	1+1			
Compulsory Elective Modules							
Atmospheric Spectroscopy and Middle Atmospheric Research RSGI-MPRA-3		Atmospheric Spectroscopic Measurements	SS	2	2	No	oral ~ 30 min.
	4052071	Atmospheric Radiation	SS	2	2		
Scientific Applications of GNSS RSGI-MPEG-3	6048209	Scientific Applications of GNSS	SS	0+2	3	No	other according to SPO RSGI §4/2
Advanced Gravity Field Modelling RSGI-MPEG-4	6042205	Advanced Gravity Field Modelling	WS	1+1	3	Yes: successful participation in exercises	oral ~ 20 min.
SAR and InSAR Remote Sensing RSGI-MPEG-6	6025201/ 6025202	SAR and InSAR Remote Sensing	SS	1+1	3	Yes: successful participation in exercises	oral ~ 20 min.

Module	Course No	Course	Sem.	Contact hours	CP	Condition for admission to examination	Examination type and duration
Compulsory Elective Modules continued							
Geodetic Sensor Fusion RSGI-MPEG-7	6042206	Geodetic Sensor Fusion	WS	1+1	3	Yes: successful participation in exercises	oral ~ 20 min.
Recent Earth Observation Programs and Systems GEOD-MWCV-7	6048201	Recent Earth Observation Programs and Systems	SS	1+0	2	No	other according to SPO RSGI §4/2
Hyperspectral Remote Sensing GEOD-MPEA-1	6047101/ 6047102	Hyperspectral Remote Sensing	WS	1+1	3	Yes: Successful participation in exercises	oral ~ 20 min
Seminar Topics of Remote Sensing GEOD-MWEA-1	6047203	Seminar Topics of Remote Sensing	SS	1+0	2	No	oral ~ 20 min
Seminar Environmental Geodesy	6048208	Seminar Environmental Geodesy	SS	0+2	2	No	other according to SPO RSGI §4/2

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

Module	Course	Sem.	contact hours	CP	Condition for admission to examination	Examination type and duration
Lab Rotation I RSGI-ML-1	Lab Rotation I	WS/SS	4	10	45 CPs from compulsory or compulsory elective modules	other according to SPO RSGI §4/2
Lab Rotation II RSGI-ML-2	Lab Rotation II	WS/SS	4	10	45 CPs from compulsory or compulsory elective modules	other according to SPO RSGI §4/2

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

Module	Course	Sem.	CP	Condition for admission to examination	Examination type and duration
Master Thesis RSGI-MASR	Master Thesis	WS/SS	30	70 CPs (see SPO for details)	Thesis

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

Mandatory	
Master's Thesis	30 CR
Profiles	20 CR
Lab Rotations	20 CR
Remote Sensing	23 CR
Mathematics and Beyond	15 CR
Supplementary Modules	8 CR
Key Competences	4 CR
Voluntary	
Additional Examinations *This field will not influence the calculated grade of its parent.*	

5.1 Master's Thesis

Credits
30

Mandatory		
M-BGU-104549	Master's Thesis	30 CR

5.2 Profiles

Credits 20

Profile (Election: 1 item)	
Profile: Computer Vision and Geoinformatics	20 CR
Profile: Computer Vision and Remote Sensing of the Atmosphere	20 CR
Profile: Computer Vision and Environmental Geodesy	20 CR
Profile: Geoinformatics and Remote Sensing of the Atmosphere	20 CR
Profile: Geoinformatics and Environmental Geodesy	20 CR
Profile: Remote Sensing of the Atmosphere and Environmental Geodesy	20 CR

5.2.1 Profile: Computer Vision and Geoinformatics

Part of: Profiles

Credits 20

Mandatory		
M-BGU-101041	GeoDB	5 CR
M-BGU-104531	Advanced Topics in Computer Vision	5 CR
Compulsory Elective Modules (Election: at least 10 credits)		
M-BGU-101042	3D / 4D GIS	4 CR
M-BGU-101045	Mobile GIS / Location Based Services	3 CR
M-BGU-101047	Augmented Reality	4 CR
M-BGU-101052	Tomographic Laser- and Radar Sensing	3 CR
M-BGU-101057	Seminar Topics of Image Analysis	2 CR
M-BGU-101099	Active Sensors for Computer Vision	3 CR
M-BGU-106343	Deep Learning for Computer Vision and Remote Sensing *First usage possible from 4/1/2023.*	5 CR
M-BGU-104436	Module Wildcard 1 Profile ComVisGeoinf	10 CR

5.2.2 Profile: Computer Vision and Remote Sensing of the Atmosphere

Part of: Profiles

Credits 20

Mandatory		
M-BGU-104531	Advanced Topics in Computer Vision	5 CR
M-BGU-104532	Remote Sensing of Atmospheric Temperature, Trace Gases, Clouds and Aerosols	5 CR
Compulsory Elective Modules (Election: at least 10 credits)		
M-BGU-101047	Augmented Reality	4 CR
M-BGU-101052	Tomographic Laser- and Radar Sensing	3 CR
M-BGU-101057	Seminar Topics of Image Analysis	2 CR
M-BGU-101099	Active Sensors for Computer Vision	3 CR
M-BGU-104533	Atmospheric Spectroscopy and Middle Atmospheric Research	4 CR
M-BGU-106343	Deep Learning for Computer Vision and Remote Sensing *First usage possible from 4/1/2023.*	5 CR
M-BGU-104437	Module Wildcard 1 Profile ComVisRemSen	10 CR

5.2.3 Profile: Computer Vision and Environmental Geodesy

Part of: Profiles

Credits 20

Mandatory		
M-BGU-104531	Advanced Topics in Computer Vision	5 CR
M-BGU-104536	Geodetic Earth Observation	5 CR
Compulsory Elective Modules (Election: at least 10 credits)		
M-BGU-101047	Augmented Reality	4 CR
M-BGU-101051	Hyperspectral Remote Sensing	3 CR
M-BGU-101052	Tomographic Laser- and Radar Sensing	3 CR
M-BGU-101054	Seminar Topics of Remote Sensing	2 CR
M-BGU-101057	Seminar Topics of Image Analysis	2 CR
M-BGU-101099	Active Sensors for Computer Vision	3 CR
M-BGU-101765	Recent Earth Observation Programs and Systems	2 CR
M-BGU-104537	Advanced Gravity Field Modelling	3 CR
M-BGU-104557	Seminar Environmental Geodesy	2 CR
M-BGU-104561	Geodetic Sensor Fusion	3 CR
M-BGU-104586	SAR and InSAR Remote Sensing	3 CR
M-BGU-104566	Scientific Applications of GNSS	3 CR
M-BGU-106343	Deep Learning for Computer Vision and Remote Sensing *First usage possible from 4/1/2023.*	5 CR
M-BGU-104438	Module Wildcard 1 Profile ComVisEnvGeo	10 CR

5.2.4 Profile: Geoinformatics and Remote Sensing of the Atmosphere

Part of: Profiles

Credits 20

Mandatory		
M-BGU-101041	GeoDB	5 CR
M-BGU-104532	Remote Sensing of Atmospheric Temperature, Trace Gases, Clouds and Aerosols	5 CR
Compulsory Elective Modules (Election: at least 10 credits)		
M-BGU-101042	3D / 4D GIS	4 CR
M-BGU-101045	Mobile GIS / Location Based Services	3 CR
M-BGU-104533	Atmospheric Spectroscopy and Middle Atmospheric Research	4 CR
M-BGU-104439	Module Wildcard 1 Profile GeoinfRemS	10 CR

5.2.5 Profile: Geoinformatics and Environmental Geodesy

Part of: Profiles

Credits 20

Mandatory		
M-BGU-101041	GeoDB	5 CR
M-BGU-104536	Geodetic Earth Observation	5 CR
Compulsory Elective Modules (Election: at least 10 credits)		
M-BGU-101042	3D / 4D GIS	4 CR
M-BGU-101045	Mobile GIS / Location Based Services	3 CR
M-BGU-101051	Hyperspectral Remote Sensing	3 CR
M-BGU-101054	Seminar Topics of Remote Sensing	2 CR
M-BGU-101765	Recent Earth Observation Programs and Systems	2 CR
M-BGU-104537	Advanced Gravity Field Modelling	3 CR
M-BGU-104557	Seminar Environmental Geodesy	2 CR
M-BGU-104561	Geodetic Sensor Fusion	3 CR
M-BGU-104566	Scientific Applications of GNSS	3 CR
M-BGU-104586	SAR and InSAR Remote Sensing	3 CR
M-BGU-104440	Module Wildcard 1 Profile GeoinfEnvGeo	10 CR

5.2.6 Profile: Remote Sensing of the Atmosphere and Environmental Geodesy

Part of: Profiles

Credits 20

Mandatory		
M-BGU-104532	Remote Sensing of Atmospheric Temperature, Trace Gases, Clouds and Aerosols	5 CR
M-BGU-104536	Geodetic Earth Observation	5 CR
Compulsory Elective Modules (Election: at least 10 credits)		
M-BGU-101051	Hyperspectral Remote Sensing	3 CR
M-BGU-101054	Seminar Topics of Remote Sensing	2 CR
M-BGU-101765	Recent Earth Observation Programs and Systems	2 CR
M-BGU-104533	Atmospheric Spectroscopy and Middle Atmospheric Research	4 CR
M-BGU-104537	Advanced Gravity Field Modelling	3 CR
M-BGU-104557	Seminar Environmental Geodesy	2 CR
M-BGU-104561	Geodetic Sensor Fusion	3 CR
M-BGU-104566	Scientific Applications of GNSS	3 CR
M-BGU-104586	SAR and InSAR Remote Sensing	3 CR
M-BGU-104441	Module Wildcard 1 Profile RemSenEnvGeo	10 CR

5.3 Lab Rotations

Credits 20

Mandatory		
M-BGU-104588	Lab Rotation I	10 CR
M-BGU-104589	Lab Rotation II	10 CR

5.4 Remote Sensing

Credits
23

Mandatory		
M-BGU-101011	Geoinformatics	5 CR
M-BGU-104517	Computer Vision and Remote Sensing	8 CR
M-BGU-104524	Remote Sensing of the Atmosphere	5 CR
M-BGU-104553	Fundamentals of Environmental Geodesy	5 CR

5.5 Mathematics and Beyond

Credits
15

Mandatory		
M-BGU-101013	Numerical Mathematics	6 CR
M-BGU-104530	Scientific Programming	3 CR
M-BGU-104918	Basics of Estimation Theory and its Application in Geoscience Remote Sensing	6 CR

5.6 Supplementary Modules

Credits
8

Supplementary Modules (Election: at least 8 credits)		
M-BGU-101051	Hyperspectral Remote Sensing *First usage possible from 2/15/2021.*	3 CR
M-BGU-101057	Seminar Topics of Image Analysis *First usage possible from 2/15/2021.*	2 CR
M-BGU-101042	3D / 4D GIS *First usage possible from 2/17/2021.*	4 CR
M-BGU-101045	Mobile GIS / Location Based Services *First usage possible from 2/17/2021.*	3 CR
M-BGU-101099	Active Sensors for Computer Vision *First usage possible from 2/17/2021.*	3 CR
M-BGU-101105	Real Estate Valuation II *First usage possible from 2/17/2021.*	4 CR
M-BGU-101107	Cartography II *First usage possible from 2/17/2021.*	1 CR
M-BGU-101765	Recent Earth Observation Programs and Systems *First usage possible from 2/17/2021.*	2 CR
M-BGU-104557	Seminar Environmental Geodesy *First usage possible from 2/17/2021.*	2 CR
M-BGU-101047	Augmented Reality	4 CR
M-BGU-104586	SAR and InSAR Remote Sensing	3 CR
M-BGU-104566	Scientific Applications of GNSS	3 CR
M-BGU-101021	Visualization of Geodata in 2D, 3D and 4D	3 CR
M-BGU-104536	Geodetic Earth Observation	5 CR
M-BGU-101037	Geodetic Application of SAR Interferometry	4 CR
M-BGU-106199	Introduction to Python *First usage possible from 10/1/2022.*	3 CR
M-BGU-106343	Deep Learning for Computer Vision and Remote Sensing *First usage possible from 4/1/2023.*	5 CR
M-BGU-101054	Seminar Topics of Remote Sensing neu	2 CR
M-BGU-101041	GeoDB neu *First usage possible from 10/1/2023.*	5 CR
M-BGU-101052	Tomographic Laser- and Radar Sensing neu *First usage possible from 10/1/2023.*	3 CR
M-BGU-104531	Advanced Topics in Computer Vision neu *First usage possible from 10/1/2023.*	5 CR
M-BGU-104532	Remote Sensing of Atmospheric Temperature, Trace Gases, Clouds and Aerosols neu *First usage possible from 10/1/2023.*	5 CR
M-BGU-104537	Advanced Gravity Field Modelling neu *First usage possible from 10/1/2023.*	3 CR
M-BGU-104561	Geodetic Sensor Fusion neu *First usage possible from 10/1/2023.*	3 CR
M-BGU-104944	Wildcard 1 Supplementary Modules	8 CR

5.7 Key Competences

Credits
4

Key Competences: Elective Modules (Election: at least 4 credits)		
M-BGU-104711	Further Key Competences	4 CR
M-BGU-104712	Further Key Competences	2 CR
M-BGU-104943	Wildcard Key Competences 1	2 CR

5.8 Additional Examinations

Additional Modules (Election: at most 30 credits)		
M-BGU-104713	Further Examinations	30 CR
M-BGU-101042	3D / 4D GIS neu	4 CR
M-BGU-101028	Geometric Object Modelling in 2D, 3D and 4D	3 CR
M-BGU-101051	Hyperspectral Remote Sensing	3 CR
M-BGU-101107	Cartography II	1 CR
M-BGU-104586	SAR and InSAR Remote Sensing neu	3 CR
M-BGU-104557	Seminar Environmental Geodesy neu	2 CR
M-BGU-106343	Deep Learning for Computer Vision and Remote Sensing neu	5 CR
M-BGU-106199	Introduction to Python neu *First usage possible from 10/1/2023.*	3 CR
M-ZAK-106099	Supplementary Studies on Sustainable Development *First usage possible from 4/1/2023.*	19 CR
M-ZAK-106235	Supplementary Studies on Culture and Society *First usage possible from 4/1/2023.*	22 CR

6 Modules

M 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	Grading scale	Recurrence	Duration	Language	Level	Version
4	Grade to a tenth	Each summer term	1 term	German/English	4	2

Mandatory			
T-BGU-101781	3D / 4D GIS, Prerequisite *This item will not influence the grade calculation of this parent.*	1 CR	Breunig
T-BGU-101760	3D / 4D GIS	3 CR	Breunig

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 programing 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 programing is helpful.

Literature
None

M 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)

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
3	Grade to a tenth	Each summer term	1 term	German/English	4	2

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

M 6.3 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)

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
3	Grade to a tenth	Each winter term	1 term	English	4	3

Mandatory			
T-BGU-109289	Advanced Gravity Field Modelling, Prerequisite *This item will not influence the grade calculation of this parent.*	2 CR	Seitz
T-BGU-109290	Advanced Gravity Field Modelling, Examination	1 CR	Seitz

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 tesseroid-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

M 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)

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
5	Grade to a tenth	Each winter term	1 term	English	4	1

Mandatory			
T-BGU-109280	Advanced Topics in Computer Vision, Examination	4 CR	Weinmann
T-BGU-110748	Advanced Topics in Computer Vision, Prerequisite	1 CR	Hinz, Weinmann

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

M 6.5 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)

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
4	Grade to a tenth	Each summer term	1 term	English	4	1

Mandatory			
T-BGU-109284	Atmospheric Spectroscopy and Middle Atmosphere Research, Examination	4 CR	Clarmann von Clarenau, Hase

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 amosphere 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

M 6.6 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

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
4	Grade to a tenth	Each winter term	1 term	German/English	4	2

Mandatory			
T-BGU-101717	Augmented Reality, Prerequisite *This item will not influence the grade calculation of this parent.*	2 CR	Wursthorn
T-BGU-101716	Augmented Reality	2 CR	Wursthorn

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 und geo information systems in the field of augmented reality.

Content
Selection of augmented reality applications in science, industry and entertainment. Sensors and technologies for positioning und orientation. Display technologies like glasses and projectors. User interaction in augmented reality.

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

M 6.7 Module: Basics of Estimation Theory and its Application in Geoscience Remote Sensing (RSGI-MMCM-2) [M-BGU-104918]

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	Grading scale	Recurrence	Duration	Language	Level	Version
6	Grade to a tenth	Each term	2 terms	English	4	4

Mandatory			
T-BGU-106633	Data Analysis in Geoscience Remote Sensing Projects, Prerequisite *This item will not influence the grade calculation of this parent.*	2 CR	Andersen, Cermak
T-BGU-111186	Basics of Estimation Theory, Prerequisite *This item will not influence the grade calculation of this parent.*	1 CR	Hase, Hinz
T-BGU-109952	Basics of Estimation Theory and its Application in Geoscience Remote Sensing, Examination	3 CR	Cermak, Hase, Hinz

Competence Certificate

- T-BGU-106633 - Data Analysis in Geoscience Remote Sensing Projects, Vorleistung
- T-BGU-111186 - Basics of Estimation Theory, Prerequisite
- T-BGU-109952 - Basics of Estimation Theory and its Application in Geoscience Remote Sensing, Examination

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 gase 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.

M 6.8 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

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

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

Prerequisites
none

M 6.9 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

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

Mandatory			
T-BGU-101759	Methods of Remote Sensing, Prerequisite	1 CR	Weidner
T-BGU-109269	Computer Vision and Remote Sensing, Examination	7 CR	Hinz, Jutzi, Weinmann

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/used 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

M 6.10 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

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
5	Grade to a tenth	Each summer term	1 term	English	4	1

Mandatory			
T-BGU-112866	Deep Learning for Computer Vision and Remote Sensing, Prerequisites *This item will not influence the grade calculation of this parent.*	2 CR	Weinmann
T-BGU-112865	Deep Learning for Computer Vision and Remote Sensing, Exam	3 CR	Weinmann

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

M 6.11 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	Grading scale	Recurrence	Duration	Language	Level	Version
5	Grade to a tenth	Each term	2 terms	English	4	4

Mandatory			
T-BGU-109328	Fundamentals of Environmental Geodesy Part A *This item will not influence the grade calculation of this parent.*	1 CR	Kutterer, Seitz
T-BGU-109329	Fundamentals of Environmental Geodesy Part B *This item will not influence the grade calculation of this parent.*	1 CR	Kutterer, Mayer
T-BGU-109330	Fundamentals of Environmental Geodesy, Examination	3 CR	Kutterer, Mayer, Seitz

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 bullentin
  - 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

M 6.12 Module: Further Examinations [M-BGU-104713]

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

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
30	pass/fail	Each term	2 terms	German	4	1

Further Examinations (Election: at most 30 credits)			
T-BGU-109599	Wildcard Additional Examinations 1	2 CR	
T-BGU-109604	Wildcard Additional Examinations 6	5 CR	

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

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

Credits	Grading scale	Recurrence	Duration	Level	Version
4	pass/fail	Each term	2 terms	4	2

Further Key Competences (Election: at least 4 credits)			
T-BGU-109594	Wildcard Further Key Competences 1 ub	1 CR	
T-BGU-109595	Wildcard Further Key Competences 2 ub	1 CR	
T-BGU-109596	Wildcard Further Key Competences 3 ub	1 CR	
T-BGU-109597	Wildcard Further Key Competences 4 ub	1 CR	
T-BGU-111648	Wildcard Further Key Competences 5	1 CR	
T-BGU-111649	Wildcard Further Key Competences 6	1 CR	
T-BGU-111706	SelfAssignment-MScRSGI-1-graded	2 CR	
T-BGU-111707	SelfAssignment-MScRSGI-2-graded	2 CR	
T-BGU-111708	SelfAssignment-MScRSGI-3-ungraded	2 CR	
T-BGU-111709	SelfAssignment-MScRSGI-4-ungraded	2 CR	

Prerequisites
none

M 6.14 Module: Further Key Competences [M-BGU-104712]

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

Credits	Grading scale	Recurrence	Duration	Level	Version
2	pass/fail	Each term	2 terms	4	2

Further Key Competences (Election: at least 2 credits)			
T-BGU-109594	Wildcard Further Key Competences 1 ub	1 CR	
T-BGU-109595	Wildcard Further Key Competences 2 ub	1 CR	
T-BGU-111648	Wildcard Further Key Competences 5	1 CR	
T-BGU-111649	Wildcard Further Key Competences 6	1 CR	

Prerequisites
none

M 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)

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
5	Grade to a tenth	Each winter term	1 term	German/English	4	2

Mandatory			
T-BGU-101754	GeoDB, Prerequisite *This item will not influence the grade calculation of this parent.*	1 CR	Breunig
T-BGU-101753	GeoDB	4 CR	Breunig

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

M 6.16 Module: Geodetic Application of SAR Interferometry (GEOD-MWGF-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

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
4	Grade to a tenth	Each winter term	1 term	German/English	4	1

Mandatory			
T-BGU-103501	Geodetic Application of SAR Interferometry, Prerequisite *This item will not influence the grade calculation of this parent.*	2 CR	Hinz, Westerhaus
T-BGU-101711	Geodetic Application of SAR Interferometry	2 CR	Hinz, Westerhaus

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

M 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

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

M 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)

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
3	Grade to a tenth	Each winter term	1 term	English	4	1

Mandatory			
T-BGU-109475	Geodetic Sensor Fusion, Prerequisite	2 CR	Kutterer
T-BGU-109344	Geodetic Sensor Fusion, Examination	1 CR	Kutterer

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

M 6.19 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

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
5	Grade to a tenth	Each winter term	2 terms	German/English	4	3

Mandatory			
T-BGU-110321	Geoinformatics, Prerequisite SoSe	1 CR	Breunig
T-BGU-110322	Geoinformatics, Prerequisite WiSe	1 CR	Breunig
T-BGU-101742	Geoinformatics	3 CR	Breunig

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 analszed. 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 programing 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

M 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

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
3	Grade to a tenth	Each summer term	1 term	German	4	1

Mandatory			
T-BGU-101708	Geometric Object Modelling in 2D, 3D and 4D, Prerequisite *This item will not influence the grade calculation of this parent.*	1 CR	Hinz
T-BGU-101707	Geometric Object Modelling in 2D, 3D and 4D	2 CR	Hinz

Prerequisites
none

M 6.21 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)
Additional Examinations

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
3	Grade to a tenth	Each winter term	1 term	English	4	2

Mandatory			
T-BGU-101721	Hyperspectral Remote Sensing, Prerequisite *This item will not influence the grade calculation of this parent.*	1 CR	Weidner
T-BGU-101720	Hyperspectral Remote Sensing	2 CR	Weidner

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.

M 6.22 Module: Introduction to Python (RSGI-MMCE-2) [M-BGU-106199]

Responsible: 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)

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

Mandatory			
T-BGU-112598	Introduction to Python	3 CR	Cermak, Fuchs

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 Senesing Projects) Python will be applied.

M 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

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
10	Grade to a tenth	Each term	1 term	German	5	1

Mandatory			
T-BGU-109412	Lab Rotation I	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

M 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

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
10	Grade to a tenth	Each term	1 term	German	5	1

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

M 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

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
30	Grade to a tenth	Each term	1 term	English	5	1

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

M 6.26 Module: Mobile GIS / Location Based Services (GEOD-MWGI-2) [M-BGU-101045]

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

Mandatory			
T-BGU-101713	Mobile GIS / Location Based Services, Prerequisite	3 CR	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 modul 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

- *Song Gao, Gengchen Mai. (2018) Mobile GIS and Location-Based Services. In Bo Huang, Thomas J. Cova, and Ming-Hsiang Tsou et al.(Eds): Comprehensive Geographic Information Systems, Vol 1, pp. 384-397, Elsevier. Oxford, UK. DOI: 10.1016/B978-0-12-409548-9.09710-4.*
- *Haosheng Huang, Georg Gartner, Jukka M. Krisp, Martin Raubal & Nico Van de Weghe (2018) Location based services: ongoing evolution and research agenda, Journal of Location Based Services, 12:2, 63-93, DOI: 10.1080/17489725.2018.1508763*

M 6.27 Module: Module Wildcard 1 Profile ComVisEnvGeo [M-BGU-104438]

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

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

Wildcard (Election: at least 1 item)			
T-BGU-109070	Wildcard 1 Profile 3	0 CR	
T-BGU-109071	Wildcard 2 Profile 3	10 CR	

Prerequisites
None

M 6.28 Module: Module Wildcard 1 Profile ComVisGeoinf [M-BGU-104436]

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

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

Wildcard (Election: at least 1 item)			
T-BGU-109066	Wildcard 1 Profile 1	0 CR	
T-BGU-109067	Wildcard 2 Profile 1	10 CR	

Prerequisites
None

M 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)

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

Wildcard (Election: at least 1 item)			
T-BGU-109068	Wildcard 1 Profile 2	0 CR	
T-BGU-109069	Wildcard 2 Profile 2	10 CR	

Prerequisites
None

M 6.30 Module: Module Wildcard 1 Profile GeoinfEnvGeo [M-BGU-104440]

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

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

Wildcard (Election: at least 1 item)			
T-BGU-109074	Wildcard 1 Profile 5	0 CR	
T-BGU-109075	Wildcard 2 Profile 5	10 CR	

Prerequisites
None

M 6.31 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)

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

Wildcard (Election: at least 1 item)			
T-BGU-109072	Wildcard 1 Profile 4	0 CR	
T-BGU-109073	Wildcard 2 Profile 4	10 CR	

Prerequisites
None

M 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)

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

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

M 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

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
6	Grade to a tenth	Each winter term	1 term	English	4	3

Mandatory			
T-BGU-111174	Numerical Mathematics, Prerequisite *This item will not influence the grade calculation of this parent.*	1 CR	Bradley
T-BGU-111175	Numerical Mathematics, Exam	5 CR	Bradley

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

M 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)

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

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]

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 2/17/2021)

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
2	Grade to a tenth	Each summer term	1 term	English	4	2

Mandatory			
T-BGU-103407	Recent Earth Observation Programs and Systems	2 CR	Weidner

Competence Certificate

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

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

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

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)

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

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.

M 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

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
5	Grade to a tenth	Each summer term	1 term	English	4	4

Mandatory			
T-BGU-110304	Satellite Climatology: Remote Sensing of a Changing Climate, Prerequiste *This item will not influence the grade calculation of this parent.*	1 CR	Cermak
T-BGU-111185	Atmospheric Remote Sensing Infrastructures, Prerequisite *This item will not influence the grade calculation of this parent.*	1 CR	Cermak
T-BGU-109274	Remote Sensing of the Atmosphere, Examination	3 CR	Cermak

Competence Certificate

- T-BGU-110304 - Satellite Climatology: Remote Sensing of a Changing Climate, Prerequiste
- 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-105095 - Satellite Climatology: Remote Sensing of a Changing Climate
- 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.

M 6.38 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

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
3	Grade to a tenth	Each summer term	1 term	English	4	1

Mandatory			
T-BGU-109409	SAR and InSAR Remote Sensing, Prerequisite	2 CR	Hinz, Westerhaus
T-BGU-109410	SAR and InSAR Remote Sensing, Examination	1 CR	Hinz, Westerhaus

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)

M 6.39 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

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
3	Grade to a tenth	Each summer term	1 term	English	4	1

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

Competence Certificate
other 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).

M 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

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
3	Grade to a tenth	Each winter term	1 term	German	4	1

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.

M 6.41 Module: Seminar Environmental Geodesy (RSGI-MPEG-2) [M-BGU-104557]

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 2/17/2021)
Additional Examinations

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
2	Grade to a tenth	Each summer term	1 term	English	4	1

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).

M 6.42 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)

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
2	Grade to a tenth	Each winter term	1 term	English	4	3

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 disscussions
- 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

M 6.43 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	Grading scale	Recurrence	Duration	Language	Level	Version
2	Grade to a tenth	Each summer term	1 term	German/English	4	2

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

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

M 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)

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
22	Grade to a tenth	Each term	3 terms	German	1	1

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 examantion grades, not as the average of the module grades.

Mandatory			
T-ZAK-112653	Basics Module - Self Assignment BAK	3 CR	Mielke, Myglas
In-depth Module (Election: 3 items)			
T-ZAK-112654	In-depth Module - Technology & Responsibility - Self Assignment BAK	3 CR	Mielke, Myglas
T-ZAK-112655	In-depth Module - Doing Culture - Self Assignment BAK	3 CR	Mielke, Myglas
T-ZAK-112656	In-depth Module - Media & Aesthetics - Self Assignment BAK	3 CR	Mielke, Myglas
T-ZAK-112657	In-depth Module - Spheres of Life - Self Assignment BAK	3 CR	Mielke, Myglas
T-ZAK-112658	In-depth Module - Global Cultures - Self Assignment BAK	3 CR	Mielke, Myglas
Mandatory			
T-ZAK-112660	Practice Module	4 CR	Mielke, Myglas
T-ZAK-112659	Oral Exam - Supplementary Studies on Culture and Society	4 CR	Mielke, Myglas

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.

M 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)

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
19	Grade to a tenth	Each term	3 terms	German	1	1

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 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 §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 examantion grades, not as the average of the module grades.

Mandatory			
T-ZAK-112345	Basics Module - Self Assignment BeNe	3 CR	Myglas
Elective Module (Election: at least 6 credits)			
T-ZAK-112347	Elective Module - Sustainable Cities and Neighbourhoods - Self Assignment BeNe	3 CR	
T-ZAK-112348	Elective Module - Sustainability Assessment of Technology - Self Assignment BeNe	3 CR	
T-ZAK-112349	Elective Module - Subject, Body, Individual: the Other Side of Sustainability - Self Assignment BeNe	3 CR	
T-ZAK-112350	Elective Module - Sustainability in Culture, Economy and Society - Self Assignment BeNe	3 CR	
Mandatory			
T-ZAK-112346	Specialisation Module - Self Assignment BeNe	6 CR	Myglas
T-ZAK-112351	Oral Exam - Supplementary Studies on Sustainable Development	4 CR	

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-booking 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.

M 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)

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
3	Grade to a tenth	Each summer term	1 term	English	4	2

Mandatory			
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

M 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

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
3	Grade to a tenth	Each summer term	1 term	German/English	4	2

Mandatory			
T-BGU-101703	Visualization of Geodata in 2D, 3D and 4D, Prerequisite *This item will not influence the grade calculation of this parent.*	1 CR	Wursthorn
T-BGU-101702	Visualization of Geodata in 2D, 3D and 4D	2 CR	Wursthorn

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

M 6.48 Module: Wildcard 1 Supplementary Modules [M-BGU-104944]

Organisation: University
Part of: Supplementary Modules

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

PH 1 Supplementary Modules (Election: at least 1 item)			
T-BGU-110049	Wildcard 1.1 Supplementary Modules	8 CR	

M 6.49 Module: Wildcard Key Competences 1 [M-BGU-104943]

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

Credits	Grading scale	Recurrence	Duration	Level	Version
2	pass/fail	Each term	2 terms	4	2

Election notes
SelfAssignment included

Wildcard (Election: at least 2 credits)			
T-BGU-110047	Wildcard Key Competences 1.1 ub	1 CR	
T-BGU-110048	Wildcard Key Competences 1.2 ub	1 CR	
T-BGU-111650	Wildcard Further Key Competences 7	1 CR	
T-BGU-111651	Wildcard Further Key Competences 8	1 CR	

Prerequisites
none

7 Courses

T 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

Type	Credits	Grading scale	Version
Oral examination	3	Grade to a third	1

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
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 programing is helpful.

T 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

Type	Credits	Grading scale	Recurrence	Version
Completed coursework	1	pass/fail	Each summer term	2

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 excercise sheets.

Prerequisites
none

Recommendation
Knowledge in GIS and object-oriented programing is helpful.

Annotation
None

T 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

Type	Credits	Grading scale	Recurrence	Version
Oral examination	3	Grade to a third	Each term	2

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.

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

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

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

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.

T 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

Type	Credits	Grading scale	Recurrence	Version
Completed coursework	2	pass/fail	Each winter term	1

Prerequisites
None

T 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

Type	Credits	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each term	2

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.

T 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

Type	Credits	Grading scale	Expansion	Version
Completed coursework	1	pass/fail	1 terms	1

Prerequisites
None

T 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

Type	Credits	Grading scale	Recurrence	Expansion	Version
Completed coursework	1	pass/fail	Each summer term	1 terms	2

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

T 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

Type	Credits	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each term	1

Prerequisites
None

T 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

Type	Credits	Grading scale	Version
Oral examination	2	Grade to a third	1

Events					
WT 23/24	6026107	Augmented Reality	1 SWS	Lecture / 🗣	Wursthorn
WT 23/24	6026108	Augmented Reality, Exercises	2 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-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.

T 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	Credits	Grading scale	Recurrence	Version
Completed coursework	2	pass/fail	Each winter term	2

Events					
WT 23/24	6026107	Augmented Reality	1 SWS	Lecture / 🗣	Wursthorn
WT 23/24	6026108	Augmented Reality, Exercises	2 SWS	Practice	Wursthorn

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

T 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

Type	Credits	Grading scale	Version
Completed coursework	3	pass/fail	1

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
Fjordevik, Anneli und Jörg Roche: Angewandte Kulturwissenschaften. Vol. 10. Narr Francke Attempto Verlag, 2019.

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.

T 7.13 Course: Basics Module - Self Assignment BeNe [T-ZAK-112345]

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

Type	Credits	Grading scale	Version
Completed coursework	3	pass/fail	1

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 aquired from the following study providers:

- Zentrum für Angewandte Kulturwissenschaft und Studium Generale
- ZAK Begleitstudium

Recommendation
Kropp, Ariane: Grundlagen der Nachhaltigen Entwicklung: Handlungsmöglichkeiten und Strategien zur Umsetzung. Springer-Verlag, 2018.

Pufé, Iris: Nachhaltigkeit. 3. überarb. Edition, UTB, 2017.

Roorda, Niko, et al.: Grundlagen der nachhaltigen Entwicklung. Springer-Verlag, 2021.

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.

T 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

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

Type	Credits	Grading scale	Recurrence	Version
Oral examination	3	Grade to a third	Each summer term	2

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.

T 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

Type	Credits	Grading scale	Recurrence	Expansion	Version
Completed coursework	1	pass/fail	Each summer term	1 terms	2

Prerequisites
None

T 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

Type	Credits	Grading scale	Version
Oral examination	1	Grade to a third	1

Prerequisites
none

T 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

Type	Credits	Grading scale	Recurrence	Version
Oral examination	7	Grade to a third	Each term	2

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.

T 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

Type	Credits	Grading scale	Recurrence	Version
Completed coursework	2	pass/fail	Each winter term	4

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

T 7.19 Course: Deep Learning for Computer Vision and Remote Sensing, Exam [T-BGU-112865]

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

Type	Credits	Grading scale	Recurrence	Expansion	Version
Oral examination	3	Grade to a third	Each term	1 terms	2

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.

T 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

Type	Credits	Grading scale	Recurrence	Expansion	Version
Completed coursework	2	pass/fail	Each summer term	1 terms	1

Competence Certificate
Completed coursework accoring to SPO $4 (3). For the successfull completion of work sheets, 50% of the achieveable points are needed. More details will be clearly communicated in the exercises.

Prerequisites
none

T 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

Type	Credits	Grading scale	Recurrence	Version
Completed coursework	2	pass/fail	Each summer term	1

Events					
ST 2023	6019404	Deformation Processes	2 SWS	Lecture / Practice (/ 🗣	Kutterer, Westerhaus

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

Prerequisites
None

T 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

Type	Credits	Grading scale	Version
Examination of another type	3	Grade to a third	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 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.

T 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

Type	Credits	Grading scale	Version
Examination of another type	3	Grade to a third	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 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.

T 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	Credits	Grading scale	Version
Examination of another type	3	Grade to a third	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 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.

T 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

Type	Credits	Grading scale	Version
Examination of another type	3	Grade to a third	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 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.

T 7.26 Course: Fundamentals of Environmental Geodesy Part A [T-BGU-109328]

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

Type	Credits	Grading scale	Recurrence	Expansion	Version
Completed coursework	1	pass/fail	Each winter term	1 terms	2

Competence Certificate
written scientific bulletin

T 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

Type	Credits	Grading scale	Recurrence	Expansion	Version
Completed coursework	1	pass/fail	Each summer term	1 terms	2

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

T 7.28 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

Type	Credits	Grading scale	Recurrence	Expansion	Version
Oral examination	3	Grade to a third	Each term	1 terms	3

Competence Certificate
Oral (30 minutes)

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.

T 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

Type	Credits	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each winter term	1

Events					
WT 23/24	6026101	GeoDB, Lecture	2 SWS	Lecture / 🗣	Breunig
WT 23/24	6026102	GeoDB, Exercises	1 SWS	Practice / 🗣	Kuper

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.

T 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

Type	Credits	Grading scale	Recurrence	Version
Completed coursework	1	pass/fail	Each winter term	2

Events					
WT 23/24	6026101	GeoDB, Lecture	2 SWS	Lecture / 🗣	Breunig
WT 23/24	6026102	GeoDB, Exercises	1 SWS	Practice / 🗣	Kuper

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

Prerequisites
None

T 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

Type	Credits	Grading scale	Version
Oral examination	2	Grade to a third	1

Events					
WT 23/24	6025106	Geodetic Application of SAR Interferometry, Lecture	2 SWS	Lecture / 🗣	Westerhaus
WT 23/24	6025107	Geodetic Application of SAR Interferometry, Exercises	1 SWS	Practice / 🗣	Westerhaus

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.

T 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

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

Events					
WT 23/24	6025106	Geodetic Application of SAR Interferometry, Lecture	2 SWS	Lecture /	Westerhaus
WT 23/24	6025107	Geodetic Application of SAR Interferometry, Exercises	1 SWS	Practice /	Westerhaus

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 at 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.

T 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	Credits	Grading scale	Recurrence	Version
Oral examination	1	Grade to a third	Each summer term	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.

T 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

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

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.

T 7.35 Course: Geodetic Sensor Fusion, Prerequisite [T-BGU-109475]

Responsible: Prof. Dr.-Ing. Hansjörg Kutterer
Organisation: KIT Department of Civil Engineering, Geo and Environmental Sciences
Part of: M-BGU-104561 - Geodetic Sensor Fusion
Prerequisite for: T-BGU-109344 - Geodetic Sensor Fusion, Examination

Type	Credits	Grading scale	Recurrence	Expansion	Version
Completed coursework	2	pass/fail	Each winter term	1 terms	1

Prerequisites
None

T 7.36 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

Type	Credits	Grading scale	Version
Oral examination	3	Grade to a third	2

Events					
WT 23/24	6022106	Geoinformatics (Part A), Exercises	1 SWS	Practice /	Landgraf

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.

T 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

Type	Credits	Grading scale	Recurrence	Expansion	Version
Completed coursework	1	pass/fail	Each summer term	1 terms	2

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

T 7.38 Course: Geoinformatics, Prerequisite WiSe [T-BGU-110322]

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

Type	Credits	Grading scale	Recurrence	Expansion	Version
Completed coursework	1	pass/fail	Each winter term	1 terms	2

Events					
WT 23/24	6022106	Geoinformatics (Part A), Exercises	1 SWS	Practice /	Landgraf

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 successfully completed exercises in Geoinformatics Part (A).

Prerequisites
none

T 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

Type	Credits	Grading scale	Version
Oral examination	2	Grade to a third	1

Events					
ST 2023	6024208	Geometric Object Modeling in 2D, 3D and 4D	1 SWS	Lecture / 🗣	Hinz, Ulrich
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

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.

T 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

Type	Credits	Grading scale	Recurrence	Version
Completed coursework	1	pass/fail	Each summer term	2

Events					
ST 2023	6024208	Geometric Object Modeling in 2D, 3D and 4D	1 SWS	Lecture / 🗣	Hinz, Ulrich
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

T 7.41 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

Type	Credits	Grading scale	Recurrence	Version
Oral examination	2	Grade to a third	Each winter term	2

Events					
WT 23/24	6047101	Hyperspectral Remote Sensing, Lecture	1 SWS	Lecture / 🗣	Weidner
WT 23/24	6047102	Hyperspectral Remote Sensing, Exercises	1 SWS	Practice / 🗣	Weidner

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

T 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

Type	Credits	Grading scale	Recurrence	Version
Completed coursework	1	pass/fail	Each winter term	2

Events					
WT 23/24	6047101	Hyperspectral Remote Sensing, Lecture	1 SWS	Lecture / 🗣	Weidner
WT 23/24	6047102	Hyperspectral Remote Sensing, Exercises	1 SWS	Practice / 🗣	Weidner

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 excercises and 5 min. presentation of recent paper related to a topic of the lecture. The detailled conditions will be announced in the lecture.

Prerequisites
None

Recommendation
None

Annotation
None

T 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	Credits	Grading scale	Version
Examination of another type	3	Grade to a third	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 aquired from the following study providers:

- Zentrum für Angewandte Kulturwissenschaft und Studium Generale
- ZAK Begleitstudium

Annotation
The content of the Basic Modul is helpful.

T 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

Type	Credits	Grading scale	Version
Examination of another type	3	Grade to a third	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 aquired from the following study providers:

- Zentrum für Angewandte Kulturwissenschaft und Studium Generale
- ZAK Begleitstudium

Annotation
The content of the Basic Modul is helpful.

T 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

Type	Credits	Grading scale	Version
Examination of another type	3	Grade to a third	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 aquired from the following study providers:

- Zentrum für Angewandte Kulturwissenschaft und Studium Generale
- ZAK Begleitstudium

Annotation
The content of the Basic Modul is helpful.

T 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	Credits	Grading scale	Version
Examination of another type	3	Grade to a third	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 aquired from the following study providers:

- Zentrum für Angewandte Kulturwissenschaft und Studium Generale
- ZAK Begleitstudium

Annotation
The content of the Basic Modul is helpful.

T 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

Type	Credits	Grading scale	Version
Examination of another type	3	Grade to a third	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 aquired from the following study providers:

- Zentrum für Angewandte Kulturwissenschaft und Studium Generale
- ZAK Begleitstudium

Annotation
The content of the Basic Modul is helpful.

T 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

Type	Credits	Grading scale	Recurrence	Version
Completed coursework	3	pass/fail	Each winter term	1

Events					
WT 23/24	6224907	Introduction to Matlab	2 SWS	Lecture / Practice (/	Ehret, Wienhöfer

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.

T 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

Type	Credits	Grading scale	Recurrence	Expansion	Version
Completed coursework (practical)	3	pass/fail	Each winter term	1 terms	2

Events					
WT 23/24	6020130	Introduction to Python	2 SWS	Lecture / Practice (/	Cermak

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.

T 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

Type	Credits	Grading scale	Recurrence	Version
Examination of another type	10	Grade to a third	Each term	1

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

T 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

Type	Credits	Grading scale	Recurrence	Version
Examination of another type	10	Grade to a third	Each term	1

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

T 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

Type	Credits	Grading scale	Recurrence	Version
Completed coursework	2	pass/fail	Each summer term	1

Prerequisites
None

T 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

Type	Credits	Grading scale	Recurrence	Expansion	Version
Final Thesis	30	Grade to a third	Each term	1 terms	1

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

T 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

Type	Credits	Grading scale	Recurrence	Version
Completed coursework	1	pass/fail	Each winter term	2

Events					
WT 23/24	6048101	Methods of Remote Sensing, Lecture	1 SWS	Lecture / 🗣	Weidner
WT 23/24	6048102	Methods of Remote Sensing, Exercises	1 SWS	Practice / 🗣	Weidner

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

Competence Certificate
Assessment of success is in the form of a coursewoork (§ 4 (3) SPO) based on active participation during excercisees and performing a classification within the excercises. The exact conditions will be announced in the lecture.

Prerequisites
none

Recommendation
None

Annotation
None

T 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

Type	Credits	Grading scale	Recurrence	Version
Completed coursework	3	pass/fail	Each summer term	3

Events					
ST 2023	6026206	Mobile GIS/Location Based Services	1 SWS	Lecture /	Breunig, Kuper, Landgraf
ST 2023	6026207	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

T 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

Type	Credits	Grading scale	Recurrence	Expansion	Version
Written examination	5	Grade to a third	Each term	1 terms	3

Events					
WT 23/24	6061101	Numerische Mathematik	3 SWS	Lecture / 🗣	Bradley

Legend: 📱 Online, 🎛 Blended (On-Site/Online), 🗣 On-Site, ✕ Cancelled

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, Prerequsite (Version 1)

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-BGU-111174 - Numerical Mathematics, Prerequisite must have been passed.

T 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

Type	Credits	Grading scale	Recurrence	Expansion	Version
Completed coursework	1	pass/fail	Each winter term	1 terms	2

Events					
WT 23/24	6061101	Numerische Mathematik	3 SWS	Lecture / 🗣	Bradley

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.

T 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

Type	Credits	Grading scale	Version
Oral examination	4	Grade to a third	1

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.

T 7.59 Course: Oral Exam - Supplementary Studies on Sustainable Development [T-ZAK-112351]

Organisation:

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

Type	Credits	Grading scale	Version
Oral examination	4	Grade to a third	1

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.

T 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

Type	Credits	Grading scale	Version
Completed coursework	4	pass/fail	1

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.

T 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

Type	Credits	Grading scale	Version
Oral examination	4	Grade to a third	1

Prerequisites
none

T 7.62 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

Type	Credits	Grading scale	Version
Examination of another type	2	Grade to a third	2

Events					
ST 2023	6048201	Recent Earth Observation Programs and Systems	1 SWS	Lecture / 🗣	Weidner

Legend: 🖳 Online, 🔀 Blended (On-Site/Online), 🗣 On-Site, ✕ 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
Knoledge of sensors and apllications in remote sensing are recommended.

T 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

Type	Credits	Grading scale	Recurrence	Expansion	Version
Completed coursework	1	pass/fail	Each summer term	1 terms	2

Prerequisites
None

T 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	Credits	Grading scale	Recurrence	Version
Oral examination	4	Grade to a third	Each term	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.

T 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	Credits	Grading scale	Recurrence	Version
Oral examination	3	Grade to a third	Each term	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, Prerequiste 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).

T 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

Type	Credits	Grading scale	Expansion	Version
Oral examination	1	Grade to a third	1 terms	1

Competence Certificate
oral (ca. 20 min.).

Prerequisites
Prerequisite in SAR and InSAR Remote Sensing

Modeled Conditions
The following conditions have to be fulfilled:

1. The course T-BGU-109409 - SAR and InSAR Remote Sensing, Prerequisite must have been passed.

T 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

Type	Credits	Grading scale	Expansion	Version
Completed coursework	2	pass/fail	1 terms	1

T 7.68 Course: Satellite Climatology: Remote Sensing of a Changing Climate, Prerequiste [T-BGU-110304]

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

Type	Credits	Grading scale	Recurrence	Expansion	Version
Completed coursework	1	pass/fail	Each summer term	1 terms	2

Events					
ST 2023	6043106	Satellite Climatology: Remote Sensing of a Changing Climate, Lecture	2 SWS	Lecture / 🗣	Cermak
ST 2023	6043107	Satellite Climatology: Remote Sensing of a Changing Climate, Exercises	1 SWS	Practice / 🛠	Cermak, Andersen

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 haved started.

T 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

Type	Credits	Grading scale	Recurrence	Version
Examination of another type	3	Grade to a third	Each term	1

Competence Certificate
other according to SPO RSGI x4/2

Prerequisites
None

T 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

Type	Credits	Grading scale	Recurrence	Version
Examination of another type	2	Grade to a third	Each term	1

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; titel and credit points of the grades are transferred.

T 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

Type	Credits	Grading scale	Recurrence	Version
Examination of another type	2	Grade to a third	Each term	1

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; titel and credit points of the grades are transferred.

T 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

Type	Credits	Grading scale	Recurrence	Version
Completed coursework	2	pass/fail	Each term	1

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; titel and credit points of the grades are transferred.

T 7.73 Course: SelfAssignment-MScRSGI-4-ungraded [T-BGU-111709]

Organisation: KIT Department of Civil Engineering, Geo and Environmental Sciences
Part of: M-BGU-104711 - Further Key Competences

Type	Credits	Grading scale	Recurrence	Version
Completed coursework	2	pass/fail	Each term	1

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; titel and credit points of the grades are transferred.

T 7.74 Course: Seminar Environmental Geodesy, Exam [T-BGU-109338]

Responsible: Prof. Dr.-Ing. Hansjörg Kutterer
Organisation: KIT Department of Civil Engineering, Geo and Environmental Sciences
Part of: M-BGU-104557 - Seminar Environmental Geodesy

Type	Credits	Grading scale	Recurrence	Expansion	Version
Examination of another type	2	Grade to a third	Each summer term	1 terms	2

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

T 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

Type	Credits	Grading scale	Recurrence	Version
Oral examination	2	Grade to a third	Each winter term	2

Competence Certificate
The assessment consists of aoral 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

T 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

Type	Credits	Grading scale	Recurrence	Version
Examination of another type	2	Grade to a third	Each summer term	3

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.

T 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

Type	Credits	Grading scale	Version
Examination of another type	6	Grade to a third	1

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 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
Knowledge from 'Basic Module ' and 'Elective Module ' is helpful.

T 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

Type	Credits	Grading scale	Version
Oral examination	2	Grade to a third	1

Events					
ST 2023	6043212	Tomographic Laser- and Radar Sensing	1 SWS	Lecture / 🗣	Schenk, Hinz, Jutzi
ST 2023	6043213	Tomographic Laser- and Radar Sensing, Tutorial	1 SWS	Practice / 🗣	Schenk, Hinz, Jutzi

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.

T 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

Type	Credits	Grading scale	Recurrence	Version
Completed coursework	1	pass/fail	Each summer term	2

Events					
ST 2023	6043212	Tomographic Laser- and Radar Sensing	1 SWS	Lecture /	Schenk, Hinz, Jutzi
ST 2023	6043213	Tomographic Laser- and Radar Sensing, Tutorial	1 SWS	Practice /	Schenk, Hinz, Jutzi

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 excercise sheet, a short presentation of a publication (10 min.), project word and presentation of the preoject work (10 min. incl. discussion). The detailled conditions will be announced in the lecture.

Prerequisites
None

Recommendation
None

Annotation
None

T 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

Type	Credits	Grading scale	Version
Oral examination	2	Grade to a third	1

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.

T 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

Type	Credits	Grading scale	Recurrence	Version
Completed coursework	1	pass/fail	Each summer term	2

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
The assessment consists of a a coursework § 4 para. 3 SPO M.Sc. Geodäsie und Geoinformatik based on elaborations of excercise sheets. The detailled conditions will be announced in the lecture.

Prerequisites
None

Recommendation
None

Annotation
None

T 7.82 Course: Wildcard 1 Profile 1 [T-BGU-109066]

Organisation: University
Part of: M-BGU-104436 - Module Wildcard 1 Profile ComVisGeoinf

Type	Credits	Grading scale	Version
Completed coursework	0	pass/fail	1

T 7.83 Course: Wildcard 1 Profile 2 [T-BGU-109068]

Organisation: University
Part of: M-BGU-104437 - Module Wildcard 1 Profile ComVisRemSen

Type	Credits	Grading scale	Recurrence	Version
Completed coursework	0	pass/fail	Each term	1

T 7.84 Course: Wildcard 1 Profile 3 [T-BGU-109070]

Organisation: University
Part of: M-BGU-104438 - Module Wildcard 1 Profile ComVisEnvGeo

Type	Credits	Grading scale	Recurrence	Version
Completed coursework	0	pass/fail	Each term	1

T 7.85 Course: Wildcard 1 Profile 4 [T-BGU-109072]

Organisation: University
Part of: M-BGU-104439 - Module Wildcard 1 Profile GeoinfRemS

Type	Credits	Grading scale	Recurrence	Version
Completed coursework	0	pass/fail	Each term	1

T 7.86 Course: Wildcard 1 Profile 5 [T-BGU-109074]

Organisation: University
Part of: M-BGU-104440 - Module Wildcard 1 Profile GeoinfEnvGeo

Type	Credits	Grading scale	Recurrence	Version
Completed coursework	0	pass/fail	Each term	1

T 7.87 Course: Wildcard 1 Profile 6 [T-BGU-109076]

Organisation: University
Part of: M-BGU-104441 - Module Wildcard 1 Profile RemSenEnvGeo

Type	Credits	Grading scale	Recurrence	Version
Completed coursework	0	pass/fail	Each term	1

T 7.88 Course: Wildcard 1.1 Supplementary Modules [T-BGU-110049]

Organisation: University
Part of: M-BGU-104944 - Wildcard 1 Supplementary Modules

Type	Credits	Grading scale	Recurrence	Version
Examination of another type	8	Grade to a third	Each term	1

T 7.89 Course: Wildcard 2 Profile 1 [T-BGU-109067]

Organisation: University
Part of: M-BGU-104436 - Module Wildcard 1 Profile ComVisGeoinf

Type	Credits	Grading scale	Recurrence	Version
Examination of another type	10	Grade to a third	Each term	1

T 7.90 Course: Wildcard 2 Profile 2 [T-BGU-109069]

Organisation: University
Part of: M-BGU-104437 - Module Wildcard 1 Profile ComVisRemSen

Type	Credits	Grading scale	Recurrence	Version
Examination of another type	10	Grade to a third	Each term	1

T 7.91 Course: Wildcard 2 Profile 3 [T-BGU-109071]

Organisation: University
Part of: M-BGU-104438 - Module Wildcard 1 Profile ComVisEnvGeo

Type	Credits	Grading scale	Recurrence	Version
Examination of another type	10	Grade to a third	Each term	1

T 7.92 Course: Wildcard 2 Profile 4 [T-BGU-109073]

Organisation: University
Part of: M-BGU-104439 - Module Wildcard 1 Profile GeoinfRemS

Type	Credits	Grading scale	Recurrence	Version
Examination of another type	10	Grade to a third	Each term	1

T 7.93 Course: Wildcard 2 Profile 5 [T-BGU-109075]

Organisation: University
Part of: M-BGU-104440 - Module Wildcard 1 Profile GeoinfEnvGeo

Type	Credits	Grading scale	Recurrence	Version
Examination of another type	10	Grade to a third	Each term	1

T 7.94 Course: Wildcard 2 Profile 6 [T-BGU-109077]

Organisation: University
Part of: M-BGU-104441 - Module Wildcard 1 Profile RemSenEnvGeo

Type	Credits	Grading scale	Recurrence	Version
Examination of another type	10	Grade to a third	Each term	1

T 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

Type	Credits	Grading scale	Version
Completed coursework	2	pass/fail	1

T 7.96 Course: Wildcard Additional Examinations 6 [T-BGU-109604]

Organisation: KIT Department of Civil Engineering, Geo and Environmental Sciences
Part of: M-BGU-104713 - Further Examinations

Type	Credits	Grading scale	Version
Examination of another type	5	Grade to a third	1

T 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

Type	Credits	Grading scale	Version
Completed coursework	1	pass/fail	1

T 7.98 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

Type	Credits	Grading scale	Version
Completed coursework	1	pass/fail	1

T 7.99 Course: Wildcard Further Key Competences 3 ub [T-BGU-109596]

Organisation: University
Part of: M-BGU-104711 - Further Key Competences

Type	Credits	Grading scale	Version
Completed coursework	1	pass/fail	1

T 7.100 Course: Wildcard Further Key Competences 4 ub [T-BGU-109597]

Organisation: University
Part of: M-BGU-104711 - Further Key Competences

Type	Credits	Grading scale	Version
Completed coursework	1	pass/fail	1

T 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

Type	Credits	Grading scale	Version
Examination of another type	1	Grade to a third	1

T 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

Type	Credits	Grading scale	Version
Examination of another type	1	Grade to a third	1

T 7.103 Course: Wildcard Further Key Competences 7 [T-BGU-111650]

Organisation: University
Part of: M-BGU-104943 - Wildcard Key Competences 1

Type	Credits	Grading scale	Version
Examination of another type	1	Grade to a third	1

T 7.104 Course: Wildcard Further Key Competences 8 [T-BGU-111651]

Organisation: University
Part of: M-BGU-104943 - Wildcard Key Competences 1

Type	Credits	Grading scale	Version
Examination of another type	1	Grade to a third	1

T 7.105 Course: Wildcard Key Competences 1.1 ub [T-BGU-110047]

Organisation: University
Part of: M-BGU-104943 - Wildcard Key Competences 1

Type	Credits	Grading scale	Version
Completed coursework	1	pass/fail	1

T 7.106 Course: Wildcard Key Competences 1.2 ub [T-BGU-110048]

Organisation: University
Part of: M-BGU-104943 - Wildcard Key Competences 1

Type	Credits	Grading scale	Version
Completed coursework	1	pass/fail	1

Chapter 8

Contacts

Dean of Studies:
Prof. Dr. Jan Cermak
Institute of Photogrammetry and Remote Sensing (IPF), building 20.40
Office hours: by appointment
phone.: 0721/608-43675 / 24510; email: jan.cermak@kit.edu

Coordinator of degree program:
Dr. Michael Mayer
Office hours: Thursdays 13:00-14:00 (after previous contact)
phone: 0721/608-42724; email: michael.mayer@kit.edu

Examination board:
Prof. Dr. Jan Cermak (chair); Dr. Patrick Bradley (person responsible)
Office hours: by appointment
email: patrick.bradley@kit.edu

Advisor:
Dr. Michael Mayer
Onboarding: Mondays 11:30-13:00 (Jordan lecture hall, building 20.40, KIT's CS)
Office hours: Thursdays 13:00-14:00 (after previous contact)
phone: 0721/608-42724; email: michael.mayer@kit.edu

For **further contacts** of the teaching unit 'Geodesy and Geoinformatics' / 'Remote Sensing and Geoinformatics' see `https://gug.bgu.kit.edu/ansprechpartner.php`.

Study program service of the department:
KIT-Department of Civil Engineering, Geo and Environmental Sciences, building 10.81, room 312
For office hours see `http://www.bgu.kit.edu/studiengangservice.php`
email: studiengangservice@bgu.kit.edu; web: `http://www.bgu.kit.edu/studiengangservice.php`

Students' council:
Students' council of the teaching unit 'Geodesy and Geoinformatics' / 'Remote Sensing and Geoinformatics', Karlsruhe Institute of Technology (KIT)
building 20.40; room 006; email: fsgeod@gik.kit.edu; web: `https://www.fs-geod.kit.edu`