

Module Handbook Master of Science Meteorology (M.Sc.)

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KIT DEPARTMENT OF PHYSICS



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1 Introduction to the Study Guide

This module handbook is the relevant document describing the structure and the contents of the Master's degree program in Meteorology, and thus provides helpful information and guidance for the studies. The degree program and its subjects and modules are described in detail, thus providing the necessary information for planning an interdisciplinary course of studies tailored to each student's personal interests and needs.

The first section **Study Guide** specifies the organization of the degree program and further formalities in addition to the general regulations for the Study and Examination.

A key function of the module handbook is the collection of **module descriptions** (Section 2) and **course descriptions** (Section3), which provide information on the requirements and recommendations.

In addition to this module handbook, the university calendar and possibly announcements of the institutes inform about further details, for example, on times and places of lectures and classes.

Please note, that only the German version of the Regulation for the Study and Examination ("Studien- und Prüfungsordnung", SPO) is legally binding. The translated version is for the purpose of information only.

For more information please visit <u>https://www.kit.edu/kit/english/corona-faq.php?tab=%5B30607%5D#tabpanel-30607</u>

2 Qualification Goals

The graduates of the Master's program in Meteorology know and understand the scientific fundamentals of meteorology and climatology, and have deepened them in the areas of the climate system, atmospheric processes as well as applied and experimental meteorology. This also includes aspects of atmospheric composition and thus of trace gases and aerosols. They have well-founded knowledge of programming techniques, numerical methods, computer simulations and data analysis, and have the ability to explain and at least partly apply complex atmospheric measurements in the laboratory, field and from satellite. They are familiar with mechanisms of the climate system and climate change. They know the relevance of meteorological phenomena such as extreme weather events, air pollution and climate change for society, nature and economy as well as for geoscientific neighboring disciplines, and can discuss and debate them. They also have detailed knowledge in a scientific elective.

Based on the acquired knowledge, the graduates correctly classify facts and thematic areas, and have the ability to solve – or develop approaches to solve – complex problems of the atmospheric and environmental sciences in an analytical-theoretical, computer-based or experimental way. They have the ability to deduce relationships from measured or modeled data, to formulate models, to derive predictions and to concretely test them, and thus to verify or falsify them. In addition, they can apply meteorological knowledge to research-related questions and are able to solve technical problems using the methods of the subject, also employing computer programs.

The graduates furthermore have sound methodological skills with regard to clear presentation and structuring of scientific findings and research results in written and spoken texts, and are proficient in didactically appealing presentation techniques. They can work independently and have extensive communication and organizational skills, including sound knowledge of scientific English. They are able to acquire new knowledge and insights as needed and thus to achieve a broadening or deepening of their knowledge. They have learned to reflect on their actions, and to recognize and evaluate the social and ethical aspects of meteorological research and application.

An important part of the education are the principles of good scientific practice, i. e. the maxims of unrestricted conscientiousness and honesty towards oneself and others in the investigation and presentation of scientific facts, unconditional honesty in the attribution of ideas and results to their authors in the past and present, and comprehensive documentation and presentation for the purpose of an open scientific discourse, which includes reexaminations and any kind of objectively justified criticism of ideas, procedures, and results, as well as the right to make bona fide mistakes and to be mistaken.

The distinctiveness of the Master's program in Meteorology compared to other universities lies in the broad range of aspects of Meteorology covered as well as the strong research relevance. A successful completion of the Master's program in Meteorology is an excellent foundation for a PhD in Meteorology or in related disciplines, and enables an applied or researching professional activity, i.a. in the field of weather forecasting, earth observation, satellite-based remote sensing and the compilation of environmental reports as well as in atmospheric research institutions and in the insurance and energy industries.

3 Field of study structure

Mandatory				
Master's Thesis	30 CR			
Atmospheric and Climate Processes	24 CR			
Applied and Experimental Meteorology	24 CR			
Research Work	30 CR			
Required Electives	8 CR			
Interdisciplinary Qualifications	4 CR			

3.1 Master's Thesis

Credits 30

Credits 24

Credits 24

Cradit

This module is intended to provide students with in-depth aspects of scholarly writing and presentation. Building on the results from the Specialization Phase, students further advance their own research project to finally write a Master's Thesis. The written scientific work includes a summary of the state of the literature, presentation of the goals, methods used and the results obtained as well as a discussion of the knowledge gained and the remaining open questions. The students are trained to apply principles of good scientific practice, in particular to document the results, as well as to consistently self-doubt all results, and to present previous work appropriately and honestly.

More information about the modules Specialization Phase and Master's Thesis is provided in the Guidelines to Master's Thesis in section 7.

Mandatory		
M-PHYS-100956	Master's Thesis	30 CR

3.2 Atmospheric and Climate Processes

Mandatory					
M-PHYS-100951	A-PHYS-100951 Components of the Climate System				
M-PHYS-100952	Atmospheric Processes	12 CR			

3.3 Applied and Experimental Meteorology

Mandatory		
M-PHYS-100953	Experimental Meteorology	14 CR
M-PHYS-100954	Applied Meteorology	10 CR

3.4 Research Work

	Cieuits
	30

Students carry out an interdisciplinary *Study Project*, for which 30 ECTS are credited. The project prepares students for independent scientific working and writing, and introduces skills in project management. The *Study Project* focuses on the topic of the subsequent *Master's Thesis* and serves as a preparation for the scientific work. In addition to the competence in reading and understanding scientific literature, the students acquire abilities for independent work and critical evaluation of results in the context of the literature, and consolidate their knowledge of the rules of good scientific practice.

Mandatory		
M-PHYS-100955	Specialisation Phase	30 CR

3.5 Required Electives

Credits 8

The study can be complemented by electives to individualize the degree program. These could thus be modules from related disciplines such as Physics, Geoecology, Geophysics, Mechanical Engineering, or Applied Geo sciences. Examples of possible *Compulsory Elective Modules* from other disciplines are listed below.

Compulsory Elec	tive Modules (Election: at least 8 credits)						
M-PHYS-101664	M-PHYS-101664 Modern Theoretical Physics for Teacher Students						
M-PHYS-101707	Modern Theoretical Physics I, Quantum Mechanics I	8 CR					
M-BGU-102757	Computer Vision and GIS	9 CR					
M-BGU-102758	GIS and Remote Sensing	9 CR					
M-BGU-102759	Computer Vision and Remote Sensing	8 CR					
M-BGU-102760	GIS and Geo Data Infrastructures	10 CR					
M-INFO-102980	Informatics for Meteorology Students	8 CR					
M-PHYS-103336	Geophysical analysis of natural hazards	8 CR					
M-PHYS-103403	Module Wildcard Electives	8 CR					
M-BGU-103398	Geoecology	8 CR					
M-BGU-103422	Basics of Estimation Theory and its Application in Geoscience Remote Sensing	8 CR					
M-PHYS-101833	Geological Hazards and Risk	8 CR					
M-PHYS-104488	Physics of Planetary Atmospheres	10 CR					
M-BGU-105095	Satellite Climatology: Remote Sensing of a Changing Climate	4 CR					
M-BGU-105504	Fluid Mechanics and Turbulence First usage possible from 10/1/2020.	9 CR					
M-MATH-105831	Numerical Methods First usage possible from 10/1/2021.	5 CR					

3.6 Interdisciplinary Qualifications

Credits

Apart from scientific qualifications, KIT attaches high importance to transferable skills. These skills of 4 credits shall be part of the Master's Program in Meteorology. Transferable skills may be achieved additively or integratively.

A wide range of interdisciplinary qualifications is offered by

- the House of Competence (HOC)
- the Sprachenzentrum (language center)
- the Center for Cultural and General Studies (ZAK)

With regard to scientific qualification, we recommend courses that train scientific work.

Examples:

- During the specialization phase, the course "The Master's Thesis in Physics, Meteorology and Geophysics (Online)" from the HOC is suitable.
- To get a feeling for the implementation of the guidelines for good scientific practice, the Ilias course "Good Scientific Practice" of the KIT Library and the Writing Lab at the HOC is suitable.

Mandatory	Mandatory			
M-PHYS-102352	Interdisciplinary Qualifications	4 CR		

4 Program

The master's degree program in Meteorology deepens and extends the essential scientific qualifications obtained in the Bachelor's program in a research-oriented way. Consolidation occurs in the areas of Theoretical Meteorology and Numerical Weather Prediction, Climatology, Remote Sensing and Data Analysis as well as in Atmospheric Chemistry and Aerosols, while extensions take place in the area of Applied Meteorology. A comprehensive practical course familiarizes the graduates with methods of modern atmospheric measurements in the laboratory and field. With the completion of the Master's thesis, the graduates have demonstrated that they are capable of applying scientific knowledge and methods to independently solve complex research problems. In addition, they acquired detailed skills in an elective from a wide range of other natural sciences.

Semester	Credit-points	Atmosphere and Climate Processes	Applied and Experimental Meteorology	Electives	Scientific Work	Master's Thesis
1 (WS)	30 3 Examinations	Components of the Climate System 12 ECTS				
	SEXAMINATIONS	Atmopsheric Processes 12 ECTS		Elective 1 & Elective 2		
2 (SS)	(SS) 31 3 Examinations		Experimental Meteorology 10 ECTS	at least 8 ECTS		
			Applied Meteorology 14 ECTS			
3 (WS)	29				Specialization Phase: Scientific Concept Development 30 ECTS	
4 (SS)	32					Master`s Thesis 30 ECTS
	120*	24	24	8	30	30
		les mentioned here, interdi s 1 and 2. Depending on you			it points must be complete quired in the respective se	

Graphic Course Program M.Sc. Meteorology (SPO 2015)

Soft Skills are scheduled for semesters 1 and 2. Depending on your choice, additional examinations may be required in the respective semesters.

Course Program of the Masters Course Meteorology and Climate Physics. Credits corresponding to the European Credit Transfer System (ECTS).

Exemplary choice of subject in the compulsory elective area:

Module "Fluid Mechanics and Turbulence" (graded)

WS (1st semester): Choice between:

- Flow Measurement Techniques (3 CP, oral exam, approx. 30 min.) and
- Environmental Aerodynamics (3 CP, oral exam, approx. 30 min.)

SS (2nd semester): Choice between:

- Advanced Fluid Mechanics (6 CP, written exam, 90 min.) and
- Fluid Mechanics of Turbulent Flows (6 CP, oral exam, approx. 45 min.)

In the event of a clash of dates with selected compulsory courses, students always have the option of postponing attendance of the elective compulsory modules until the third or fourth semester. It is recommended that the planning be done together with the study advisor for the MSc Meteorology during a consultation.

5 Excerpts from the Regulation for the Study and Examination (SPO 2015)

5.1 Regular Period of Study, Organization of Study, Credits (§3, SPO)

- (1) The regular period of study shall be four semesters.
- (2) The curriculum of the program is divided into subjects, the subjects into modules, and the modules are divided into courses. The subjects and their scopes are defined in Article 19. Details are outlined in the module manual.
- (3) The workload envisaged for passing courses and modules is expressed in credits. The criteria for assigning credits correspond to the European Credit Transfer System (ECTS). One credit corresponds to a workload of about 30 hours. Usually, the credits shall be distributed equally over the semesters.
- (4) The coursework and examinations required for the successful completion of the study are measured in credits and amount to a total of 120 credits.
- (5) Upon prior announcement, the courses may also be offered in English.

5.2 Module Examinations, Coursework and Assessments (§4, SPO)

- (1) The master's examination shall consist of module examinations. Module examinations shall consist of one or several controls of success ("Erfolgskontrollen"). Controls of success shall consist of coursework ("Studienleistungen") and assessments ("Prüfungsleistungen").
- (2) Assessments are:
 - Written examinations,
 - oral examinations, or
 - examinations of another type.
- (3) Coursework shall be written, oral, or practical work that is usually accomplished by students simultaneously to the taught courses. The master's examination must not be completed by a coursework.
- (4) At least 70% of the module examinations shall be graded.
- (5) In case of complementary contents, module examinations of several modules may be combined (par. 2, nos. 1-3).

5.3 Registration for and Admission to Module Examinations and Courses (§5, SPO)

(1) To participate in module examinations, students shall register online on the Students Portal for the corresponding controls of success. In exceptional cases, registration can be made in writing to the Students Office or another institution authorized by the latter. For controls of success, registration deadlines may be specified by the examiners. Registration of the master's thesis is outlined in the module manual.

To get help with the Campus System visit https://www.sle.kit.edu/imstudium/videotutorialscampus.php (currently available only in German language) or ask the *student counseling* via <u>Mail</u>.

- (2) For admission to an examination in an elective module, students shall submit together with their registration for the examination a binding declaration relating to their choice of the module and its assignment to a subject prior to the first examination in this module. At the request of the student to the examination committee, the choice or assignment can be changed later. If an examination procedure in a module has already started, the choice of elective or assignment to a subject can only be changed after its completion.
- (3) Admission to a control of success shall be granted to students, who
 - are enrolled in the Master's Program in Meteorology at KIT; with the admission of students on leave being limited to examinations, and to students, who
 - can prove that they meet the requirements for admission to a control of success outlined in the module manual and

- can prove that their entitlement to an examination in the Master's Program in Meteorology has not been lost.
- (4) According to Article 30, par. 5, LHG (Landeshochschulgesetz), admission to individual mandatory courses may be restricted. The examiner shall decide on the selection of students, who have registered in due time before the deadline given by the examiner, taking into account the study progress made by these students and taking into consideration Article 13, par. 1, clauses 1 and 2, if the surplus of registrations cannot be reduced by other or additional courses. In the case of identical study progress, further criteria shall be specified by the KIT departments. The result shall be announced to the students in due time.
- (5) Admission shall be refused, if the conditions outlined in pars. 3 and 4 are not fulfilled. Admission may be refused, if a control of success that was required for admission to this Master's Program was already passed in a KIT bachelor's program. This shall not apply to premature master's examinations ("Mastervorzug"). Admission to these shall be approved explicitly according to clause 1.

5.4 Execution of Controls of Success (§6, SPO)

- (1) Controls of success shall be performed simultaneously to the taught courses, usually while conveying the contents of the individual modules or shortly afterwards.
- (2) The type of control of success (Article 4, par. 2, nos. 1 3, par. 3) shall be specified by the examiner of the respective course depending on the contents of the course and teaching objectives of the module. The type of controls of success, their frequency, sequence, weighting, and the determination of the module grade, if applicable, shall be announced in the module manual six weeks prior to the start of the lecturing period at the latest. The examiner and student may change the type of examination and the examination language later on. In the former case, Article 4, par. 4 has to be observed. When organizing examinations, the needs of students with a disability or chronic disease shall be considered according to Article 13, par. 1. Article 13, par. 1, clauses 3 and 4 shall apply accordingly.
- (3) In case of an unreasonably high examination workload, a written examination may also be passed orally or an oral examination may also be passed in writing. This modification shall be announced six weeks prior to the examination at the latest.
- (4) In case of courses in the English language (Article 3, par. 5), the corresponding controls of success can be executed in this language. Article 6, par. 2 shall apply accordingly.
- (5) Written examinations (Article 4, par. 2, no. 1) shall usually be evaluated by an examiner according to Article 17, pars. 2-4. If an evaluation is made by several examiners, the grade shall be the arithmetic mean of the individual evaluations. If the arithmetic mean does not correspond to any of the grade levels defined in Article 7, par. 2, cl. 2, the grade shall be rounded to the next higher or lower grade level. In case of equal distance to the next higher and lower levels, the grade shall be rounded to the next higher grade level. The evaluation procedure shall not exceed six weeks. Written examinations shall last at least 60 and not more than 300 minutes.
- (6) Oral examinations (Article 4, par. 2, no. 2) shall be performed and evaluated as group or individual examinations by several examiners (examining board) or by one examiner in the presence of an assessor. Prior to determining the grade, the examiner shall consult the other examiners of the examining board. Oral examinations shall usually last at least 15 minutes and not more than 60 minutes per student.

Major details and results of the *oral examination* shall be minuted. The result of the examination shall be announced to the student directly after the oral examination.

Students who intend to take the same examination in a later semester shall be admitted to oral examinations as an observer depending on the space available and upon approval of the examinee. They shall not be admitted to the consultation of the examining board and the announcement of the examination results.

(7) For examinations of another type, (Article 4, par. 2, no. 3), appropriate deadlines and submission dates shall be specified. Proper description of the task and adequate documentation shall ensure that the examination passed can be credited to the student. Major details and results of the control of success shall be minuted.

During *oral examinations of another type*, an assessor shall be present in addition to the examiner, who shall also sign the minutes together with the examiner.

Theses or papers to be written for *an examination of another type* shall be provided with the following declaration:

"Ich versichere wahrheitsgemäß, die Arbeit selbstständig angefertigt, alle benutzten Hilfsmittel vollständig und genau angegeben und alles kenntlich gemacht zu haben, was aus Arbeiten anderer unverändert oder mit Abänderungen entnommen wurde."

"I herewith declare that the present thesis/paper is original work written by me alone and that I have indicated completely and precisely all aids used as well as all citations, whether changed or unchanged, of other theses and publications."

If the thesis/paper does not contain this declaration, it shall not be accepted. Major details and results of such a control of success shall be minuted.

5.5 Controls of Success by a Multiple-Choice Test (§6a, SPO)

It is outlined in the module manual whether and to what extent controls of success can be made by a multiple-choice test.

5.6 Repetition of Examinations, Ultimate Failure (§8, SPO)

- (1) Students may repeat once a written examination that has not been passed (Article 4, par. 2, no. 1). In case a repeated written examination is given the grade of "nicht ausreichend" (5.0, failed), an oral re-examination shall take place soon after the date of the failed examination. In this case, the grade of this examination may not be better than "ausreichend" (4.0, sufficient).
- (2) Students may repeat once an oral examination that has not been passed (Article 4, par. 2, no. 2).
- (3) Repeated examinations according to paragraphs 1 and 2 shall correspond to the first examination in terms of contents, scope, and type (oral or written). At request, exceptions may be approved by the responsible examination committee.
- (4) Examinations of another type (Article 4, par. 2, no. 3) can be repeated once.
- (5) Coursework can be repeated several times.
- (6) An examination shall ultimately not be passed, if the oral re-examination according to par. 1 was evaluated with the grade of "nicht ausreichend" (5.0, failed). The examination also shall ultimately not be passed, if the oral examination according to par. 2 or the examination of another type according to par. 4 was evaluated twice with the grade of "nicht bestanden" (failed).
- (7) The module shall ultimately not be passed, if an examination required for passing the module is ultimately not passed.
- (8) A second repetition of the same examination according to Article 4, par. 2 shall be possible in exceptional cases at the request of the student only ("Antrag auf Zweitwiederholung" – application for a second repetition). As a rule, the application shall be submitted in writing to the examination committee within two months after announcement of the grade.

The examination committee shall decide on the first application of a student for a second repetition. If the examination committee dismisses the application, a member of the Presidential Committee shall decide. Upon comment of the examination committee, a member of the Presidential Committee shall decide on further applications for a second repetition. If the

application is accepted, the second repetition shall take place on the next but one examination date at the latest. Paragraph 1, clauses 2 and 3 shall apply accordingly.

- (9) Repetition of a passed examination shall not be permitted.
- (10) In case a Master's thesis has been granted the grade "nicht ausreichend" (5.0, failed), it can be repeated once. A second repetition of the Master's thesis shall be excluded.

5.7 Loss of the Entitlement to an Examination (§9, SPO)

In case coursework or an examination required according to the present Regulations for Study and Examination is ultimately not passed or the master's examination, including potential repetitions, is not passed completely by the end of the examination period of the seventh semester, the entitlement to examination in the Master's Program in Meteorology shall expire, unless the student is not responsible for having exceeded the deadline. The decision on extending the deadline and on exceptions from the deadline regulations shall be made by the examination committee taking into account the activities listed in Article 32, par. 6, LHG at the request of the student. This request shall be made in writing usually six weeks prior to the expiry of the deadline.

5.8 Deregistration, Absence, Withdrawal (§10, SPO)

- (1) Students can revoke their registration for written examinations until the issue of the examination tasks without having to indicate any reasons (deregistration). Deregistration can be made online on the Students Portal by 12 pm on the day before the examination or in justified exceptional cases with the Students Office during office hours. If the deregistration is addressed to the examiner, the latter shall ensure that the deregistration is documented in the Campus Management System.
- (2) In case of *oral examinations*, deregistration shall be declared to the examiner at least three working days before the date of examination. Withdrawal from an oral examination less than three working days before the date of examination shall be possible under the conditions outlined in par. 5 only. In principle, withdrawal from oral reexaminations in the sense of Article 9, par. 1 shall be possible under the conditions of par. 5 only.
- (3) Withdrawal from *examinations of another type* and from *coursework* shall be subject to the provisions given in the module manual.
- (4) An examination shall be deemed to have been "nicht ausreichend" (5.0, failed), if the student fails to be present at the examination without a good reason or if she/he withdraws from the examination after its start without a good reason. The same shall apply, if the master's thesis is not submitted within the period envisaged, unless the student is not responsible for having exceeded the deadline.
- (5) The reason given for withdrawal after the start of the examination or absence shall be notified immediately, credibly, and in writing to the examination committee. In case of sickness of the student or of a child cared for by the student alone or of a relative in need of care, submission of a medical certificate may be required.

5.9 Maternity Leave, Parental Leave, Assumption of Family Obligations (§12, SPO)

- (1) At the student's request, the maternity protection periods as defined by the Act on the Protection of the Working Mother (Mutterschutzgesetz, MuSchG), as amended, shall be considered. The required evidence shall be enclosed with this request. The maternity protection periods suspend any deadline according to the present examination regulations. The duration of maternity protection shall not be included in the deadline given.
- (2) At request, the deadlines of parental leave shall be considered according to the valid legislation (Bundeselterngeld- und Elternzeitgesetz (Parental Benefit and Parental Leave Act – BEEG)). Four weeks prior to the desired start of the parental leave period at the latest, the student shall inform the examination committee in writing about the time when she/he wishes to be on parental leave. The required evidence shall be enclosed. The examination committee shall then check whether the legal prerequisites would justify an employee's claim for parental leave and inform the student

immediately of the result and the new times of examination. The period of work on the Master's thesis may not be interrupted by parental leave. In this case, the thesis shall be deemed to have not been assigned. After expiry of the parental leave period, the student shall receive a new subject that is to be dealt with within the period defined in Article 14.

(3) At request, the examination committee shall decide on the flexible handling of examination deadlines according to the provisions of the Act of Baden-Württemberg on Universities and Colleges (LHG), if students have to assume family obligations. Paragraph 2, clauses 4 to 6 shall apply accordingly.

5.10 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 shall be considered. In particular, students with a disability or chronic disease shall 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) n case students provide evidence of a disability or chronic disease, as 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.
- (4) Examples of possible compensations of disadvantages:
 - Modified form of exams, for instance oral exams instead of written exams, and vice versa
 - Conducting exams in a separate room
 - Allowing necessary utilities and assistance, e.g. sign language interpreter
 - Additional breaks during time-limited exams
 - Extension of the periods between exams

5.11 Master's Thesis (§14, SPO)

The *Master's Thesis* is an independent scientific study and includes the theoretical and/or experimental work on a complex problem. Students deal with the current state of research and apply the expertise and scientific methods acquired during the studies. They can document, discuss and evaluate the obtained results. Furthermore, they can present and defend the essential findings. The topic of the *Master's Thesis* depends on the subject area chosen for the thesis.

(1) For admission to the master's thesis module, module examinations worth 70 credits must have been passed successfully. In particular, module examination in the subject of "Wissenschaftliches Arbeiten" (Scientific Work) must have been passed successfully. At the request of the student, the examination committee shall decide on exceptions.

(1a) 30 credits are assigned to the master's thesis module. It consists of the master's thesis and a presentation. The presentation shall be given four weeks after submission of the master's thesis at the latest.

- (2) The master's thesis topic can only be given out by university teachers ("Hochschullehrer(in)"), habilitated scientists, and leading scientists ("leitende(r) Wissenschaftler(in)") according to Article 14, par. 3, clause 1, KITG. In addition, the examination committee can authorize other examiners to give out the topic according to Article 17, pars. 2-4. The student shall be given the possibility of making proposals for the topic. If the master's thesis is to be written outside of the KIT Department of Physics, the approval of the examination committee shall be required. The master's thesis may also be accepted in the form of group work, if the contribution of the individual student to be evaluated in the examination can be distinguished clearly based on objective criteria and if the requirement outlined in par. 4 is fulfilled. In exceptional cases, the chairperson of the examination committee shall take care of the student receiving a topic for the master's thesis within four weeks after her/his request. In this case, the topic is issued by the chairperson of the examination committee.
- (3) The subject, task, and scope of the master's thesis shall be limited by the supervisor such that it can be handled with the workload outlined in par. 4.
- (4) The master's thesis shall demonstrate that the student is able to deal with a problem of her/his subject area in an independent manner and within a limited period of time using scientific methods. The scope of the master's thesis shall correspond to 30 credits. The maximum duration of work on the thesis shall amount to six months. The subject and task shall be adapted to the scope envisaged. The examination committee shall specify in which languages the master's thesis can be written. At the request of the student, the examiner can permit the master's thesis to be written in a language other than German.
- (5) When submitting the master's thesis, the student shall assure in writing that the thesis is original work by her/him alone and that she/he has used no sources and aids other than indicated, marked all citations in word and content, and observed the Rules of KIT for Safeguarding Good Scientific Practice, as amended. If this declaration is not contained, the thesis will not be accepted. The wording of the declaration may be:

The wording of the declaration may be:

"Ich versichere wahrheitsgemäß, die Arbeit selbständig verfasst, alle benutzten Hilfsmittel vollständig und genau angegeben und alles kenntlich gemacht zu haben, was aus Arbeiten anderer unverändert oder mit Abänderungen entnommen wurde sowie die Satzung des KIT zur Sicherung guter wissenschaftlicher Praxis in der jeweils gültigen Fassung beachtet zu haben."

"I herewith declare that the present thesis is original work written by me alone and that I have indicated completely and precisely all aids used as well as all citations, whether changed or unchanged, of other theses and publications, and that I have observed the Rules of KIT for Safeguarding Good Scientific Practice, as amended."

If the declaration is not true, the master's thesis shall be evaluated "nicht ausreichend" (5.0, failed).

- (6) The time of giving out of the topic of the master's thesis shall be recorded in the files of the examination committee by the supervisor and the student. The time of submission of the master's thesis shall be recorded in the files of the examination committee by the examiner. The student shall be allowed to return the topic of the master's thesis once only within the first month of the period of work on the thesis. At the justified request of the student, the examination committee may extend the time of work on the thesis given in par. 4 by three months at the maximum. If the master's thesis is not submitted in time, it shall be deemed to have been "nicht ausreichend" (failed, 5.0), unless the student is not responsible for this failure.
- (7) The master's thesis shall be evaluated at least by one university teacher ("Hochschullehrer(in)") or leading scientist ("leitende(r) Wissenschaftler(in)") according to Article 14, par. 3, clause 1, KITG and another examiner. Usually, one of the examiners is the person who gave out the thesis topic according to par. 2. In case of deviating evaluations of both persons, the examination committee shall fix the grade of the master's thesis within the limits of the evaluations of both persons. It may also appoint another expert. The evaluation period shall not exceed eight weeks after submission of the master's thesis.

5.12 Additional Achievements (§15, SPO)

- (1) Up to 30 further credits may be acquired in courses offered by KIT (additional achievements, "Zusatzleistungen"). Articles 3 and 4 of the examination regulations shall remain unaffected. These additional achievements shall not be considered when calculating the final and module grades. The credits not considered when determining the module grade shall be listed as additional achievements in the transcript of records. At the student's request, additional achievements shall be indicated in the master's certificate and marked as additional achievements. Additional achievements shall be listed with the grades outlined in Article 7.
- (2) The student shall declare a module examination an additional achievement when registering for this examination. At the student's request, allocation of the module can be changed later on.

5.13 Transferable Skills (Soft Skills) (§15a, SPO)

Apart from scientific qualifications, KIT attaches high importance to transferable skills. These skills of 4 credits shall be part of the Master's Program in Meteorology. Transferable skills may be achieved additively or integratively.

A wide range of interdisciplinary qualifications is offered by

- the House of Competence (HOC)
- the Sprachenzentrum (language center)
- the Center for Cultural and General Studies (ZAK)

5.14 Recognition of Coursework and Examinations as well as of Study Periods (§18, SPO)

- (1) Coursework and examinations completed, as well as study periods passed, in study programs at state or state-recognized universities and universities of cooperative education of the Federal Republic of Germany or at foreign state or state-recognized universities shall be recognized at the request of the student, if the competencies acquired do not differ considerably from the achievements or degrees to be replaced. For this, no schematic comparison, but an overall analysis shall be made. As regards the scope of a coursework to be recognized, the principles of the ECTS shall be applied.
- (2) he student shall submit the documents required for recognition. Students newly enrolled in the Master's Program in Meteorology shall submit the application together with the documents required for recognition within one semester after enrolment. If documents are not available in the German or English language, an officially certified translation may be required. The examination committee shall bear the burden of proving that the application does not meet the recognition requirements.
- (3) If achievements from outside of the KIT are recognized, they are listed as "anerkannt" (recognized) in the certificate. If grades exist, they shall be taken as is in case of comparable grade scales and shall be included in the calculation of module grades and the final grade. In case of incomparable grade systems, the grades can be converted. In the absence of grades, the note "bestanden" (passed) shall be entered.
- (4) When recognizing coursework and examinations passed outside of the Federal Republic of Germany, the equivalence agreements adopted by the Conference of Ministers of Education and the German Rectors' Conference as well as agreements concluded within the framework of university partnerships shall be considered.
- (5) Knowledge and skills acquired outside of the university system shall be recognized, if they are equivalent to the coursework and examinations to be replaced in terms of contents and level and if the institution, where the knowledge and skills were acquired, has a standardized quality assurance system. Recognition may be refused in parts when more than 50% of the university's study program is to be replaced.
- (6) The examination committee (§16, SPO) shall be responsible for recognition. To determine whether a considerable difference in the sense of par. 1 exists, the responsible subject representatives shall be

heard. Depending on the type and scope of coursework and examinations to be recognized, the examination committee shall decide on admission to a higher semester.

The process of recognition is as follows:

In case of a change of the degree program

If you want to change from another course of studies to Meteorology, you can in principle have achievements from the old course of studies recognized by the examination board. Students of **Meteorology** fill in the form after consulting **appl. Prof. Dr. Andreas Fink (Advisory Service for Meteorology).**

In case of a change of university

Students who continue a bachelor's or master's program in Meteorology at KIT that they started at another university may have their study and examination achievements recognized. The procedure is the same as for changing the course of study. The excerpt of the student's* grades and the module handbook of the university from which the student changed to KIT serve as proof.

In case of a stay abroad

When planning your study abroad, you can select courses in the module handbook of your host university that essentially correspond to the curriculum of the KIT Faculty of Physics.

In the **ERASMUS program**, you fill out a form for an individual study plan, the so-called *Learning Agreement*, before you start your studies abroad. For this purpose, suggest to the examination board which courses and performance assessments (study or examination achievements) of your host university should replace those of KIT. The scope (in credit points) of the course to be recognized must not be significantly smaller, the central contents (according to the module handbook) and the form of examination (written, oral, ...) must be identical, and the degree of difficulty of the performance review must be comparable to or higher than at KIT.

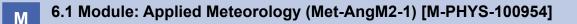
We offer students who plan to study abroad outside the ERASMUS program the agreement of an individual study plan with the KIT faculty (analogous to the ERASMUS Learning Agreement). You can find the form on our <u>website</u> under "Stay abroad". Students fill out the ERASMUS *Learning Agreement* or the individual study plan of the KIT faculty together with the above-mentioned student advisory service. After their return, they will then apply for the recognition of their achievements abroad. For this purpose, the usual form has to be filled in and submitted to the examination board with supporting documents (e.g. the transcript of records). Study achievements that were not previously agreed upon can also be recognized. Additional achievements cannot be acquired abroad (SPO §15 (1)).

5.15 Accomplishments obtained outside of the Higher Education System

Accomplishments made outside of the higher education system, as for example vocational training, can be accredited if the acquired competences contribute to the qualification goals of the Master's program. Recognition is requested with the respective form of the examination committee.

The examination committee verifies to which extent the acquired knowledge and capabilities can be recognized, and which parts of the program they can replace. At maximum, 50 % of the university education can be replaced. The form for recognition must be submitted to the study advisor, who will transfer it to the examination committee and the "Studierendenservice".

6 Modules



Responsible:Prof. Dr. Joaquim José Ginete Werner PintoOrganisation:KIT Department of PhysicsPart of:Applied and Experimental Meteorology

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

Mandatory			
T-PHYS-109142	Methods of Data Analysis	0 CR	Ginete Werner Pinto, Knippertz
T-PHYS-109143	Applied Meteorology (Module Exam)	10 CR	Ginete Werner Pinto
Compulsory Electiv	ves Applied Meteorology (Election: between 2 and 3 items)		
T-PHYS-108610	Turbulent Diffusion	0 CR	Hoose, Hoshyaripour
T-PHYS-109141	Energy Meteorology	0 CR	Emeis, Ginete Werner Pinto
T-PHYS-109139	Advanced Numerical Weather Prediction	0 CR	Knippertz

Competence Certificate

Prerequisite: Coursework ("Studienleistung")

For type of Coursework see Course description ("Teilleistungsbeschreibung")

 \rightarrow successful completion of the prerequisites entitles to exam

Examination: Assessment ("Prüfungsleistung")

T-PHYS-109143 Applied Meteorology (Module Exam)

Oral exam (approx. 60 minutes) in accordance with § 4 (2) No. 2 SPO Master's Meteorology

Competence Goal

The students can professionally explain essential aspects of application of meteorology and assign them to specific application areas. The students are capable to derive the Impact on air pollution and generating regenerative energy from weather information. They are capable of analyzing meteorological phenomena using statistical and computer-based methods.

Content

This module aims to give students an overview of important applications of

meteorology in areas such as weather forecasting and warning, insurance and energy industry, air quality and data analysis. In particular, the module deals with the following aspects:

- **Methods of data analysis** that are widely used in the Geosciences and particularly in meteorology / climate research are presented (e.g., statistical methods, correlation analyzes, least-squares (linear, multi-linear, and nonlinear regression), principal component analysis, Fourier analysis)
- Methods of **numerical weather prediction** (hydrodynamic systems of equations, spectral approximation methods, difference approximation on irregular grids, statistical data assimilation methods, operational aspects of weather forecasting).
- Energy meteorology (fundamentals of the energy system, application of meteorological expertise in the energy industry, in particular for the integration of renewable energies wind power, solar energy and hydro power, deepening of individual meteorological aspects of particular relevance)
- Dispersion of atmospheric constituents (relevant trace gases, diurnal cycles of emissions and concentrations, temperature and flow evolution in the lower atmosphere, **turbulent diffusion**, turbulence parameterization, chemical conversion processes, numerical models)

Module grade calculation

Grade of the oral exam.

6 MODULES

Workload

Presence time in lectures, exercises: 90 hours Preparation / follow-up: 90 hours Exam preparation: 120 hours

Recommendation

Basic knowledge in statistics are helpful.

6.2 Module: Atmospheric Processes (Met-AtPr1-1) [M-PHYS-100952]

 Responsible:
 Prof. Dr. Corinna Hoose

 Organisation:
 KIT Department of Physics

 Part of:
 Atmospheric and Climate Processes

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

Mandatory

Mandatory			
T-PHYS-107694	Cloud Physics	0 CR	Hoose
T-PHYS-107695	Energetics	0 CR	Fink
T-PHYS-108938	Atmospheric Aerosols	0 CR	Möhler
T-PHYS-107696	Atmospheric Radiation	0 CR	Höpfner
T-PHYS-108939	Atmospheric Processes (Module Exam)	12 CR	Hoose

Competence Certificate

Prerequisite: Coursework ("Studienleistung")

For type of Coursework see Course description ("Teilleistungsbeschreibung")

 \rightarrow successful completion of the prerequisites entitles to exam

Examination: Assessment ("Prüfungsleistung")

T-PHYS-108939 Atmosperic Processes (Module Exam)

Oral exam (approx. 60 minutes) in accordance with § 4 (2) No. 2 SPO Master's Meteorology

Competence Goal

The students can name essential processes in the atmosphere and explain these using physical and chemical laws. In particular, they are capable of explaining structure and dynamics of different cloud systems and estimating the micro physical processes in clouds or calculating them directly for idealized conditions. In addition, the students are capable of mathematically evaluating the radiation transport in the atmosphere and describe the importance of radiation processes for the structure of the atmosphere, for climate change and for the measurement of different atmospheric variables. They can also explain the chemical structure and the composition of the aerosols in the troposphere and the stratosphere on the basis of the atmospheric physico-chemical processes and transformations. The students know the main aerosol-cloud processes and are familiar with the *Köhler theory* and the classical nucleation theory.

Content

This module aims to give students an overview of important convey physical and chemical processes in the atmosphere. In particular, it includes:

Cloud Physics (phenomenology, cloud dynamics of stratiform and convective clouds, microphysics of warm and cold clouds, collision and coalescence, primary and secondary ice formation, condensational and depositional growth)

Energetics (mean meridional circulation, stationary and transient eddies; basic forms, budget equations and transport processes of energy in the atmosphere; principle of available potential energy; Lorenz cycle: energy reservoirs and transformation processes, eddy and thermally driven jets (EP flux vectors))

Atmospheric aerosols (gas particle processes (kinetics, diffusion, condensation), aerosol properties (diffusion, coagulation, sedimentation, impaction), Aerosol thermodynamics (chemical potential, solubility, crystallization), aerosol cloud processes (Köhler theory, ice nucleation))

Atmospheric radiation (basic quantities of electromagnetic radiation, atmospheric radiative transfer, boundary conditions, reflection, emission, molecular spectroscopy, line broadening, scattering, optical phenomena, radiation parametrization in atmospheric models, radiation budget, climate change, remote sensing)

Module grade calculation Grade of the oral exam

Workload

Presence time in lectures, exercises: 113 hours Preparation / follow-up: 87 hours Exam preparation: 160 hours

6.3 Module: Basics of Estimation Theory and its Application in Geoscience Remote Sensing (GSchApplGeoRS) [M-BGU-103422]

Responsible:Prof. Dr. Jan Cermak
Prof. Dr.-Ing. Stefan HinzOrganisation:KIT Department of Civil Engineering, Geo and Environmental Sciences
Part of:Part of:Required Electives

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

Mandatory	Mandatory						
T-BGU-106821	Basics of Estimation Theory, Prerequisite This item will not influence the grade calculation of this parent.	1 CR	Hinz				
T-BGU-106633	Data Analysis in Geoscience Remote Sensing Projects, Prerequisite This item will not influence the grade calculation of this parent.	2 CR	Cermak				
T-BGU-106822	Basics of Estimation Theory and its Application in Geoscience Remote Sensing	5 CR	Cermak, Hinz				

Competence Certificate

oral exam of about 30 min.

Prerequisites

none

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, deformation and statistical analysis to data recorded by geodetic, geophysical or remote sensing systems. An even deeper understanding of the subjects is reached by home and project work. The students process the collected project data and evaluate the obtained results critically. 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,
- · an introduction into the different statistical based methods of deformation analysis,
- statistical approaches to the analysis of remote sensing data in a geosciences context.

Module grade calculation

grade of oral exam

Workload

210 h total, thereof 45 h contact hours

6.4 Module: Components of the Climate System (Met-KKli1-1) [M-PHYS-100951] Μ

Responsible: Prof. Dr. Andreas Fink **Organisation:** Part of:

KIT Department of Physics

Atmospheric and Climate Processes

Credits	Grading scale	Recurrence	Duration	Language	Level	Version
12	Grade to a tenth	Each winter term	1 term	English	4	7

Mandatory			
T-PHYS-108933	Components of the Climate System (Module Exam)	12 CR	Fink
Compulsory Electiv	ves (Election: between 3 and 5 items)		
T-PHYS-107692	Seminar on IPCC Assessment Report	0 CR	Ginete Werner Pinto, Hoose, Ludwig
T-PHYS-107693	Tropical Meteorology	0 CR	Knippertz
T-PHYS-108928	Climate Modeling & Dynamics with ICON	0 CR	Ginete Werner Pinto, Voigt
T-PHYS-108931	Middle Atmosphere in the Climate System	0 CR	Höpfner, Sinnhuber
T-PHYS-108932	Ocean-Atmosphere Interactions	0 CR	Fink
T-PHYS-111273	Arctic Climate System	0 CR	Sinnhuber

Competence Certificate

Prerequisite: Coursework ("Studienleistung")

For type of Coursework see Course description ("Teilleistungsbeschreibung")

 \rightarrow successful completion of the prerequisites entitles to exam

Examination: Assessment ("Prüfungsleistung")

T-PHYS-108933 Components of the Climate System (Module Exam)

Oral exam (approx. 60 minutes) in accordance with § 4 (2) No. 2 SPO Master's Meteorology

Competence Goal

The students can explain essential components of the climate system and their physical properties. They are capable of explaining causes of climate change competently, present them and discuss them critically. Students can name and explain climate monitoring systems and explain the basic principles of climate models.

The students can designate essential processes in the atmosphere and ocean and explain them with physical and chemical laws. They are able to analyze and interpret climate and weather data on the basis of diagnostic methods. In addition, they can competently present and discuss learned or self-developed scientific findings.

Content

This module aims to give students an overview of important components of the climate system, their physical and chemical backgrounds and their temporal and spatial changes.

This includes lectures, course work, computer and modelling classes on individual components of the climate system (e.g. tropics, polar regions, ocean, middle atmosphere) and on climate dynamics and change.

Module grade calculation

Grade of the oral exam.

Annotation

In the module Components of the climate system courses (C) are offered with lectures (L) and exercises (2L1E) and lectures without exercises (2L). Registration for this examination is only possible if courseworks have been made in a sufficient amount. There are different ways to do this:

- 2C with 2L1E and 2C with 2L

Workload

Presence time in lectures, exercises: 120 hours

Preparation / follow-up: 120 hours

Exam preparation: 120 hours

Recommendation

Basic knowledge about the climate system is helpful.

Master of Science Meteorology (M.Sc.) Module Handbook as of 05/09/2022

6.5 Module: Computer Vision and GIS [M-BGU-102757]

Responsible:	Prof. DrIng. Stefan Hinz
Organisation:	KIT Department of Civil Engineering, Geo and Environmental Sciences
Part of:	Required Electives

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

Mandatory

T-BGU-101681	Introduction to GIS for Students of Natural, Engineering and Geo Sciences	3 CR	Rösch, Wursthorn			
T-BGU-103541	Introduction to GIS for Students of Natural, Engineering and Geo Sciences, Prerequisite	3 CR	Rösch, Wursthorn			
T-BGU-101732	Image Processing and Computer Vision	4 CR	Weidner			

Competence Certificate

online test, written exam (90 min., oral exam (30 min.)

Prerequisites

None

Competence Goal

Die Studierenden sind mit der Erfassung, Analyse und Präsentation von Daten mit Raumbezug vertraut. Darüber hinaus kennen sie die unterschiedlichen Aspekte geometrischer und topologischer Modellierung und beherrschen die Sachdatenverwaltung.

Die Studierenden verstehen ferner die grundlegenden Prinzipien eines Geoinformationssystems und sind mit der Definition des Raumbezugs vertraut. Sie sind in der Lage, einfache projektbezogene Fragestellungen selbstständig zu bearbeiten. Darüber hinaus können sie ausgewählte Grundlagen der Bildverarbeitung und Computer Vision beschreiben, anwenden und auf andere Anwendungsgebiete übertragen.

Content

Einführung in GIS für Studierende natur-, ingenieur- und geowissenschaftlicher Fachrichtungen: Bezugs- und Koordinatensysteme sowie deren Transformation (z.B. UTM, Gauß-Krüger); Grundlagen der Informatik (z.B. Datenbanken, SQL); Geodatenmodellierung und Erfassung (z.B. GNSS); Normierung und Standardisierung in GIS (z.B. ISO, OGC, WFS, WMS); Einfache Algorithmen (z. B. "Point in Polygon"); Software: Vornehmlich QGIS, ArcGIS, Web-GIS u. a.

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.

Workload

Einführung in GIS für Studierende natur-, ingenieur- und geowissenschaftlicher Fachrichtungen: 180 h gesamt, davon Präsenzzeit 45 h

Image Processing and Computer Vision: 90 h total, thereof 32 h contact hours

Recommendation

None

6.6 Module: Computer Vision and Remote Sensing [M-BGU-102759]									
Responsible:Prof. Dr. Jan Cermak DrIng. Uwe WeidnerOrganisation:KIT Department of Civil Engineering, Geo and Environmental Sciences Part of:Part of:Required Electives									
	Credits 8	Grading scale Grade to a tenth	Recurrence Each summer term	Duration 2 terms	Language German/English	-	vel 4	Version 3	
Manda	itory								
T-BGI	U-105725	Introduction into C	lassification Methods o	f Remote Sen	sing	4 CR	Wei	dner	
Compu	uter Vision	and Remote Sensin	g (Election: between [,]	1 and 2 items	as well as 4 cred	dits)			
T-BGI	U-101732	Image Processing	and Computer Vision			4 CR	CR Weidner		
T-BGl	U-106333	Remote Sensing o	f a Changing Climate, I	Prerequisite		1 CR	Ceri	mak	
T-BGI	U-106334	Remote Sensing o	f a Changing Climate, I	Examination		3 CR	Cermak		
T-PH	YS-108283	Wildcard				4 CR			
T-PH	YS-108284	Wildcard				4 CR			
T-PH	YS-108285	Wildcard				4 CR			
T-PH	YS-108286	Wildcard				4 CR			

Competence Certificate

oral exams

Prerequisites

none

Competence Goal

Einführung in Klassifizierungsverfahren der Fernerkundung (Pflicht): Studierende können die Grundlagen der Fernerkundung erklären sowie grundlegende Klassifizierungsverfahren benennen, erläutern und selbststtätig anwenden.

Satellite climatology – remote sensing of a changing climate: 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 in 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.

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.

Content

Einführung in Klassifizierungsverfahren der Fernerkundung: Die in den Vorlesungen und Übungen behandelten Themen umfassen die Themenbereiche Vorprozessierung und Visualisierung von Fernerkundungsdaten und deren Eigenschaften, grundlegende Klassifizierungsverfahren und Prinzipien der Bewertung der Klassifizierungsgüte sowie Anwendungsbereiche von Klassifizierungen und deren Ergebnisse hinsichtlich Landbedeckung und Landnutzung.

Satellite climatology – remote sensing of a changing climate:

- 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 mechnisms of global change
 - Land and ocean surface
 - Atmosphere
- · Links between remote sensing and other methods in global change research

Image Processing and Computer Vision: This lecture 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 teaching concept consists of lectures and labs.

Module grade calculation weighted mean by credit points

Workload

Einführung in Klassifizierungsverfahren der Fernerkundung (Pflicht): 120 h gesamt, davon 32 h Präsenz

Satellite climatology – remote sensing of a changing climate: 120 h total, thereof 32 contact hours Image Processing and Computer Vision: 120 h total, thereof 32 h contact hours

6.7 Module: Experimental Meteorology (Met-ExpM2-1) [M-PHYS-100953]

 Responsible:
 Dr. Björn-Martin Sinnhuber

 Organisation:
 KIT Department of Physics

 Part of:
 Applied and Experimental Meteorology



Election notes

The credit points for T-BGU-111185 have been adapted to the course program Meteorology and Climate Physics (0 LP). Further information see course description.

Mandatory							
T-PHYS-109135	Advanced Practical Courses	0 CR	Höpfner				
T-PHYS-109136	Field Trip	0 CR	Hoose				
T-PHYS-109137	Experimental Meteorology (Module Exam)	14 CR	Sinnhuber				
T-PHYS-111274	Remote Sensing of Atmosphere and Ocean	0 CR	Sinnhuber				
T-BGU-111185	Atmospheric Remote Sensing Infrastructures, Prerequisite	0 CR	Cermak				

Competence Certificate

Prerequisite: Coursework ("Studienleistung")

For type of Coursework see Course description ("Teilleistungsbeschreibung")

 \rightarrow successful completion of the prerequisites entitles to exam

Examination: Assessment ("Prüfungsleistung")

T-PHYS-109137 Experimental Meteorology (Module Exam)

Oral exam (approx. 60 minutes) in accordance with § 4 (2) No. 2 SPO Master's Meteorology

Competence Goal

The students can explain the functionality of modern meteorological measuring methods and measuring principles and name their possible uses. This is especially true for remote sensing, advanced in-situ, trace gas and aerosol measurements. The students are able to build and execute experiments in the lab or in the field according to instructions, to record and evaluate data scientifically founded and then interpret and present the results. They are aware of the Rules for Safeguarding Good Scientific Practice and the responsibilities associated with the production and use of scientific data, e.g. not to invent/pretend results or to distort or suppress undesired data and results.

Content

This module is intended to provide students with an overview of modern measurement methods in meteorology and practical aspects of application. In particular, this includes:

- **remote sensing** (physical basics, radiation transfer, inverse methods, basics of satellite remote sensing, techniques and applications),
- atmospheric remote sensing infrastructures (Large-scale research infrastructures: role in environmental and atmospheric research, Overview of atmospheric remote sensing infrastructures at KIT, Details of selected atmospheric remote sensing infrastructures and ongoing project work
- In addition, the module provides the students with an insight into and **practical experience** with modern measuring methods, such as those used in research at KIT and other institutions, on the basis of the internship and the excursion.

Module grade calculation

Grade of the oral exam

Workload

Presence time in lectures, exercises: 57 hours Attendance time in excursion and practicals 100 hours Preparation / follow-up: 143 hours Exam preparation: 120 hours

6.8 Module: Fluid Mechanics and Turbulence (bauiEX217-FMTURB) [M-BGU-105504]

Responsible: Prof. Dr. Olivier Eiff

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

Part of:Required Electives (Usage from 10/1/2020)

	Credits 9	Grading scale Grade to a tenth	Recurrence Each summer term	Duration 2 terms	Language English	Level 4	Version 1	
Electives	Electives 1 (Election: 1 item as well as 6 credits)							
T-BGU-1	T-BGU-106612 Advanced Fluid Mechanics					6 CR	Eiff	
T-BGU-110841		Fluid Mechanics of T	urbulent Flows			6 CR	Uhlmann	

Electives 2 (Election: 1 item as well as 3 credits)				
T-BGU-110411	Flow Measurement Techniques	3 CR	Gromke	
T-BGU-111060	Building and Environmental Aerodynamics	3 CR	Gromke	

Competence Certificate

One examination has to be taken in one of the 'Teilleistungen' 'Fluid Mechanics of Turbulent Flows' or 'Advanced Fluid Mechanics' and one other exmaination in one of the 'Teilleistungen' 'Flow Measurement Technique' or 'Building- and Environmental Aerodynamics'. The learning controls depend on the selected 'Teilleistungen' (s. 'Teilleistungen').

- 'Teilleistung' T-BGU-106612 with written examination according to § 4 Par. 2 No. 1

- 'Teilleistung' T-BGU-110841 with oral examination according to § 4 Par. 2 No. 2
- 'Teilleistung' T-BGU-110411 with oral examination according to § 4 Par. 2 No. 2
- 'Teilleistung' T-BGU-111060 with oral examination according to § 4 Par. 2 No. 1

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

Prerequisites

none

Competence Goal

The studierenden are able to explain basic terms and concepts in the field of fluid mechanics with appropriate terminology and attribute them to physical laws. They are familiar with examples of application, modelling and measurement.

Content

- Advanced Fluid Mechanics teaches the advanced fundamentals of fluid mechanics and forms the basis for environmental fluid mechanics. Starting from the underlying local conservation laws, the phenomena of the different classes of flow and their possible analytical solutions are treated. This includes the general and special forms of the basic equations, flow kinematics, incompressible viscous flows, ideal fluid flows, shallow water flows and buoyancy effects in flows. Furthermore, waves and turbulence are addressed and different analysis methods such as scaling are treated.
- 2. Fluid Mechanics of Turbulent Flows provides the mathematical description of the physics of turbulence is successively developed. The module presents the phenomenology of turbulent flows, introduces the statistical description of turbulent flow processes, discusses the characteristics of free and wall-bounded shear flows, and presents an analysis of the turbulent energy cascade.
- 3. Flow Measurement Techniques teaches the basics of flow velocity measurement, with a focus on laser-optical measurement techniques such as those used in wind tunnels.
- 4. Building- and Environmental Aerodynamics gives an introduction to the natural wind and its interaction with the built and natural environment. In the focus are wind load on buildings and wind induced vibrations as well as flow processes in the natural environment regarding natural wind shelter, fresh air ventilation to urban areas and wind comfort.

Module grade calculation

grade of the module is the weighted average of the partial examinations from compulsory elective block 1 (75%), Advanced Fluid Mechanics or Fluid Mechanics of Turbulent Flows, and compulsory elective block 2 (25%), Flow Measurement Techniques or Building and Environmental Aerodynamics.

Annotation

none

Workload

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

depending on the selected courses or examinatrions, respectively:

- Advanced Fluid Mechanics lecture/exercise: 60 h
- · Fluid Mechanics of Turbulent Flows lecture/exercise: 60 h
- Flow Measurement Techniques lecture/exercise: 30 h
- Building and Environmental Aerodynamics lecture/exercise: 30 hrs.

independent study:

depending on the selected courses or examinatrions, respectively:

- preparation and follow-up lecture/exercises Advanced Fluid Mechanics: 30 h
- working on exercises Advanced Fluid Mechanics: 30 h
- examination preparation Advanced Fluid Mechanics: 60 h
- preparation and follow-up lecture/exercises Fluid Mechanics of Turbulent Flows : 60 h
- examination preparation Advanced Fluid Mechanics: 60 h
- preparation and follow-up lecture/exercises Flow Measurement Techniques: 30 h
- · examination preparation Flow Measurement Techniques: 30 h
- preparation and follow-up lecture/exercises Building and Environmental Aerodynamics: 30 h
- examination preparation Building and Environmental Aerodynamics: 30 h

total: 270 h

Recommendation

basics in Mathematics and Hydromechanics; prior knowledge in programming with Matlab is helpful for the couorse "Fluid Mechanics of Turbulent Flows"

start of the module in summer term

Base for

non specified

6.9 Module: Geoecology [M-BGU-103398]

Responsible:	Prof. Dr. Wolfgang Wilcke
Organisation:	KIT Department of Civil Engineering, Geo and Environmental Sciences
Part of:	Required Electives



Mandatory				
T-BGU-107487	Geomorphology and Soil Science	7 CR	Wilcke	
T-BGU-107486	Field Course Soil Science	1 CR	Wilcke	

Competence Certificate

- Brick T-BGU-107487 with a written examination with 90 minutes according to § 4 Par. 2 No. 1 of the study and examination regulations (SPO) master meteorology

- Brick T-BGU-107486 with with not graded accomplishment (soil profile in small groups with approximately 2 pages) according to § 4 Par. 3 of the study and examination regulations (SPO) master meteorology

Details about the learning control see at the bricks

Prerequisites

None

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Competence Goal

The students know the basic terms, concepts and theories of the disciplines Geomorphology and Soil Science. They are able to recognize important land surface forms and to interpret them in a knowledgeable way. They know the composition, structure, properties and functions of soils.

Content

The module teaches the fundamental principles of Soil Science and Geomorphology. It consists of three courses with the following contents:

- Geomorphology and Soil Science: This brick treats the most important exogenic processes (weathering including karst, gravitational mass self-discplacements, glacial and periglacial dynamics, eolic, fluviatile and litoral dynamics, peneplains and escarpments). The soil is introduced as three-phases system and the individual phases (solid, liquid and gaseous) are discussed. Subject of this brick are the soil-forming factors and processes and the resulting suite of horizons of soils. Important physical properties of soils are introduced (color, texture, structure, mechanical stability, water retention and transport, heat budget). Important physico-chemical soil properties are treated (humus properties, soil acidity, redox potential, cation exchange). Ecological soil functions are presented. This brick moreover introduces the minerals of soils. The most important mineral formation processes are presented with a focus on silicates, oxides and sulfides. The interactions between microorganisms and soil minerals are discussed.
- Soils of Europe: This brick introduces the German soil classification and uses it as structure. The World Reference Base
 of Soil Resources and the US Keys to Soil Taxonomy are presented. The most important diagnostic prperties of soils
 (surface and subsoil Horizons, specific properties) are taught. This brick puts all soil types of the German Soil
 Classification in their pedogenetic context. The brick treats the property-forming processes and the ecological soil
 properties resulting from these processes.
- Soil scientific field exercise: This brick consists of a one-day exercise in the surroundings of Karlsruhe, during which important local landscape features and soils are introduced and during which the students train the Interpretation of geomorphologic forms and properties of soil horizons.

Module grade calculation

Grade of the module is grade of the written examination

Annotation

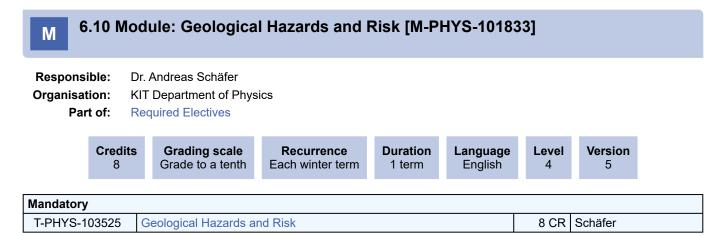
None

Workload

- 1. Contact hours in lecture and exercises: 67,5 h
- 2. Preparation and follow-up: 142,5 h
- 3. Examination and exam preparation: 30 h

Recommendation

The first attendance of the course "geomorphology and soil science" is recommended. The participation of the exercise "geomorphology and soil science" is optionally.



Competence Certificate

Active and regular attendance of lecture and practicals. Project work (graded).

Prerequisites

none

Competence Goal

The students understand basic concepts of hazard and risk. They can explain in detail different aspects of earthquake hazard, volcanic hazard as well as other geological hazards, can compare and evaluate those hazards. The have fundamental knowledge of risk reduction and risk management. They know methods of risk modelling and are able to apply them.

Content

- Earthquake Hazards
 - Short introduction to seismology and seismometry (occurrence of tectonic earthquakes, types of seismic waves, magnitude, intensity, source physics)
 - Induced seismicity
 - Engineering seismology, Recurrence intervals, Gutenberg-Richter, PGA, PGV, spectral acceleration, hazard maps
 - Earthquake statistics
 - Liquefaction
- Tsunami Hazards
- Landslide Hazards
- · Hazards from Sinkholes
- Volcanic Hazards
 - Short introduction to physical volcanology
 - Types of volcanic hazards
- The Concept of Risk, Damage and Loss
- · Data Analysis and the use of GIS in Risk analysis
- · Risk Modelling Scenario Analysis
- Risk Reduction and Risk Management
- Analysis Feedback and Prospects in the Risk Modelling Industry

Module grade calculation

Project work will be graded.

Workload

- 60 h: active attendance during lectures and exercises
- 90 h: review, preparation and weekly assignments
- 90 h: project work

Learning type

4060121 Geological Hazards and Risk (V2) 4060122 Übungen zu Geological Hazards and Risk (Ü2)

Literature

Literature will be provided by the lecturer.

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6.11 Module: Geophysical analysis of natural hazards [M-PHYS-103336]

Responsible:Prof. Dr. Andreas RietbrockOrganisation:KIT Department of PhysicsPart of:Required Electives

(Credits 8	Grading scale Grade to a tenth	Recurrence Each summer term	Duration 2 terms	Language English	Level 4	Version 3	
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Mandatory					
T-PHYS-103553	Introduction to Volcanology, Prerequisite	3 CR	Bohlen		
T-PHYS-103644	Introduction to Volcanology, Exam	1 CR	Bohlen		
T-PHYS-107673	Seminar on Recent Topics of Risk Science	4 CR	Rietbrock		

Competence Certificate

Introduction to Volcanology

Active and regular attendance of lecture and practicals, presentation of a volcano in a short (10 – 15 minute) talk with slides, submission of a scientific essay about their presentation, approx. 8-10 pages, which will be graded.

Seminar on recent topics of risk sclence

Preparation and presentation of a talk based on a scientific publication, critical discussion of the scientific results.

Competence Goal

Introduction to Volcanology

The students know and understand the basic concepts of physical volcanology. They are able to classify volcanoes by their tectonic location, can discriminate between different eruption types and describe different volcanic edifices with respect to their tectonic environment. They understand the concept of volcanic hazard and risk and are able to apply it. They can explain the physics of volcanic monitoring methods and know about their advantages and disadvantages. They gained insight into numerical moelling tools and can name several appliations. The students understand the impact of volcanic eruptions on climate and know both, presently as well as historically active volcanoes and their prominent eruptions.

The students have gained an overview about active volcanoes and recent eruptions and are able to summerize the main characteristics and scientific achievements about one volcano of their choice in a 10-15 minute talk. They are able to discuss and answer questions related to their subject. They can summarize their research about the volcano of their choice in a scientific essay (8-10 pages).

Seminar on recent topics of risk sclence

The students understand scientific literature regarding current topics of natural hazards and risk. They can summarize a selected topic, describe and explain the main idea to their fellow students in an oral presentation (30-40 minutes). They know how to structure and present a scientific talk. They are able to understand the topics presented by their fellow students, discuss and analyze the content critically. They are able to compare those research results and evaluate the content critically.

Content Introduction to oulcanology

- Introduction, Overview
- Volcanoes and Plate TectonicsMagma and Volcanic Deposits
- Eruption types
- Volcanic Edifices
- Volcanic Hazard and Risk
- Volcano Monitoring
- Volcano Seismology
- Numerical Modelling of Volcanic Products
- Historic Eruptions
- Volcanoes and Climate

Seminar on recent topics of risk science

The students will read and discuss current literature about current topics of natural hazards and risk.

Module grade calculation

The grade of the module results from grade of of the scientific essay of "Introduction to Volcanology".

Learning type

4060251 Introduction to Volcanology (V1) 4060252 Exercises to Introduction to Volcanology (Ü1) 4060254 Seminar über aktuelle Fragen aus der Risikoforschung (S2)

Literature

Literature will be provided by the lecturer.

6.12 Module: GIS and Geo Data Infrastructures [M-BGU-102760]

 Responsible:
 Prof. Dr.-Ing. Stefan Hinz

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

 Part of:
 Required Electives

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

Mandatory

mandatory						
T-BGU-101681	Introduction to GIS for Students of Natural, Engineering and Geo Sciences	3 CR	Rösch, Wursthorn			
T-BGU-103541	Introduction to GIS for Students of Natural, Engineering and Geo Sciences, Prerequisite	3 CR	Rösch, Wursthorn			
T-BGU-101756	Geo Data Infrastructures and Web Services	1 CR	Wursthorn			
T-BGU-101757	Geodata Infrastructures and Web-Services, Prerequisite	3 CR	Wursthorn			

Competence Certificate

Einführung in GIS: schriftliche Klausur (90 min.); Geodateninfrastrukturen: mündliche Prüfung (20 min.) oder schriftliche Ausarbeitung

Prerequisites

None

Competence Goal

Die Studierenden sind mit der Erfassung, Analyse und Präsentation von Daten mit Raumbezug vertraut. Darüber hinaus kennen sie die unterschiedlichen Aspekte geometrischer und topologischer Modellierung und beherrschen die Sachdatenverwaltung.

Die Studierenden verstehen ferner die grundlegenden Prinzipien eines Geoinformationssystems und sind mit der Definition des Raumbezugs vertraut. Sie sind in der Lage, einfache projektbezogene Fragestellungen selbstständig zu bearbeiten.

Darüber hinaus können sie standardisierte Geo-Webdienste erklären und diese Dienste auf der Client-Seite nutzen und diese selbst als Service zur Verfügung stellen. Die Studierenden können dabei ihr Wissen über Geodateninfrastrukturen an konkreten, praktischen Fragestellungen anwenden.

Content

Einführung in GIS für Studierende natur-, ingenieur- und geowissenschaftlicher Fachrichtungen: Bezugs- und Koordinatensysteme sowie deren Transformation (z.B. UTM, Gauß-Krüger); Grundlagen der Informatik (z.B. Datenbanken, SQL); Geodatenmodellierung und Erfassung (z.B. GNSS); Normierung und Standardisierung in GIS (z.B. ISO, OGC, WFS, WMS); Einfache Algorithmen (z. B. "Point in Polygon"); Software: Vornehmlich QGIS, ArcGIS, Web-GIS u. a.

Geodateninfrastrukturen und Webdienste: Das Modul befasst sich mit den standardisierten Geodateninfrastrukturen INSPIRE, GDI-DE und behandelt die dafür nötigen OGC Dienste. Darüber hinaus wird Überblick über Geo-Webdienste außerhalb der OGC-Welt gegeben.

Module grade calculation

weighted mean

Workload

Einführung in GIS für Studierende natur-, ingenieur- und geowissenschaftlicher Fachrichtungen: 180 h gesamt, davon Präsenzzeit 45 h

Geodateninfrastrukturen und Web-Dienste: 120 h gesamt, davon Präsenzzeit 45 h

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6.13 Module: GIS and Remote Sensing [M-BGU-102758]

Responsible:	Prof. DrIng. Stefan Hinz
Organisation:	KIT Department of Civil Engineering, Geo and Environmental Sciences
Part of:	Required Electives

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

Mandatory	Mandatory					
T-BGU-105725	Introduction into Classification Methods of Remote Sensing	4 CR	Weidner			
T-BGU-101681	Introduction to GIS for Students of Natural, Engineering and Geo Sciences	3 CR	Rösch, Wursthorn			
T-BGU-103541	Introduction to GIS for Students of Natural, Engineering and Geo Sciences, Prerequisite	3 CR	Rösch, Wursthorn			

Competence Certificate

Online test, written exam (90 min.), oral exam (approx. 20 min.)

Prerequisites

None

Competence Goal

Die Studierenden sind mit der Erfassung, Analyse und Präsentation von Daten mit Raumbezug vertraut. Darüber hinaus kennen sie die unterschiedlichen Aspekte geometrischer und topologischer Modellierung und beherrschen die Sachdatenverwaltung.

Die Studierenden verstehen ferner die grundlegenden Prinzipien eines Geoinformationssystems und sind mit der Definition des Raumbezugs vertraut. Sie sind in der Lage, einfache projektbezogene Fragestellungen selbständig zu bearbeiten.

Darüber hinaus können sie die Grundlagen der Fernerkundung erklären sowie grundlegende Klassifizierungsverfahren benennen, erläutern und selbsttätig anwenden.

Content

Einführung in GIS für Studierende natur-, ingenieur- und geowissenschaftlicher Fachrichtungen: Bezugs- und Koordinatensysteme sowie deren Transformation (z.B. UTM, Gauß-Krüger); Grundlagen der Informatik (z.B. Datenbanken, SQL); Geodatenmodellierung und Erfassung (z.B. GNSS); Normierung und Standardisierung in GIS (z.B. ISO, OGC, WFS, WMS); Einfache Algorithmen (z. B. "Point in Polygon"); Software: Vornehmlich QGIS, ArcGIS, Web-GIS u. a.

Einführung in Klassifizierungsverfahren der Fernerkundung: Die in den Vorlesungen und Übungen behandelten Themen umfassen die Themenbereiche Vorprozessierung und Visualisierung von Fernerkundungsdaten und deren Eigenschaften, grundlegende Klassifizierungsverfahren und Prinzipien der Bewertung der Klassifizierungsgüte sowie Anwendungsbereiche von Klassifizierungen und deren Ergebnisse hinsichtlich Landbedeckung und Landnutzung.

Module grade calculation

weighted mean

Annotation

None

Workload

Einführung in GIS für Studierende natur-, ingenieur- und geowissenschaftlicher Fachrichtungen: 180 h gesamt, davon Präsenzzeit 45 h

Einführung in Klassifizierungsverfahren der Fernerkundung: 90 h gesamt, davon Präsenzzeit 32 h

Recommendation

None

6.14 Module: Informatics for Meteorology Students [M-INFO-102980]

Responsible:Prof. Dr. Bernhard BeckertOrganisation:KIT Department of InformaticsPart of:Required Electives



Informatics for Meteorology Students (Election: at least 1 item as well as at least 8 credits)						
T-INFO-101345	Parallel Computer Systems and Parallel Programming	4 CR	Streit			
T-INFO-101298	Distributed Computing	4 CR	Streit			
T-INFO-102061	Mobile Computing and Internet of Things	5 CR	Beigl			
T-INFO-101497	Database Systems	4 CR	Böhm			
T-INFO-101275	Visualization	5 CR	Dachsbacher			
T-INFO-111622	Data Science I	5 CR	Böhm, Fouché			

Competence Certificate

Die Erfolgskontrollen werden in den jeweiligen Teilleistungen beschrieben.

Competence Goal

T-INFO-101345 Parallelrechner und Parallelprogrammierung

Qualifikationsziele:Studierende erörtern die Grundbegriffe paralleler Architekturen und die Konzepte ihrer Programmierung. Sie analysieren verschiedene Architekturen von Höchstleistungsrechnern und differenzieren zwischen verschiedene Typen anhand von Beispielen aus der Vergangenheit und Gegenwart Studierende analysieren Methoden und Techniken zum Entwurf, Bewertung und Optimierung paralleler Programme, die für den Einsatz in Alltags- oder industriellen Anwendungen geeignet sind und wenden diese an. Studierende können Probleme im Bereich der Parallelprogrammierung beschreiben, analysieren, und beurteilen.

T-INFO-101298 Verteiltes Rechnen

Qualifikationsziele:Studierende verstehen die Grundbegriffe verteilter Systeme, im Speziellen in den aktuellen Techniken des Grid und Cloud Computing sowie des Management großer bzw. verteilter Daten. Sie wenden zugrundeliegenden Paradigmen und Services auf gegebene Beispiel an.Studierende analysieren Methoden und Technologien des Grid und Cloud Computing sowie verteilten Daten-Managements, die für den Einsatz in alltags- und industriellen Anwendungsgebieten geeignet sind bzw. welche heute von Google, Facebook, Amazon, etc. eingesetzt werden. Hierfür vergleichen die Studierenden Web/Grid Services, elementare Grid Funktionalitäten, Datenlebenszyklen, Metadaten, Archivierung, Cloud Service Typen (IaaS, SaaS, PaaS) und Public/Private Clouds anhand von Beispielen aus der Praxis.

T-INFO-102061 Mobile Computing und Internet der Dinge Qualifikationsziele:Mobile Computing und Internet der Dinge ermöglichen es im beruflichen und privaten Alltag ubiquitär auf Informationen und Dienste zuzugreifen. Diese Dienste reichen von Augmented-Reality Informationsdiensten über den Ad-Hoc Austausch von Daten zwischen benachbarten Smartphones bis hin zur Haussteuerung.Ziel der Vorlesung ist es, Kenntnisse über Grundlagen, weitergehende Methoden und Techniken des Mobile Computing und des Internet der Dinge zu erwerben.Nach Abschluss der Vorlesung können die Studierenden• Techniken zur Gestaltung von Mobile Computing Software und Benutzerschnittstellen für Mobile Computing Anwendungen benennen, beschreiben und erklären und bewerten• Software- und Kommunikationsschnittstellen für das Internet der Dinge und Basiskenntnisse zu Personal Area Networks (PAN) bennenen, beschreiben, vergleichen und bewerten• selbständig Systeme für Mobile Computing und das Internet der Dinge entwerfen, Entwürfe analysieren und bewerten• eine adaptive Webseite entwerfen, implementieren und auf ihre Usability hin untersuchen• eine eigene App konzipieren und implementieren, die über Bluetooth mit einem Gerät kommuniziert

T-INFO-101305 Analysetechniken für große Datenbestände

Qualifikationsziele:Am Ende der Lehrveranstaltung sollen die Teilnehmer die Notwendigkeit von Konzepten der Datenanalyse gut verstanden haben und erläutern können. Sie sollen unterschiedliche Ansätze zur Verwaltung und Analyse großer Datenbestände hinsichtlich ihrer Wirksamkeit und Anwendbarkeit einschätzen und vergleichen können. Die Teilnehmer sollen verstehen, welche Probleme im Themenbereich der Vorlesung derzeit offen sind, und einen Einblick in den diesbezüglichen Stand der Forschung gewonnen haben.

T-INFO-101497 Datenbanksysteme

Qualifikationsziele:

Der/die Studierende• ist in der Lage den Nutzen von Datenbank-Technologie darzustellen,• kennt die Modelle und Methoden bei der Entwicklung von funktionalen Datenbank-Anwendungen,• ist in der Lage selbstständig einfache Datenbanken anzulegen und Zugriffe auf diese zu tätigen,kennt und versteht die entsprechenden Begrifflichkeiten und die Grundlagen der zugrundeliegenden Theorie

T-INFO-101275 Visualisierung

Qualifikationsziele:

Die Studierenden lernen in dieser Vorlesung wichtige Algorithmen und Verfahren der Visualisierung kennen und können diese unterschiedlichen Anwendungsfeldern zuordnen, sie analsieren und bewerten. Die erworbenen Kenntnisse sind in vielen Bereichen der Forschung in der Computergrafik, und der (Medizin-/Bio-/Ingenieurs-)Informatik wertvoll. Die Studierenden können für ein gestelltes Problem geeignete Visualisierungstechniken auswählen und selbst implementieren.

Content

T-INFO-101345 Parallelrechner und Parallelprogrammierung

Inhalt:Die Vorlesung gibt eine Einführung in die Welt moderner Parallel- und Höchstleistungsrechner, des Supercomputings bzw. des High-Performance Computings (HPC) und die Programmierung dieser Systeme.Zunächst werden allgemein und exemplarisch Parallelrechnersysteme vorgestellt und klassifiziert. Im Einzelnen wird auf speichergekoppelte und nachrichtengekoppelte System, Hybride System und Cluster sowie Vektorrechner eingegangen. Aktuelle Beispiele der leistungsfähigsten Supercomputer der Welt werden ebenso wie die Supercomputer am KIT kurz vorgestellt.Im zweiten Teil wird auf die Programmierung solcher Parallelrechner, die notwendigen Programmierparadigmen und Synchronisationsmechanismen, die Grundlagen paralleler Software sowie den Entwurf paralleler Programme eingegangen. Eine Einführung in die heute üblichen Methoden der parallelen Programmierung mit OpenMP und MPI runden die Veranstaltung ab.

T-INFO-101298 Verteiltes Rechnen

Inhalt:Die Vorlesung "Verteiltes Rechnen" gibt eine Einführung in die Welt des verteilten Rechnens mit einem Fokus auf Grundlagen, Technologien und Beispielen aus Grid, Cloud und dem Umgang mit Big Data.Zuerst wird eine Einführung in die Hauptcharakteristika verteilter Systeme gegeben. Danach wird auf die Thematik Grid näher eingegangen und es werden Architektur, Grid Services, Sicherheit und Job Ausführung vorgestellt. Am Beispiel des WLCG (der Grid Infrastruktur zur Verteilung, Speicherung und Analyse der Daten des LHC-Beschleunigers am CERN) wird die enge Verwandtschaft zwischen Grid Computing und verteilter Daten-Management dargestellt.Im zweiten Teil werden Prinzipien und Werkzeuge zum Management großer bzw. verteilter Daten vorgestellt - dies schließt Datenlebenszyklus, Metadaten und Archivierung ein. Beispiele aus Wissenschaft und Industrie dienen zur Veranschaulichung. Moderne Speichersysteme wie z.B. dCache, xrootd, Ceph und HadoopFS werden als praktische Beispiele vorgestellt.Der dritte Teil der Vorlesung geht auf das Thema Cloud ein. Nach der Definition grundlegender Begriffe und Prinzipien (Iaas, PaaS, SaaS, public vs. private Clouds), auch mittels Beispielen, wird das Thema Virtualisierung als grundlegende Technik des Cloud Computing vorgestellt. Den Abschluss bildet MapReduce als Mechanismus zur Verarbeitung und Analyse großer, verteilter Datenbestände wie es auch von Google eingesetzt wird.

T-INFO-102061 Mobile Computing und Internet der Dinge

Inhalt:Die Vorlesung bietet eine Einführung in Methoden und Techniken des mobile Computing und des Internet der Dinge (Internet of Things, IoT). Die Übung vertieft das in der Vorlesung erworbene Wissen in einem Praxisprojekt. Im praktischen Teil wird insbesondere die Erstellung von Benutzerschnittstellen für Anwendungen im Bereich Mobile Computing und dem Internet der Dinge sowie von Software-Apps erlernt. Die praktische Übung startet mit den Aspekten Benutzerschnittstellenentwurf und Software-Entwurf. Es begleitet dann mit kleinen Programmieraufgaben die technischen Teile der gesamte Vorlesung.Die Vorlesung gliedert sich in folgende Themenbereiche:Mobile Computing:• Plattformen: SmartPhones, Tablets, Glasses• Mensch-Maschine-Interaktion für Mobile Computing• Software Engineering, -Projekte und Programmierung für mobile Plattformen (native Apps, HTML5)• Sensoren und deren Einsatz• Plattformen und Software Engineering für das Internet der Dinge: Raspberry Pi und Arduino• Personal Area Networks: Bluetooth (4.0), ANT• Home Networks: ZigBee/IEEE 802.15.4, CEBus, m-bus• Technologien des Internet der Dinge, IoT: RFID, NFC, Auto-ID, EPC, Web of Things

T-INFO-101305 Analysetechniken für große Datenbestände

Inhalt:Techniken zur Analyse großer Datenbestände stoßen bei Anwendern auf großes Interesse. Das Spektrum ist breit und umfasst klassische Branchen wie Banken und Versicherungen, neuere Akteure, insbesondere Internet-Firmen oder Betreiber neuartiger Informationsdienste und sozialer Medien, und Natur- und Ingenieurswissenschaften. In allen Fällen besteht der Wunsch, in sehr großen, z. T. verteilten Datenbeständen die Übersicht zu behalten, mit möglichst geringem Aufwand interessante Zusammenhänge aus dem Datenbestand zu extrahieren und erwartetes Systemverhalten mit dem tatsächlichen systematisch vergleichen zu können. In der Vorlesung geht es sowohl um die Aufbereitung von Daten als Voraussetzung für eine schnelle und leistungsfähige Analyse als auch um moderne Techniken für die Analyse an sich.

T-INFO-101497 Datenbanksysteme

Inhalt:Datenbanksysteme gehören zu den entscheidenden Softwarebausteinen in modernen Informationssystemen und sind ein zentrales Thema der Universitätsstudiengänge im Gebiet der Informatik. Ziel der Vorlesung ist die Vermittlung von Grundkenntnissen zur Arbeit mit Datenbanken. Die wichtigen Themen der Vorlesung sind guter Datenbankentwurf, der Zugriff auf Datenbanken und die Anbindung an Anwendungen, Mehrbenutzerbetrieb und eine Übersicht über unterschiedliche Datenbanktypen (relational vs. NoSQL insbesondere).

T-INFO-101275 Visualisierung

Inhalt:Die Visualisierung beschäftigt sich mit der visuellen Repräsentation von Daten aus wissenschaftlichen Experimenten, Simulationen, medizinischen Scannern, Datenbanken etc., mit dem Ziel ein größeres Verständnis oder eine einfachere Repräsentation komplexer Vorgänge zu erhalten. Hierzu werden u.a. Methoden aus der interaktiven Computergrafik herangezogen und neue Methoden entwickelt. Diese Vorlesung behandelt die sogenannte Visualisierungspipeline, spezielle Algorithmen und Datenstrukturen und zeigt praktische Anwendungen.Themen dieser Vorlesung sind u.a.:• Einführung, Visualisierungspipeline• Datenakquisition und -repräsentation• Perzeption und Abbildung (Mapping) auf grafische Repräsentationen• Visualisierung von Skalarfeldern (Isoflächenextraktion, Volumenrendering)• Visualisierung von Vektorfeldern (Particle Tracing, texturbasierte Methoden)• Tensorfelder und Daten mit mehreren Attributen• Informationsvisualisierung

Annotation

Qualifikationszeile und Inhalt sind der jeweiligen Module der gewählten Teilleistungen zu entnehmen.

Workload

mind. 240 Stunden.

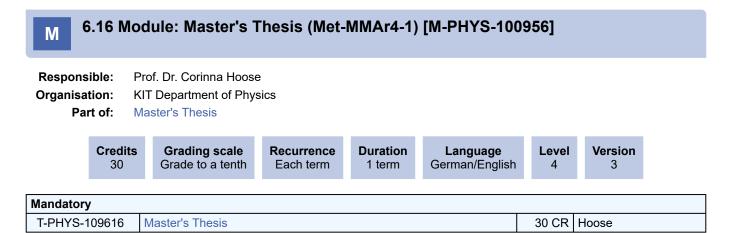
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6.15 Module: Interdisciplinary Qualifications [M-PHYS-102352] Μ

Responsible: Prof. Dr. Corinna Hoose **Organisation:** KIT Department of Physics Part of: Interdisciplinary Qualifications



Elective Studies (Election: at least 4 credits)						
T-PHYS-112122	Wildcard	1 CR				
T-PHYS-112123	Wildcard	1 CR				
T-PHYS-112124	Wildcard	1 CR				
T-PHYS-112125	Wildcard	1 CR				
T-PHYS-104675	Wildcard	2 CR				
T-PHYS-104677	Wildcard	2 CR				



Competence Certificate

Module examination: Assessment ("Prüfungsleistung")

Written report (Master's thesis) and presentation (SPO §14 (1a)) in accordance with § 14 SPO Master's Meteorology evaluated by at least one professor, one habilitated scientist of the KIT-Faculty of Physics or one leading scientist in accordance with § 14 Abs. 3 para. 1 KITG and one other examiner. The overall assessment will be recorded in a written report.

The evaluation period shall not exceed eight weeks upon submission of the Master's thesis.

Prerequisites

Students have successfully completed modules with a minimum of 70 ECTS credits, especially the module *Specialization Phase* must be successfully completed. (SPO §14)

Modeled Conditions

The following conditions have to be fulfilled:

- 1. You need to have earned at least 40 credits in the following fields:
 - Applied and Experimental Meteorology
 - Atmospheric and Climate Processes
 - Interdisciplinary Qualifications
 - Required Electives
- 2. The module M-PHYS-100955 Specialisation Phase must have been passed.

Competence Goal

Students can independently develop and carry out a scientific work. To this end, they deal with the latest state of research and apply the knowledge and the methods acquired during studies. They can discuss and evaluate the obtained results and present them in writing as well as defend the work in a presentation.

The students are able to work on a coherent problem from their field of study independently and in a limited time according to scientific methods and then present the knowledge gained in a written paper and in a presentation in an understandable and precise manner and to discuss it competently.

Furthermore, the students are aware of their responsibility in dealing with self-obtained data, developed methods and used materials and their storage. They are able to correctly handle primary data of other researchers and to protect their copyrights.

Content

After choosing a subject area and topic at the beginning of the module *Specialization Phase* and preparing their thesis, the students start their original scientific study. The Master's Thesis includes the theoretical and/or the experimental work on a complex problem using scientific methods.

It is possible to conduct the project in cooperation with external partners, for example an external research institution or an institution from the professional background.

Module grade calculation

The overall grade results from the evaluation of the thesis. This includes the final presentation.

Annotation

The maximum duration of the Master thesis is six months.

Workload

Presence on Presentations: 20 hours Preparation of the presentation: 40 hours Master's Thesis: 840 hours

Recommendation

Attendance of the Karlsruhe Meteorological Colloquium and the departmental seminars (IMK-TRO, IMK-ASF, IMK-AAF).

Master of Science Meteorology (M.Sc.) Module Handbook as of 05/09/2022

6.17 Module: Modern Theoretical Physics for Teacher Students [M-PHYS-101664]

Responsible:Studiendekan PhysikOrganisation:KIT Department of PhysicsPart of:Required Electives



Mandatory			
T-PHYS-103203	Modern Theoretical Physics for Teacher Students - Prerequisite	0 CR	Eder
T-PHYS-103204	Modern Theoretical Physics for Teacher Students	8 CR	Eder

Competence Certificate

See components of this module

Prerequisites

none

Competence Goal

The students know the fundamentals of the theory of electric and magnetic fields and the electrical and magnetic properties of matter. Fundamentals of quantum mechanics with simple applications.

Content

- Electrostatics: basic equations, scalar potential, examples.
- Magneto statics: basic equations, vector potential, examples.
- · Special relativity theory, relativistic formulation of electrodynamics.
- Time-dependent fields and radiation phenomena: basic equations, Poynting theorem.
- · Electromagnetic waves: plane waves, polarization, wave packets,
- spherical waves, electromagnetic potentials and gauge transformations, Hertzian dipole.
- Basic equations of quantum mechanics. Uncertainty principle. Interpretation of the wave function. A particle in one dimension. Multiparticle states, Pauli principle. Energy eigenstates of the hydrogen atom. Atomic structure and periodic table of the elements in the model of hydrogen-like atoms.

Workload

240 hours composed of active time (90), wrap-up of the lecture incl. preparation of the examination and the excercises (150)

6.18 Module: Modern Theoretical Physics I, Quantum Mechanics I [M-PHYS-101707]

 Responsible:
 Studiendekan Physik

 Organisation:
 KIT Department of Physics

 Part of:
 Required Electives

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

Mandatory			
T-PHYS-102317	Modern Theoretical Physics I, Quantum Mechanics 1, Prerequisite 1	4 CR	Shnirman
T-PHYS-105134	Modern Theoretical Physics I, Quantum Mechanics 1	4 CR	Studiendekan Physik

Competence Certificate

See components of this module

Prerequisites

none

Competence Goal

The student learns the basic concepts of single-particle quantum mechanics and applies them to important questions. He / she lays the foundation for a fundamental understanding of the microscopic world.

Content

- · Introduction: Historical Remarks, Limitations of Classical Physics
- Dualism particle and wave: wave mechanics, matter waves, wave
- packets, uncertainty principle, Schrödinger equation, qualitative understanding of simple cases.
 Mathematical tools: Hilbert space, Bra and Ket, operators, hermiticity,
- unitarity, eigenvectors and eigenvalues, observable, basis, completeness.
- Postulates of quantum mechanics: measurement process, time evolution, time evolution of expectation values, Ehrenfest theorem and classical borderline case.
- One-dimensional potentials: Potential wells, harmonic oscillator.
- Bound states in a three-dimensional potential: separation of variables, central potential, angular momentum, rotational symmetry and spin, degeneracy, particles in the external electromagnetic field, hydrogen atom.
- Time-independent perturbation theory: Neat and degenerate case, fine structure of the hydrogen spectrum, Stark effect.
- Basics of Scattering Theory: Differential cross section, Born series and Born approximation, partial waves and scattering phases, optical theorem.

Workload

240 hours composed of active time (90), wrap-up of the lecture incl. preparation of the examination and the excercises (150)

Literature

Textbooks on quantum mechanics

6.19 Module: Module Wildcard Electives [M-PHYS-103403]

Organisation: University

Part of:

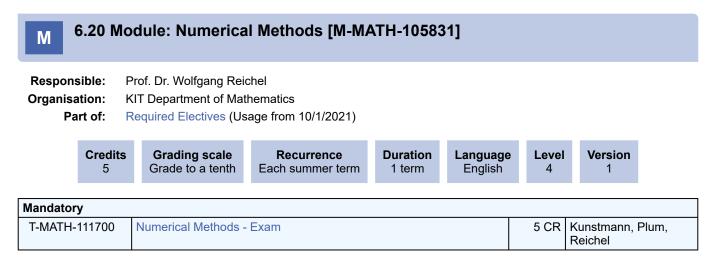
Required Electives

	Credits	Grading scale	Recurrence	Duration	Language	Level	Version	
	8	Grade to a tenth	Each term	1 term	German	4	1	
Wildcard (El	/ildcard (Election: at least 1 item)							

Wildcard (Election: at least 1 item)					
T-PHYS-106794	Wildcard	2 CR			
T-PHYS-106795	Wildcard	3 CR			
T-PHYS-106796	Wildcard	4 CR			
T-PHYS-106797	Wildcard	5 CR			

Prerequisites

None



Competence Certificate

Success control takes the form of a written examination (120 minutes).

Prerequisites

none

Competence Goal

Students who pass the module are familiar with basic concepts and ways of thinking on the topic of numerical mathematics. They know different procedures for solving linear and nonlinear problems in numerical mathematics. They are furthermore able to use numerical methods for solving problems from applications in an independent, critical, and needs-based way.

Content

In the lecture basic ideas and numerical methods for the following topics will be presented:

- · systems of linear equations, Gauss-algorithm, LR-decomposition, Cholesky decomposition
- · eigenvalue problems, von-Mises iteration
- linear optimization (also called linear programming)
- error analysis
- Newton's method
- quadrature, Newton-Cotes formulas
- numerical solution of initial value problems, Runge-Kutta methods
- finite difference method for solving boundary value problems
- finite elements

Module grade calculation

The module grade is the grade of the written exam.

Workload

Approximately 150h workload. The workload includes:

45h - attendance in lectures, exercises and examination

105h - self studies:

- · follow-up and deepening of the course content
- solving problem sheets
- · literature study and internet research on the course content
- preparation for the module examination

6.21 Module: Physics of Planetary Atmospheres [M-PHYS-104488]

Responsible:Prof. Dr. Thomas LeisnerOrganisation:KIT Department of PhysicsPart of:Required Electives



Mandatory			
T-PHYS-109177	Physics of Planetary Atmospheres	8 CR	Leisner
T-PHYS-109180	Exam on Physics of Planetary Atmospheres	2 CR	Leisner

Competence Certificate

Prerequisite: Coursework ("Studienleistung")

For type of Coursework see Course description ("Teilleistungsbeschreibung")

 \rightarrow successful completion of the prerequisites entitles to exam

Examination: Assessment ("Prüfungsleistung")

T-PHYS-109180 Exam on Physics of Planetary Atmospheres

Exam (approx. 60 minutes, oral, written or otherwise) in accordance with § 4 (2) SPO Master's Meteorology

Prerequisites

None

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Competence Goal

The students acquire the basic knowledge of atmospheric physics.

On the basis of concrete case studies from current research, the students learn to understand the concepts and are empowered to apply the learned methods independently.

Emphasis is placed on the basic physical and chemical principles, so that knowledge can be generally applied to planetary atmospheres and not limited to the earth. This is supported by correspondingly created exercises. One focus is the experimental methods of atmospheric remote sensing.

Methods Learning:

- · Understanding the basics of atmospheric physics
- · Acquisition of the ability to present a current research topic independently as well as in a team
- Acquisition of the ability to apply the concepts and experimental methods in an experimental To implement a master's thesis

Content

The topics covered include a general introduction to the field of work with its fundamental questions, theoretical concepts and experimental methods.

One of the focal points is radiation transport in atmospheres, which is of central importance for the energy budget as well as for remote sensing. Clouds and aerosols are a central factor in many planetary atmospheres, their nucleation and their properties are treated in generalized form.

Module grade calculation

Grade is earned through the associated exam (oral, written or otherwise).

Workload

240 hours consisting of attendance times (60 hours), follow-up of the lecture incl. Exam preparation and editing exercises (180 hours).

Recommendation

Basic knowledge of physics, physical chemistry and fluid dynamics at Bachelor level

Learning type

Lectures (2 Ch) and Exercises (2Ch)

Literature

Raymond T. Pierrehumpert: Principles of Planetary Climate, Cambridge Univ. Press, 2010 Augustin Sanchez-Lavega: An Introduction to Planetary Atmospheres, Taylor&Francis, 2010 Frédéric J. Pont: Alien Skies: Planetary Atmospheres from Earth to Exoplanets, Springer, 2014 K. N. Liu: An introduction to atmospheric radiation, Academic Press, 2010

6.22 Module: Satellite Climatology: Remote Sensing of a Changing Climate [M-BGU-105095]

 Responsible:
 Prof. Dr. Jan Cermak

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

 Part of:
 Required Electives

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

j			
T-BGU-110305	Satellite Climatology: Remote Sensing of a Changing Climate, Examination	3 CR	Cermak
T-BGU-110304	Satellite Climatology: Remote Sensing of a Changing Climate, Prerequiste	1 CR	Cermak

Competence Certificate

- T-BGU-110304 Satellite climatology: Remote Sensing of a Changing Climate, Prerequisite
- T-BGU-110305 Satellite climatology: Remote Sensing of a Changing Climate

For details on the individual performance reviews, see the respective "Teilleistungen".

Prerequisites

M-BGU-103313 Remote Sensing of a Changing Climate must not have 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

Module grade calculation

The grade of the module is the grade of the exam in T-BGU-110305 Satellite climatology: Remote Sensing of a Changing Climate

Annotation Knowledge in geosciences/climate and statistics are helpful.

Workload

Total workload: 120 hours

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

Self-study: 90 hours

- consolidation of subject by recapitulation of lectures
- consolidation of subject by use of references and by own inquiry -
- preparation of the monitoring project data analysis and data processing
- preparations for exam

6.23 Module: Specialisation Phase (Met-Spph3-1) [M-PHYS-100955] Μ **Responsible:** Prof. Dr. Corinna Hoose **Organisation:** KIT Department of Physics Part of: **Research Work** Credits **Grading scale** Recurrence Duration Version Language Level 30 pass/fail Each term 1 term German/English 4 4 Mandatory T-PHYS-109617 Scientific Concept Development 30 CR

Competence Certificate

Module examination: Coursework ("Studienleistung")

Examination of other type in accordance to §4(2) No. 3 SPO Master's Meteorology:

Final presentation (20-25 minutes) in the *Seminar on Specialization Phase*, followed by a short discussion with the audience(15 minutes). Afterwards a short feedback meeting with the examiners and the supervisor about the progress and next steps will take place.

Prerequisites

Students need to have successfully completed all four module exams in the subjects Atmospheric and Climate Processes and Applied and Experimental Meteorology.

Soft skills and complementary elective can still be incomplete.

Competence Goal

Students are able to work on a meteorological or interdisciplinary research project using scientific methods.

They can, with guidance, plan, structure, prepare, conduct a study and document their results complete and comprehensible. In doing so, they follow the rules of citing their own or others' prior work or previously published results.

They can select appropriate methods for the solution of the given problem.

Students are able to work self-organized and structured. They possess skills in the field of project management and presentation, both orally and in writing.

Content

Conducting a meteorological, interdisciplinary project work. This may be of a theoretical and/or experimental type. The focus is on the development of conclusions using scientific methods, project management and presentation of the results.

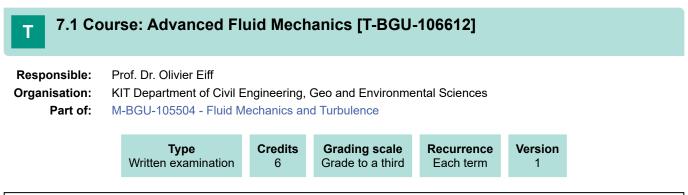
Students are invited to make suggestions for topics.

It is possible to conduct the project in cooperation with external partners.

Workload

Independent scientific work: 820 hours Preparation Lecture and presence in the accompanying seminar: 80 hours

7 Courses



Events							
ST 2022	6221701	Advanced Fluid Mechanics	4 SWS	Lecture / Practice (/	Eiff		
Exams	Exams						
ST 2022 8244106612 Advanced Fluid Mechanics				Eiff			
WT 22/23	8244106612	Advanced Fluid Mechanics			Eiff		

Legend: Bonline, 🕄 Blended (On-Site/Online), 🗣 On-Site, 🗙 Cancelled

Competence Certificate

written exam, 90 min.

Prerequisites

none

Recommendation

none

Annotation

none

7.2 Course: Advanced Numerical Weather Prediction [T-PHYS-109139]

Responsible:Prof. Dr. Peter KnippertzOrganisation:KIT Department of PhysicsPart of:M-PHYS-100954 - Applied Meteorology



Events						
ST 2022	4052051	Advanced Numerical Weather Prediction	2 SWS	Lecture / 🗣	Knippertz	
ST 2022	4052052	Exercises to Advanced Numerical Weather Prediction	1 SWS	Practice / 🗣	Knippertz, Burba, Borne	
Exams						
ST 2022	7800017	Advanced Numerical Weather Pred	Advanced Numerical Weather Prediction (Prerequisite)			
					•	

Legend: Bonline, 🕄 Blended (On-Site/Online), 🗣 On-Site, 🗙 Cancelled

Prerequisites

none

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

7	Advanced Numerical Weather Prediction	Lecture (V)
×	4052051, SS 2022, 2 SWS, Language: English, Open in study portal	On-Site

Content

- Introduction
- Parametrizations
- Data assimilation
- Ensemble predictions
- Verification
- Post-processing

Organizational issues

· Please register for the ILIAS course to receive further information

7.3 Course: Advanced Practical Courses [T-PHYS-109135] Т **Responsible:** Dr. Michael Höpfner **Organisation:** KIT Department of Physics Part of: M-PHYS-100953 - Experimental Meteorology Credits Grading scale Version Туре Recurrence Completed coursework 0 pass/fail Each summer term 1 **Events** ST 2022 4052103 NN, Wagner, Höpfner, Advanced Meteorological Practical 5 SWS Practical course / Course ę Kohler Exams ST 2022 7800026 Advanced Meteorological Practical Course Sinnhuber Legend: Online, Hegended (On-Site/Online), On-Site, Cancelled

Competence Certificate

Timely delivery and confirmation of the internship evaluation.

Prerequisites

None

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

Advanced Meteorological Practical Course 4052103, SS 2022, 5 SWS, Language: English, Open in study portal Practical course (P) On-Site

Content

Available experiments include:

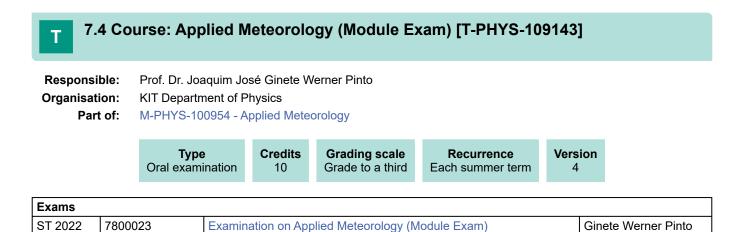
- surface energy balance (IMK-TRO)
- infrared spectroscopy (IMK-ASF)
- AIDA cloud and aerosol chamber (IMK-AAF)

Organizational issues

- AIDA: 25 29 July 2022
- Energy balance: (TBD)
- FTIR: May/June (TBD)

Please register for the ILIAS course to receive further information.

Kunz



WT 22/23	7800069	Applied Meteorology (Module Exam)

Competence Certificate

The awarding of 10 credits will take place after passing the oral exam (see module description).

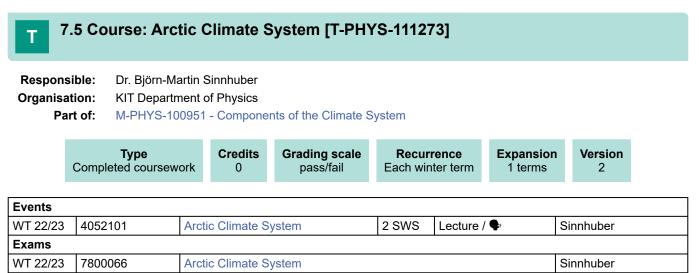
Prerequisites

It is only possible to register for the examination if the academic achievement "methods of data analysis" and further study achievements have been achieved to a sufficient degree.

Modeled Conditions

The following conditions have to be fulfilled:

- 1. You have to fulfill 2 of 3 conditions:
 - 1. The course T-PHYS-109141 Energy Meteorology must have been passed.
 - 2. The course T-PHYS-109139 Advanced Numerical Weather Prediction must have been passed.
 - 3. The course T-PHYS-108610 Turbulent Diffusion must have been passed.
- 2. The course T-PHYS-109142 Methods of Data Analysis must have been passed.



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

Competence Certificate

The assessment consists of a coursework according to §4 (3) SPO MSc Meteorology and Climate Physics in the form of a short lecture (approx. 10 minutes) on a topic relevant to the llecture . The detailled conditions will be discussed in the lecture.

Prerequisites

None

Annotation

Serreze, M., & Barry, R. (2014). The Arctic Climate System (2nd ed., Cambridge Atmospheric and Space Science Series). Cambridge: Cambridge University Press. doi:10.1017/CBO9781139583817

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

VArctic Climate System 4052101, WS 22/23, 2 SWS, Language: English, Open in study portalLecture (On-Site	. ,
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Content

- Basic climatic features of the Arctic
- Arctic atmospheric and ocean energy budgets
- Atmospheric circulation
- Energy exchange at the surface
- Sea ice
- · Arctic ocean sea ice climate interactions
- Arctic amplification and Arctic change
- Modelling the Arctic climate system

Literature

Serreze, M., & Barry, R. (2014). **The Arctic Climate System** (2nd ed., Cambridge Atmospheric and Space Science Series). Cambridge: Cambridge University Press. doi:10.1017/CBO9781139583817

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7.6 Course: Atmospheric Aerosols [T-PHYS-108938]

 Responsible:
 Dr. Ottmar Möhler

 Organisation:
 KIT Department of Physics

 Part of:
 M-PHYS-100952 - Atmospheric Processes



Events							
WT 22/23 4052041 Atmospheric Aerosols 2 SWS Lecture /							
WT 22/23	4052042	Exercises to Atmospheric Aerosols	1 SWS	Practice / 🗣	Möhler, Bogert		
Exams							
WT 22/23 7800083 Atmospheric Aerosols (Prerequisite) Hoose							
Legend: 🖥 Online,	Blended (On-Site/Online),	♀ On-Site, × Cancelled					

Prerequisites

None

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

V

Atmospheric Aerosols

4052041, WS 22/23, 2 SWS, Language: English, Open in study portal

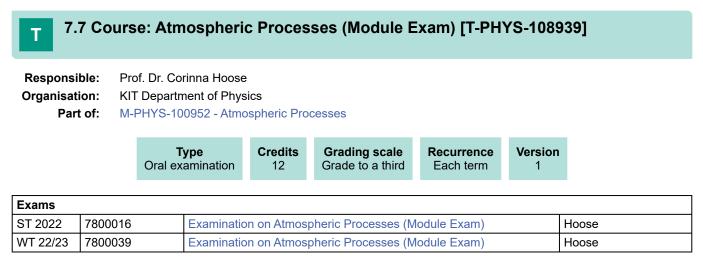
Lecture (V) On-Site

Content

Gas particle processes (kinetics, diffusion, condensation), aerosol properties (diffusion, coagulation, sedimentation, impaction), aerosol thermodynamics (chemical potential, solubility, crystallization), aerosol cloud processes (Köhler theory, ice nucleation).

Organizational issues

Please sign up for more information in the Ilias course.



All module courses must be passed.

Modeled Conditions

The following conditions have to be fulfilled:

- 1. The course T-PHYS-107694 Cloud Physics must have been passed.
- 2. The course T-PHYS-107696 Atmospheric Radiation must have been passed.
- 3. The course T-PHYS-107695 Energetics must have been passed.
- 4. The course T-PHYS-108938 Atmospheric Aerosols must have been passed.

7.8 Course: Atmospheric Radiation [T-PHYS-107696] т **Responsible:** Dr. Michael Höpfner **Organisation:** KIT Department of Physics Part of: M-PHYS-100952 - Atmospheric Processes Credits Grading scale Version Recurrence Туре Completed coursework 0 pass/fail Each winter term 1 **Events** WT 22/23 4052071 2 SWS Lecture / 🗣 Atmospheric Radiation Höpfner, Johansson Exams WT 22/23 7800106 Atmospheric Radiation (Prerequisite) Hoose Legend: Doline, 🕄 Blended (On-Site/Online), 🗣 On-Site, 🗙 Cancelled

Prerequisites

none

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

V Atmospheric Radiation Lecture (* 4052071, WS 22/23, 2 SWS, Language: English, Open in study portal On-Site	'
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Content

- Relevance: Weather/Climate, Chemistry, Remote Sensing
- · Short history of light
- · Properties of electromagnetic radiation
- Radiometric quantities
- The electromagnetic spectrum
- Boundary conditions: Sun, Earth's surface; reflection and emission
- Radiative transfer in the thermal infrared region: black body radiation, local/non-local thermodynamic equilibrium, transmission, radiative transfer, application in remote sensing
- Molecular spectroscopy, line-broadening
- Radiative transfer in the UV/Visible: absorption and scattering by particles
- Single scattering properties: Rayleigh, Mie-approximations
- Optical phenomena: rainbows, halos
- Radiative transfer with multiple scattering: why are clouds white?, two-stream approximation
- Radiative budget, climate engineering

Organizational issues

Please sign up for more information in the Ilias course.

7.9 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-PHYS-100953 - Experimental Meteorology					

	Type Completed coursewo	rk	Credits 0	Grading scale pass/fail	e Recurrence Each summer term		Expansion 1 terms	n Version 2	
Events									
ST 2022	4052201		nospheric R astractures	emote Sensing	sing 2 SWS Lecture / 🗣		Ç i	Cermak	
Exams									
ST 2022 8297111185 Atmospheric Remote Sensing Infrastructures, Prerequisite Cermak				Cermak					
egend:		€ On	-Site V Cancelle	4					

Legend: Doline, 🕄 Blended (On-Site/Online), 🗣 On-Site, 🗙 Cancelled

Competence Certificate

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

Prerequisites

none

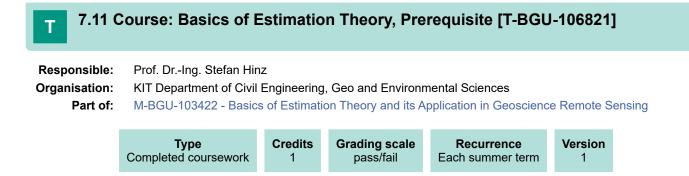
7.10 Course: Basics of Estimation Theory and its Application in Geoscience Remote Sensing [T-BGU-106822]

Responsible: Prof. Dr. Jan Cermak Prof. Dr.-Ing. Stefan Hinz **Organisation:** KIT Department of Civil Engineering, Geo and Environmental Sciences M-BGU-103422 - Basics of Estimation Theory and its Application in Geoscience Remote Sensing Part of: Credits **Grading scale** Туре Recurrence Version Oral examination 5 Grade to a third Each summer term 1

Modeled Conditions

The following conditions have to be fulfilled:

- 1. The course T-BGU-106821 Basics of Estimation Theory, Prerequisite must have been passed.
- The course T-BGU-106633 Data Analysis in Geoscience Remote Sensing Projects, Prerequisite must have been passed.



Т

7.12 Course: Building and Environmental Aerodynamics [T-BGU-111060]

 Responsible:
 Dr.-Ing. Christof-Bernhard Gromke

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

 Part of:
 M-BGU-105504 - Fluid Mechanics and Turbulence



Events									
WT 22/23	6221905	Building and Environmental Aerodynamics	2 SWS	Lecture / Practice (/	Gromke				
Exams									
ST 2022 8244111060 Building and Environmental Aerodynamics Gromke									
WT 22/23	Gromke								
_	20	-							

Legend: Bonline, 🕄 Blended (On-Site/Online), 🗣 On-Site, 🗙 Cancelled

Competence Certificate

oral exam, appr. 30 min.

Prerequisites none

Recommendation

none

Annotation

none

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



Building and Environmental Aerodynamics

6221905, WS 22/23, 2 SWS, Language: English, Open in study portal

Lecture / Practice (VÜ) On-Site

Content

The fundamentals of natural wind and its interaction with the built and natural environment are addressed in Building and Environmental Aerodynamics. Focus is on structural loads induced by wind, wind-induced vibrations of buildings and structures, and on flow phenomena in the natural and built environment, like wind shelter, cold air drainage and ventilation, urban air guality, and wind comfort.

Organizational issues

Registration in ILIAS is open till 01.11.2022. However, for planning purposes please register as soon as possible.

7.13 Course: Climate Modeling & Dynamics with ICON [T-PHYS-108928]

Responsible:	Prof. Dr. Joaquim José Ginete Werner Pinto Dr. Aiko Voigt
Organisation:	KIT Department of Physics
Part of:	M-PHYS-100951 - Components of the Climate System

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

Events					
WT 22/23	4052151	Climate Modeling & Dynamics with ICON	2 SWS	Lecture / 🕃	Ginete Werner Pinto, Ludwig
WT 22/23 4052152		Exercises to Climate Modeling & Dynamics with ICON	1 SWS	Practice / 🗣	Ginete Werner Pinto, Ludwig, Pothapakula
Exams	•			·	
WT 22/23	7800087	Climate Modeling & Dynamics with I	CON (Pre	requisite)	Fink, Ginete Werner Pinto

Legend: Doline, 🕃 Blended (On-Site/Online), 🗣 On-Site, 🗙 Cancelled

Competence Certificate

Successful participation in the exrcises.

Prerequisites

None

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



Content

Introduction to the ICON model, baroclinic life cycles, cloud impact on large-scale circulation of the atmosphere, climate change response of extra tropical jet stream, aerosol

impact on tropical rain belts.

Numerical modeling and analysis of climate and climate change (climate system, conceptual models for processes and feedback, chaotic dynamic systems, numerical climate models (EMICS, Global models, regional models), (statistical) analysis methods.

Organizational issues

Please sign up for more information in the Ilias course.

7.14 Course: Cloud Physics [T-PHYS-107694] т **Responsible:** Prof. Dr. Corinna Hoose **Organisation:** KIT Department of Physics Part of: M-PHYS-100952 - Atmospheric Processes Credits Grading scale Version Recurrence Туре Completed coursework 0 pass/fail Each winter term 1 **Events** WT 22/23 4052081 2 SWS Lecture / 🗣 **Cloud Physics** Hoose, Le Roy de Bonneville, Frey, Oertel WT 22/23 4052082 **Exercises to Cloud Physics** 1 SWS Practice / 🗣 NN, Wallentin Exams WT 22/23 7800105 Cloud Physics (Prerequisite) Hoose

Legend: Soline, 🕃 Blended (On-Site/Online), 🗣 On-Site, 🗙 Cancelled

Competence Certificate

More than 50% of the points from the exercises must be achieved and at least 1x must be pre-calculated.

Prerequisites

none

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



Cloud Physics

4052081, WS 22/23, 2 SWS, Language: English, Open in study portal

Content

Phenomenology, cloud dynamics of stratiform and convective clouds, micro physics of warm and cold clouds, collision and coalescence, primary and secondary ice formation, condesational and depositional growth.

Organizational issues

Please sign up for more information in the Ilias course.

Lecture (V)

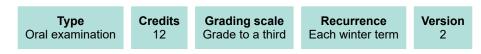
On-Site

7.15 Course: Components of the Climate System (Module Exam) [T-PHYS-108933]

 Responsible:
 Prof. Dr. Andreas Fink

 Organisation:
 KIT Department of Physics

 Part of:
 M-PHYS-100951 - Components of the Climate System



Exams				
ST 2022	7800015	Examination on Components of the Climate System (Module Exam)	Fink	
WT 22/23	7800045	Components of the Climate System (Module Exam)	Fink	

Competence Certificate

The allocation of 12 credits takes place after passing the oral exam (see module description).

Modeled Conditions

The following conditions have to be fulfilled:

- 1. The following conditions have to be fulfilled:
 - 1. You have to fulfill 2 of 3 conditions:
 - 1. The course T-PHYS-108931 Middle Atmosphere in the Climate System must have been passed.
 - 2. The course T-PHYS-108932 Ocean-Atmosphere Interactions must have been passed.
 - 3. The course T-PHYS-107692 Seminar on IPCC Assessment Report must have been passed.
 - 2. The course T-PHYS-107693 Tropical Meteorology must have been passed.
 - 3. The course T-PHYS-108928 Climate Modeling & Dynamics with ICON must have been passed.

7.16 Course: Data Analysis in Geoscience Remote Sensing Projects, Prerequisite [T-BGU-106633]

 Responsible:
 Prof. Dr. Jan Cermak

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

 Part of:
 M-BGU-103422 - Basics of Estimation Theory and its Application in Geoscience Remote Sensing



Exams		
ST 2022 8297106633	Data Analysis in Geoscience Remote Sensing Projects, Prerequisite	Cermak, Andersen

Competence Certificate

The assessment consists of a coursework according § 4 para. 3 SPO M.Sc. Geodäsie und Geoinformatik based on successful elaboration of excercices and on data analysis of a geoscientific question and written report of about 8 pages of the results. The detailled conditions will be announced in the lecture.

Prerequisites

None

Recommendation None

Annotation

None

7.17 Course: Data Science I [T-INFO-111622]									
	Responsible: Prof. DrIng. Klemens Böhm DrIng. Edouard Fouché								
-	Organisation: KIT Department of Informatics								
Part	t of:	M-INFO-102	2980 - Info	rmatics for N	Meteorology Stu	idents			
		Typ Oral exam		Credits 5	Grading sca Grade to a th		lecurrence ch winter term	Version 2	
Events									
WT 22/23	24114	4	Data Scie	ence 1		3 SWS	Lecture /	Fou	ıché
Exams									
ST 2022	7500	062	Data Science I					Böł	าm
ST 2022	7500	311	Data Science I					Böł	าฑ
WT 22/23	7500	087	Data Science 1					Böł	nm

Legend: Doline, 🕃 Blended (On-Site/Online), 🗣 On-Site, 🗙 Cancelled

7.18 Course: Database Systems [T-INFO-101497] Т **Responsible:** Prof. Dr.-Ing. Klemens Böhm Organisation: KIT Department of Informatics Part of: M-INFO-102980 - Informatics for Meteorology Students Туре Credits Grading scale Version Recurrence Written examination 4 Grade to a third Each summer term 2 **Events** ST 2022 24516 2 SWS Lecture / 🗣 Böhm Datenbanksysteme

ST 2022	24522	Übungen zu Datenbanksysteme	1 SWS	Practice / 🗣	Böhm, Kalinke
Exams					
ST 2022	7500166	Database Systems			Böhm
WT 22/23	7500189	Database Systems			Böhm

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

WT 22/23

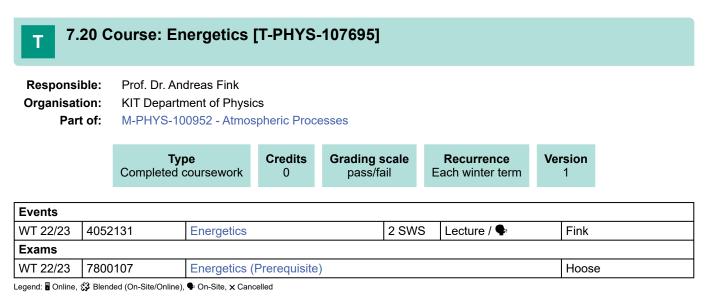
Streit

7.19 Course: Distributed Computing [T-INFO-101298] Т **Responsible:** Prof. Dr. Achim Streit Organisation: KIT Department of Informatics Part of: M-INFO-102980 - Informatics for Meteorology Students Credits Grading scale Version Туре Recurrence Written examination 4 Grade to a third Each winter term 2 **Events** WT 22/23 2400050 2 SWS Lecture / 🗣 Streit, Krauß, Fischer **Distributed Computing** Exams ST 2022 7500282 Streit **Distributed Computing**

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

Distributed Computing

7500172



none

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

Energetics

4052131, WS 22/23, 2 SWS, Language: English, Open in study portal

Lecture (V) On-Site

Content

Mean meridional circulation, stationary and transient eddies; basic forms, budget equations and transport processes of energy in the atmosphere; principle of available potential energy; Lorenz cycle: energy reservoirs and transformation processes, eddy and

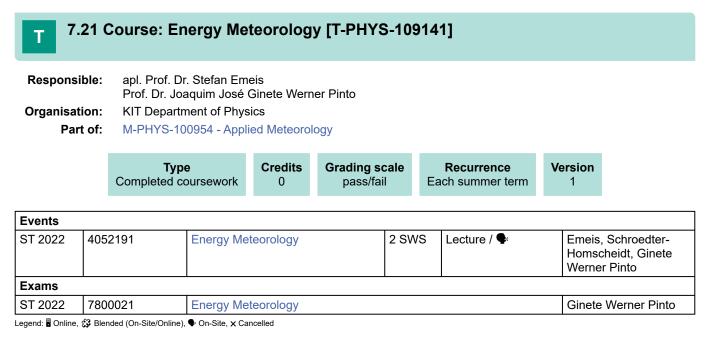
thermally driven jets (EP flux vectors).

Table of content:

- Literature & Learning goals
- The Climate System
- Basic Equations of the Climate System
- Decomposition of the general circulation
- Radiation budget and energy transports
- Consequences of the radiation and surface energy budgets
- Atmospheric water budget
- Atmospheric and oceanic energy budget
- Concept of "Available Potential Energy (APE)"

Organizational issues

Please sign up for more information in the Ilias course.



None

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

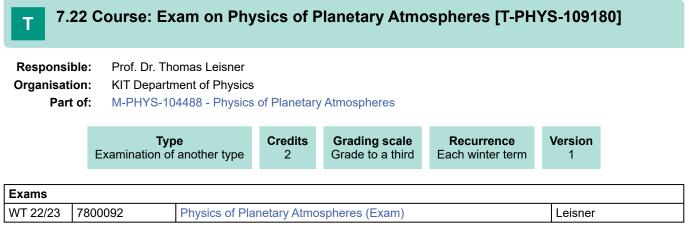
V	Energy Meteorology	Lecture (V)
V	4052191, SS 2022, 2 SWS, Language: English, Open in study portal	On-Site

Content

- Overview Energy Meteorology
- Physical basics Wind energy
- Physical basics of energy supply
- · Economic basics of energy supply
- Onshore and offshore wind parks
- Wind energy siting complex terrain
- Physical basics Solar energy
- Tracking and concentrating solar systems
- Wind measurements
- Radiation forecasts
- Wind energy yield forecasts
- Climate change & energy system
- · Community energy meteorology and where to work

Organizational issues

- Block Course 01 05 August 2022
- · Please register for the ILIAS course to receive further information

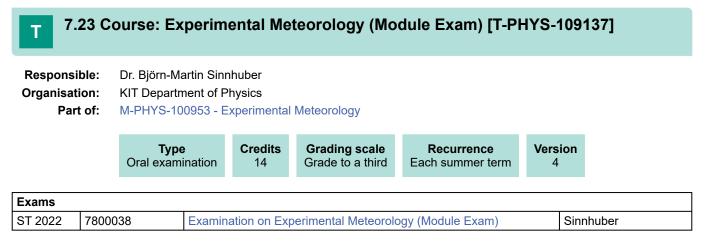


None

Modeled Conditions

The following conditions have to be fulfilled:

1. The course T-PHYS-109177 - Physics of Planetary Atmospheres must have been passed.



Competence Certificate

The allocation of 12 credits takes place after passing the oral exam (see module description).

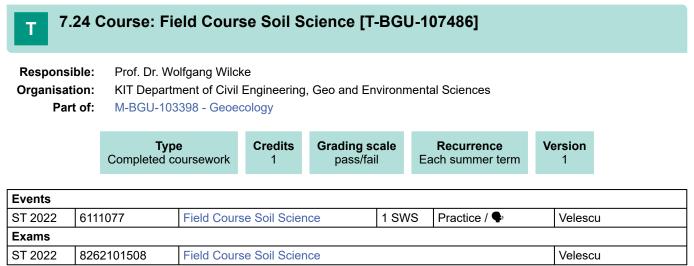
Prerequisites

In the Module "Experimental Meteorology" all offered courses must be passed.

Modeled Conditions

The following conditions have to be fulfilled:

- 1. The course T-PHYS-109135 Advanced Practical Courses must have been passed.
- 2. The course T-PHYS-109136 Field Trip must have been passed.
- 3. The course T-PHYS-111274 Remote Sensing of Atmosphere and Ocean must have been passed.
- 4. The course T-BGU-111185 Atmospheric Remote Sensing Infrastructures, Prerequisite must have been passed.



Legend: Dnline, 🕃 Blended (On-Site/Online), 🗣 On-Site, 🗙 Cancelled

Prerequisites

None

Recommendation None

Annotation

None

7.25 Course: Field Trip [T-PHYS-109136] т **Responsible:** Prof. Dr. Corinna Hoose **Organisation: KIT Department of Physics** Part of: M-PHYS-100953 - Experimental Meteorology Credits Grading scale Version Туре Recurrence Completed coursework 0 pass/fail Each summer term 1 **Events** 4052263 ST 2022 2 SWS Excursion (E / 🗣 Ginete Werner Pinto Field Trip Exams ST 2022 7800037 Sinnhuber **Field Trip** Legend: Doline, 🕄 Blended (On-Site/Online), 🗣 On-Site, 🗙 Cancelled

Competence Certificate

Lectures on specific topics about the excursion

Prerequisites

None

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



Field Trip

4052263, SS 2022, 2 SWS, Language: English, Open in study portal

Excursion (EXK) On-Site

Content

The course comprises a one-week excursion to research institutes and observatories in Germany and neighbouring countries.

Organizational issues

- The date for the field trip will be arranged in the semester opening on April 19th, 12:00-13:00
- · Please register for the ILIAS course to receive further information

7.26 Course: Flow Measurement Techniques [T-BGU-110411] **Responsible:** Dr.-Ing. Christof-Bernhard Gromke **Organisation:** KIT Department of Civil Engineering, Geo and Environmental Sciences Part of: M-BGU-105504 - Fluid Mechanics and Turbulence Credits Grading scale Туре Recurrence Expansion Version Oral examination 3 Grade to a third Each term 1 terms 1 **Events** WT 22/23 6221907 2 SWS Lecture / Practice (/ Gromke **Flow Measurement Techniques** e Exams

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

8244110411

8244110411

Competence Certificate

oral exam, appr. 30 min.

Prerequisites none

ST 2022

WT 22/23

Recommendation

none

Annotation

none

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



Flow Measurement Techniques

6221907, WS 22/23, 2 SWS, Language: English, Open in study portal

Flow Measurement Techniques

Flow Measurement Techniques

Lecture / Practice (VÜ) On-Site

Gromke

Gromke

Content

The course teaches the basics of flow measurement techniques as they are used in a wide variety of technical applications today. Measurement methods based on mechanical, electrical and optical principles are addressed in detail. Furthermore, methods of signal processing related to Fluid Mechanics and flow measurement techniques are presented, whereby basic evaluation procedures are explained.

Organizational issues

Registration in ILIAS is open till 01.11.2022. However, for planning purposes please register as soon as possible.

7.27 Course: Fluid Mechanics of Turbulent Flows [T-BGU-110841] Т **Responsible:** Prof. Dr.-Ing. Markus Uhlmann **Organisation:** KIT Department of Civil Engineering, Geo and Environmental Sciences Part of: M-BGU-105504 - Fluid Mechanics and Turbulence Credits Grading scale Recurrence Version Туре Oral examination 6 Grade to a third Each term 1 **Events** ST 2022 6221806 4 SWS Lecture / Practice (/ Uhlmann Fluid Mechanics of Turbulent Flows ¢ Exams

WT 22/23	8244110841	Fluid Mechanics of Turbulent Flows	Uhlmann		
ST 2022	8244110841	Fluid Mechanics of Turbulent Flows	Uhlmann		

Legend: Dolline, 🕄 Blended (On-Site/Online), 🗣 On-Site, 🗙 Cancelled

Competence Certificate

oral exam, appr. 45 min.

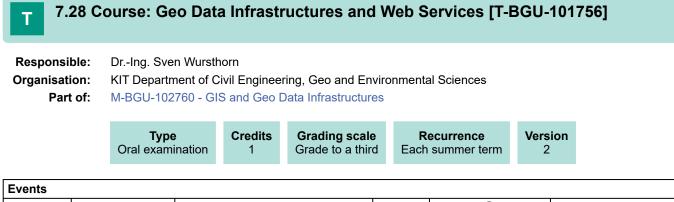
Prerequisites none

none

Recommendation none

Annotation

none



Events								
ST 2022 6026204		Geodateninfrastrukturen und 1 SWS Webdienste		Lecture / 🗣	Wursthorn			
ST 2022	6026205	Geodateninfrastrukturen und Webdienste, Übung	2 SWS	Practice / 🗣	Wursthorn			
Exams								
ST 2022	8296101756	Geo Data Infrastructures and We	Geo Data Infrastructures and Web Services		Wursthorn			

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

Prerequisites

The part T-BGU-101757 Geodateninfrastrukturen und Web-Dienste, Vorleistung has to be passed.

Modeled Conditions

The following conditions have to be fulfilled:

1. The course T-BGU-101757 - Geodata Infrastructures and Web-Services, Prerequisite must have been passed.

T 7.29 Course: Geodata Infrastructures and Web-Services, Prerequisite [T-BGU-101757]

Responsible: Dr.-Ing. Sven Wursthorn

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

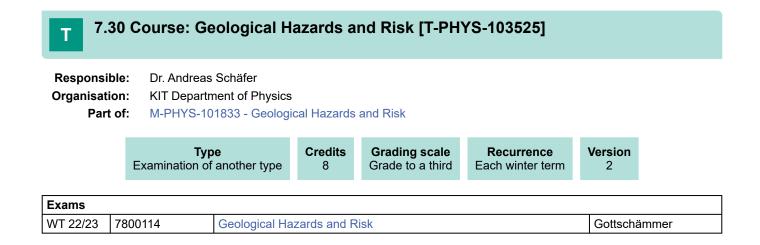
 Part of:
 M-BGU-102760 - GIS and Geo Data Infrastructures

		/pe coursework	Credits 3	Grading s pass/fa		Recurrence Each summer term	Version 2
Events							
ST 2022	6026204		Geodateninfrastrukturen und Webdienste			E Lecture / 🗣	Wursth
ST 2022	6026205		Geodateninfrastrukturen und Webdienste, Übung			Practice / 🗣	Wursth
Exams							
ST 2022	8296101757	Geodata Ir	frastructure	s and Web-S	Services,	Prerequisite	Wursth

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

Prerequisites

None



7.31 Course: Geomorphology and Soil Science [T-BGU-107487]

 Responsible:
 Prof. Dr. Wolfgang Wilcke

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

 Part of:
 M-BGU-103398 - Geoecology



Events					
ST 2022	6111071	Soils of Europe	Lecture / 🗣	Wilcke	
WT 22/23	6111061	Geomorphology and Pedology 2 SWS Lecture / 🗣		Lecture / 🗣	Wilcke
WT 22/23	6111066	Geomorphology and Soil science 1 SWS Practice / 🗣			Velescu
Exams					
ST 2022	8262101507_1	Geomorphology and Soil Science			Wilcke
ST 2022	8262101507_2	Geomorphology and Soil Science			Wilcke
					•

Legend: Doline, 🕄 Blended (On-Site/Online), 🗣 On-Site, 🗙 Cancelled

Prerequisites

None

Recommendation

None

Annotation

None

7.32 Course: Image Processing and Computer Vision [T-BGU-101732] Т **Responsible:** Dr.-Ing. Uwe Weidner **Organisation:** KIT Department of Civil Engineering, Geo and Environmental Sciences Part of: M-BGU-102757 - Computer Vision and GIS M-BGU-102759 - Computer Vision and Remote Sensing Туре Credits Grading scale Recurrence Version Oral examination 4 Grade to a third Each winter term **Events** WT 22/23 6042101 Image Processing and Computer 2 SWS Lecture / 🗣 Weinmann Vision, Lecture Image Processing and Computer WT 22/23 6042102 1 SWS Practice / Weinmann

Exams					
WT 22/23	8291101732	Image Processing and Computer Vision	Weinmann		

Legend: Doline, 🕃 Blended (On-Site/Online), 🗣 On-Site, 🗙 Cancelled

Competence Certificate

The assessment consists of a oral exam (ca. 30 min). according § 4 para. 2 No. 2 SPO M.Sc. Geodasie und Geoinformatik.

Prerequisites

The parts T-BGU-106333 und T-BGU-106334 must not have started.

Vision, Exercises

Modeled Conditions

The following conditions have to be fulfilled:

- 1. The course T-BGU-106333 Remote Sensing of a Changing Climate, Prerequisite must not have been started.
- 2. The course T-BGU-106334 Remote Sensing of a Changing Climate, Examination must not have been started.

7.33 Course: Introduction into Classification Methods of Remote Sensing [T-BGU-105725]

Responsible: Organisation: Part of:	DrIng. Uwe Weidne KIT Department of C M-BGU-102758 - GI M-BGU-102759 - Co	ivil Engineer S and Remo	te Sensing			
	Type Oral examination	Credits 4	Grading scale Grade to a third	Recurrence Each summer term	Version 2	

ST 2022 8296105725 Introduction into Classification Methods of Remote Sensing Weidner	Exams			
	ST 2022	8296105725	Introduction into Classification Methods of Remote Sensing	Weidner

Competence Certificate

oral exam (approx. 20 min.)

Prerequisites

None

Recommendation None

Annotation

None

7.34 Course: Introduction to GIS for Students of Natural, Engineering and Geo Sciences [T-BGU-101681]

Responsible:	DrIng. Norbert Rösch DrIng. Sven Wursthorn
Organisation:	KIT Department of Civil Engineering, Geo and Environmental Sciences
Part of:	M-BGU-102757 - Computer Vision and GIS M-BGU-102758 - GIS and Remote Sensing M-BGU-102760 - GIS and Geo Data Infrastructures

Туре	Credits	Grading scale	Recurrence	Version
Written examination	3	Grade to a third	Each winter term	2

Events							
WT 22/23	6071101	Einführung in GIS für Studierende natur-, ingenieur- und geowissenschaftlicher Fachrichtungen, V/Ü	natur-, ingenieur- und 🗱				
Exams							
ST 2022	8280101681	Introduction to GIS for Students of N Sciences	Introduction to GIS for Students of Natural, Engineering and Geo Sciences				
WT 22/23	8280101681	Introduction to GIS for Students of Natural, Engineering and Geo Sciences			Wursthorn		

Legend: Doline, 🕄 Blended (On-Site/Online), 🗣 On-Site, 🗙 Cancelled

Modeled Conditions

The following conditions have to be fulfilled:

1. The course T-BGU-103541 - Introduction to GIS for Students of Natural, Engineering and Geo Sciences, Prerequisite must have been passed.

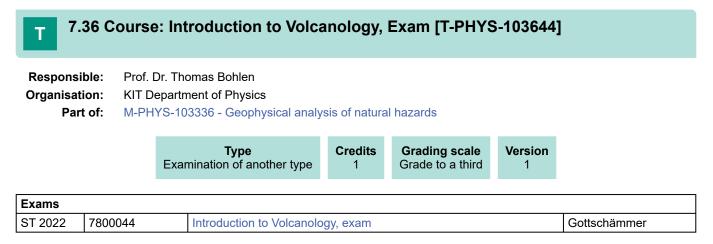
7.35 Course: Introduction to GIS for Students of Natural, Engineering and Geo Sciences, Prerequisite [T-BGU-103541]

Responsible:	DrIng. Norbert Rösch DrIng. Sven Wursthorn
Organisation:	KIT Department of Civil Engineering, Geo and Environmental Sciences
Part of:	M-BGU-102757 - Computer Vision and GIS M-BGU-102758 - GIS and Remote Sensing M-BGU-102760 - GIS and Geo Data Infrastructures

Type Completed coursework	Credits 3	Grading scale pass/fail	Recurrence Each winter term	Version 3	
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Events									
WT 22/23	6071101	Einführung in GIS für Studierende natur-, ingenieur- und geowissenschaftlicher Fachrichtungen, V/Ü	4 SWS	Lecture / Practice (/	Wursthorn				
Exams									
ST 2022	8280103541	Introduction to GIS for Students of N Sciences	Introduction to GIS for Students of Natural, Engineering and Geo Sciences						
WT 22/23	8280103541	Introduction to GIS for Students of N Sciences	Wursthorn						

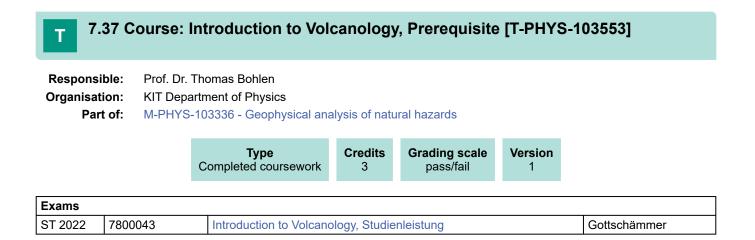
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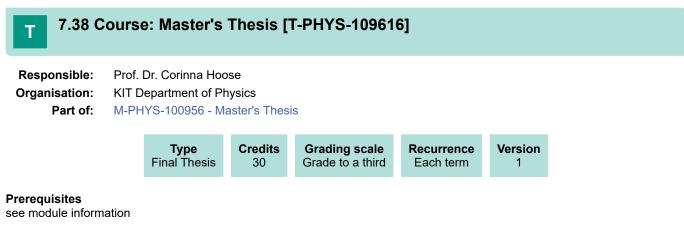


Modeled Conditions

The following conditions have to be fulfilled:

1. The course T-PHYS-103553 - Introduction to Volcanology, Prerequisite must have been passed.





Final Thesis

This course represents a final thesis. The following periods have been supplied:

Submission deadline6 monthsMaximum extension period3 months

Correction period 8 weeks

This thesis requires confirmation by the examination office.

7.39 Course: Methods of Data Analysis [T-PHYS-109142] Т **Responsible:** Prof. Dr. Joaquim José Ginete Werner Pinto Prof. Dr. Peter Knippertz **Organisation:** KIT Department of Physics Part of: M-PHYS-100954 - Applied Meteorology Туре Credits Grading scale Recurrence Version Completed coursework 0 pass/fail Each summer term 2 **Events** ST 2022 Ginete Werner Pinto, 4052171 Methods of Data Analysis 2 SWS Lecture / 🗣 Lerch ST 2022 4052172 Exercises to Methods of Data 1 SWS Practice / 🗣 Ginete Werner Pinto, Analysis Ehmele Exams ST 2022 Ginete Werner Pinto 7800022 Methods of Data Analysis (Prerequisite) Legend: 🖥 Online, 🕸 Blended (On-Site/Online), 🗣 On-Site, 🗙 Cancelled

Competence Certificate

Successful participation in the exercises.

Prerequisites

None

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



Methods of Data Analysis

4052171, SS 2022, 2 SWS, Language: English, Open in study portal

Lecture (V) On-Site

Content

- 1. Basics
- Significance testings
 Regression
- 4. Time series
- 5. Fourier wavelet analysis
- 6. Spatial analysis
- 7. Clustering
- 8. Machine Learning
- 9. Summary

Organizational issues

· Please register for the ILIAS course to receive further information

V

Exercises to Methods of Data AnalysisPractice (Ü)4052172, SS 2022, 1 SWS, Language: English, Open in study portalOn-Site

Content Following the lecture.

7.40 Course: Middle Atmosphere in the Climate System [T-PHYS-108931]

Responsible:	Dr. Michael Höpfner Dr. Miriam Sinnhuber
Organisation:	KIT Department of Physics
Part of:	M-PHYS-100951 - Components of the Climate System

	Comple	Type eted coursework	Credits 0		g scale s/fail	Recurrence Irregular	Version 1	
Events								
WT 22/23	4052061	Middle Atmosp System			2 SWS	Lecture / 🗣		öpfner, Sinnhuber
Exams								
WT 22/23	7800008	Middle Atmosp	Middle Atmosphere in the Climate System (Prerequisite)					ık

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

Prerequisites

None

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

V	Middle Atmosphere in the Climate System 4052061, WS 22/23, 2 SWS, Language: English, Open in study portal	Lecture (V) On-Site
• Mean • Radiat	y of science of the middle atmosphere (MA) state of the MA: temperature, wind, chemical composition ion: sun, radiative transfer, energy budget, photolysis irements: in-situ/remote sounding, ground-based, airborne/balloon,	

- satellite · Aerosols: stratospheric background aerosol layer, volcanic enhancement, polar stratospheric clouds, polar mesospheric clouds, meteoric dust
- · Chemistry: general concepts, global ozone layer, polar ozone chemistry
- Dynamics: fundamental description, meridional circulation, equatorial circulation, waves and tides, stratospheric warmings, tracer and age-of-air, upper troposphere/lower stratosphere, cross-tropopause transport
- · Coupling and climate: chemistry-climate coupling, trends,

Organizational issues

Please sign up for more information in the Ilias course.

7.41 Course: Mobile Computing and Internet of Things [T-INFO-102061]

 Responsible:
 Prof. Dr.-Ing. Michael Beigl

 Organisation:
 KIT Department of Informatics

 Part of:
 M-INFO-102980 - Informatics for Meteorology Students



Events							
WT 22/23	2400051	1 Mobile Computing and Internet of Things 2+1 Lecture / Practice (Lecture / Practice (Beigl		
Exams	•	·		·			
ST 2022	7500285_04.04.22	Mobile Computing and Internet of T	hings		Beigl		
ST 2022	7500287_11.04.22	Mobile Computing and Internet of T	Mobile Computing and Internet of Things				
ST 2022	7500289_30.05.22	Mobile Computing and Internet of T	Mobile Computing and Internet of Things				
ST 2022	7500292_18.07.22	Mobile Computing and Internet of T	Mobile Computing and Internet of Things				
ST 2022	7500293_30.09.22	Mobile Computing and Internet of T	Beigl				
WT 22/23	7500055	Mobile Computing and Internet of T	Beigl				
WT 22/23	7500341_07.02.22	Mobile Computing and Internet of T	Beigl				

Т

7.42 Course: Modern Theoretical Physics for Teacher Students [T-PHYS-103204]

 Responsible:
 Dr. Robert Eder

 Organisation:
 KIT Department of Physics

 Part of:
 M-PHYS-101664 - Modern Theoretical Physics for Teacher Students



Events									
WT 22/23	4012131	Moderne Theoretische Physik für Lehramtskandidaten	4 SWS Lecture / 🗣		Gieseke				
WT 22/23	4012132	Übungen zu Moderne Theoretische Physik für Lehramtskandidaten	Ŭ						
Exams	·	·	•						
WT 22/23	7800078	Modern Theoretical Physics for Teac	Modern Theoretical Physics for Teacher Students						
WT 22/23	7800079	Modern Theoretical Physics for Teac							

Legend: Doline, 🕃 Blended (On-Site/Online), 🗣 On-Site, 🗙 Cancelled

Competence Certificate

Oral exam, approx. 45 min

Prerequisites

successful completion of the exercises

Modeled Conditions

The following conditions have to be fulfilled:

1. The course T-PHYS-103203 - Modern Theoretical Physics for Teacher Students - Prerequisite must have been passed.

7.43 Course: Modern Theoretical Physics for Teacher Students - Prerequisite [T-PHYS-103203]

 Responsible:
 Dr. Robert Eder

 Organisation:
 KIT Department of Physics

 Part of:
 M-PHYS-101664 - Modern Theoretical Physics for Teacher Students

	Complet	Type ted coursework	Credits 0	Grading s pass/fa		Recurrence Each winter term	Version 1	
Events								
WT 22/23	4012131		Moderne Theoretische Physik für Lehramtskandidaten			Lecture / 🗣	Gieseke	
WT 22/23	4012132		Übungen zu Moderne Theoretische Physik für Lehramtskandidaten			Practice / 🗣	Gieseke,	
Exams								
WT 22/23	7800077	Modern The	Modern Theoretical Physics for Teacher Students - Prerequisite					

Legend: Doline, 🕄 Blended (On-Site/Online), 🗣 On-Site, 🗙 Cancelled

Competence Certificate

Course achievement, successful completion of the exercises

Prerequisites

none

T 7.44 Course: Modern Theoretical Physics I, Quantum Mechanics 1 [T-PHYS-105134]

 Responsible:
 Studiendekan Physik

 Organisation:
 KIT Department of Physics

 Part of:
 M-PHYS-101707 - Modern Theoretical Physics I, Quantum Mechanics I

TypeCreditsGrading scaleRecurrenceVersioOral examination4Grade to a thirdEach summer term1	CreditsGrading scaleRecurrenceVersideon4Grade to a thirdEach summer term1	sion	
--	---	------	--

Events									
ST 2022	4010141	Moderne Theoretische Physik I (Theorie D, Quantenmechanik I)	4 SWS	Lecture / 🗣	Shnirman				
ST 2022	4010142	Übungen zu Moderne Theoretische Physik I	Shnirman, Reich						
Exams									
ST 2022	7800060	Modern Theoretical Physics I, Quan	Modern Theoretical Physics I, Quantum Mechanics 1 - oral Exam Mühlleitner, S						
ST 2022	7800129	Modern Theoretical Physics I, Quan	Nodern Theoretical Physics I, Quantum Mechanics 1						
	A DI 1 1 10 0'' 10 1'								

Legend: Dolline, 🕄 Blended (On-Site/Online), 🗣 On-Site, 🗙 Cancelled

Competence Certificate

Oral exam, approx. 45 min

Prerequisites

successful completion of the exercises

7.45 Course: Modern Theoretical Physics I, Quantum Mechanics 1, Prerequisite 1 [T-PHYS-102317]

 Responsible:
 Prof. Dr. Alexander Shnirman

 Organisation:
 KIT Department of Physics

 Part of:
 M-PHYS-101707 - Modern Theorem

M-PHYS-101707 - Modern Theoretical Physics I, Quantum Mechanics I

		ype d coursework	Credits 4	Grading so pass/fai		Recurrence Each summer term	Version 1	
Events								
ST 2022	4010141		Moderne Theoretische Physik I (Theorie D, Quantenmechanik I)			S Lecture / 🗣	Shnirman	
ST 2022	4010142	Übungen z Physik I	Übungen zu Moderne Theoretische Physik I			S Practice / 🗣	Shnirman, Re	
Exams								
ST 2022	7800064	Modern Th - Tutorial	Modern Theoretical Physics I, Quantum Mechanics 1, Prerequisite 1 - Tutorial					

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

Competence Certificate

Course achievement, successful completion of the exercises

Prerequisites

none

T 7.	46 C	ourse: Nu	umerica	I Method	ls - Exam [T-M	ATH-111700]					
Responsi		Prof. Dr. Michael Plum Prof. Dr. Wolfgang Reichel									
Organisat		KIT Departn									
Part of: M-MATH-105831 - Numerical Methods											
		Type Written examination		Credits 5	Grading scale Grade to a third	Recurrence Each summer term	Version 1				
Exams											
ST 2022	7700	00088 Numerical Methods - Exam						tmann, politanos			
WT 22/23	7700	069	Numerica	al Methods -	Exam		Anapolitanos, Plum, Kunstmann				

Competence Certificate Success control takes the form of a written examination (120 minutes).

Prerequisites

none

7.47 Course: Ocean-Atmosphere Interactions [T-PHYS-108932] **Responsible:** Prof. Dr. Andreas Fink **Organisation:** KIT Department of Physics Part of: M-PHYS-100951 - Components of the Climate System Credits **Grading scale** Recurrence Version Туре Completed coursework 0 pass/fail Irregular 1 **Events** WT 22/23 4052121 2 SWS **Ocean-Atmosphere Interactions** Lecture / 🗣 Fink, Woodhams Exams WT 22/23 7800067 Ocean-Atmosphere Interactions (Prerequisite) Fink

Legend: Dolline, 🕸 Blended (On-Site/Online), 🗣 On-Site, 🗙 Cancelled

Prerequisites

None

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

,	Ocean-Atmosphere Interactions	Lecture (V)
	4052121, WS 22/23, 2 SWS, Language: English, Open in study portal	On-Site

Content

- Literature
- Learning goals
- Physical and chemical properties of the upper ocean layers
 - · Properties of ocean waters
 - Salinity content and density
 - Temperature distribution in the ocean
 - Horizontal salinity distribution in the ocean
 - · Vertical salinity distribution
 - Horizontal and vertical density distribution
 - · Characteristic water masses in the oceans
 - Dissolved gases in the ocean
 - Molecular transport
 - Properties of humid air
 - · Ocean surface and its immediate environment
- Wind-driven ocean surface currents
 - Equation of motion
 - Ekman's solution of the equation of motion
 - · Mass transport associated with the Ekman current
 - Up-welling in the ocean
 - Sverdrup regime
 - · Westerly boundary current: Stommel's contribution
 - Munk's solution
- Ocean waves
 - Generation of ocean waves by wind
 - Description of ocean waves
 - Global view on ocean wave climates
 - Ocean wave modeling
 - Ocean wave measurements
- Summary

Organizational issues

Please sign up for more information in the Ilias course.

T 7.48 Course: Parallel Computer Systems and Parallel Programming [T-INFO-101345]

 Responsible:
 Prof. Dr. Achim Streit

 Organisation:
 KIT Department of Informatics

 Part of:
 M-INFO-102980 - Informatics for Meteorology Students

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

Events	Events									
ST 2022	ST 2022 24617 Parallel computer systems and parallel programming 2 SWS Lecture									
Exams										
ST 2022	7500141	Parallel computer systems and para	llel progra	mming	Streit					
WT 22/23	WT 22/23 7500241 Parallel computer systems and parallel programming									

7.49 Course: Physics of Planetary Atmospheres [T-PHYS-109177] **Responsible:** Prof. Dr. Thomas Leisner **Organisation:** KIT Department of Physics Part of: M-PHYS-104488 - Physics of Planetary Atmospheres Credits Grading scale Recurrence Version Туре Completed coursework 8 pass/fail Each winter term 3 **Events** WT 22/23 4052161 Physics of Planetary Atmospheres 2 SWS Lecture / 🗣 Leisner, Sinnhuber, Reddmann WT 22/23 Practice / 🗣 4052162 Exercises to Physics of Planetary 2 SWS Leisner, Duft **Atmospheres** Evame

Exams			
WT 22/23	7800091	Physics of Planetary Atmospheres (Prerequisite)	Leisner
	AA	_	

Legend: Dolline, 🕄 Blended (On-Site/Online), 🗣 On-Site, 🗙 Cancelled

Competence Certificate

- If this module is part of the Specialization or Compulsory Subject, credits are earned through the associated exam (oral, written or otherwise).
- Otherwise, the exercises, computer exercises, internships or, if necessary, graduation lectures must be successfully completed.

Prerequisites

None

Recommendation

Basic knowledge of physics, physical chemistry and fluid dynamics at Bachelor level.

Annotation

240 hours consisting of attendance times (60 hours), follow-up of the lecture incl. Exam preparation and editing exercises (180 hours).

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



Physics of Planetary Atmospheres

4052161, WS 22/23, 2 SWS, Language: English, Open in study portal

Lecture (V) On-Site

Content

The module gives a broad introduction into the formation and properties of planets and their atmospheres and tries to constrain possible planetary atmospheres by applying fundamental principles of physics. In this respect, the module will focus on the planetary atmospheres in our solar system. Moreover, recently developed methods for the remote sensing of extra solar planets are introduced and the current understanding of their atmospheres is presented. A focus is the energy budget of planetary atmospheres, where clouds play a central role. Their formation and growth will be covered in a generalized fashion.

Organizational issues

Please sign up for more information in the Ilias course.

Varalara

7.50 Course: Remote Sensing of a Changing Climate, Examination [T-BGU-106334]

Credite Creding estate

 Responsible:
 Prof. Dr. Jan Cermak

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

 Part of:
 M-BGU-102759 - Computer Vision and Remote Sensing

		Type Oral examinat	tion 3		Grading sca Grade to a th			Version 3		
Events										
ST 2022	6043106	Ser	ellite Climato nsing of a Ch cture			2 SW	S	Lecture / 🗣	C	ermak
ST 2022	6043107	Ser	ellite Climatonsing of a Ch Proises			1 SW	S	Practice / 🕃	C	ermak
WT 22/23	6043106	Ser	ellite Climatonsing of a Ch Nature			2 SW	S	Lecture /	C	ermak
WT 22/23	6043107	Ser	ellite Climato sing of a Ch ercises			1 SW	S	Practice / 🕃	C	ermak
Exams										
ST 2022	8297106	6334 Rei	mote Sensin	g of a C	hanging Clir	nate, E	xami	nation	C	ermak
WT 22/23	8296106	6334 Rei	mote Sensin	g in a C	hanging Clir	nate, Ex	xami	nation	C	ermak

Legend: Doline, 🕄 Blended (On-Site/Online), 🗣 On-Site, 🗙 Cancelled

Competence Certificate

Oral exam of about 20 min.

Prerequisites

T-BGU-106333 (Remote Sensing in a Changing Climate, Vorleistung) passed

T-BGU-101732 (Image Processing and Computer Vision) must not have been started.

Modeled Conditions

The following conditions have to be fulfilled:

- 1. The course T-BGU-106333 Remote Sensing of a Changing Climate, Prerequisite must have been passed.
- 2. The course T-BGU-101732 Image Processing and Computer Vision must not have been started.

Recommendation

None

Annotation

None

T 7.51 Course: Remote Sensing of a Changing Climate, Prerequisite [T-BGU-106333]

 Responsible:
 Prof. Dr. Jan Cermak

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

 Part of:
 M-BGU-102759 - Computer Vision and Remote Sensing

		Type d coursework	Credits 1	Grading pass			
Events							
ST 2022	6043107	Satellite Clin Sensing of a Exercises			1 SWS	Practice / 🕃	Cerm
WT 22/23	6043107	Satellite Clin Sensing of a Exercises			1 SWS	Practice / 🕃	Cerm
Exams	•	•					
WT 22/23	8296106333	Remote Ser	nsing in a Cł	nanging Cli	mate, Pre	requisite	Cerm

Legend: Bonline, 🕄 Blended (On-Site/Online), 🗣 On-Site, 🗙 Cancelled

Modeled Conditions

The following conditions have to be fulfilled:

1. The course T-BGU-101732 - Image Processing and Computer Vision must not have been started.

т

7.52 Course: Remote Sensing of Atmosphere and Ocean [T-PHYS-111274]

Responsible:Dr. Björn-Martin SinnhuberOrganisation:KIT Department of PhysicsPart of:M-PHYS-100953 - Experimental Meteorology



Events					
ST 2022	4052151	Remote Sensing of Atmosphere and Ocean	2 SWS	Lecture / 🗣	Sinnhuber, Cermak
ST 2022	4052152	Exercises to Remote Sensing of Atmosphere and Ocean	1 SWS	Practice / 🗣	Sinnhuber, Cermak
Exams	•	· · ·	•	·	
ST 2022	Sinnhuber				

Legend: Doline, 🕄 Blended (On-Site/Online), 🗣 On-Site, 🗙 Cancelled

Competence Certificate

More than 50% of the points from the exercises must be achieved.

Prerequisites

None

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

Remote Sensing of Atmosphere and OceanLecture (V)4052151, SS 2022, 2 SWS, Language: English, Open in study portalOn-Site

Content

- physical basics
- radiation transfer
- inverse methods
- · basics of satellite remote sensing
- techniques and applications

Organizational issues

· Please register for the ILIAS course to receive further information

V	Exercises to Remote Sensing of Atmosphere and Ocean 4052152, SS 2022, 1 SWS, Language: English, Open in study portal	Practice (Ü) On-Site

Content

Following the lecture.

Organizational issues

· Please register for the ILIAS course to receive further information

7.53 Course: Satellite Climatology: Remote Sensing of a Changing Climate, Examination [T-BGU-110305]

 Responsible:
 Prof. Dr. Jan Cermak

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

 Part of:
 M-BGU-105095 - Satellite Climatology: Remote Sensing of a Changing Climate

	Type Oral examination	Credits 3	Grading scale Grade to a third	Recurre Each winte		Expansion 1 terms	Version 1
Events							
ST 2022	6043106		atology: Remote Changing Climate,	2 SWS	Lectu	re / 🗣	Cermak
ST 2022	6043107		atology: Remote Changing Climate,	1 SWS	Practi	ce / 🕃	Cermak
WT 22/23	6043106		atology: Remote Changing Climate,	2 SWS	Lectu	re / 🖥	Cermak
WT 22/23	6043107		atology: Remote Changing Climate,	1 SWS	Practi	ce / 🕃	Cermak
Exams							
ST 2022	8297110305	Satellite Clim Examination	atology: Remote Se	ensing of a Ch	nanging	Climate,	Cermak
WT 22/23	8297110305	Satellite Clim Examination	atology: Remote Se	ensing of a Ch	nanging	Climate,	Cermak

Legend: Doline, 🕄 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-106334 - Remote Sensing of a Changing Climate, Prüfung must not have started.

The part T-BGU-110304 - Satellite Climatology: Remote Sensing of a Changing Climate, Prerequiste must be passed.

Modeled Conditions

You have to fulfill one of 2 conditions:

- The course T-BGU-110304 Satellite Climatology: Remote Sensing of a Changing Climate, Prerequiste must have been passed.
- 2. The course T-BGU-101732 Image Processing and Computer Vision must not have been started.

7.54 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-105095 - Satellite Climatology: Remote Sensing of a Changing Climate

	Type Completed course	vork	Credits 1	Grading scale pass/fail		r rence nter term	Expansion 1 terms	Version 1
Events								
ST 2022	6043106		sing of a Ch	logy: Remote anging Climate,	2 SWS	Lecture /	\$:	Cermak
ST 2022	6043107	Sen		logy: Remote anging Climate,	1 SWS	Practice	(33)	Cermak
WT 22/23	6043106		sing of a Ch	logy: Remote anging Climate,	2 SWS	Lecture /		Cermak
WT 22/23	6043107	Sen	Satellite Climatology: Remote Sensing of a Changing Climate, Exercises		1 SWS	Practice	/ 🕄 🛛	Cermak
Exams								
ST 2022	8297110304		llite Climato equiste	logy: Remote Sens	sing of a Ch	nanging Cli	mate,	Fuchs, Cermak
WT 22/23	8297110304		llite Climato equiste	logy: Remote Sens	sing of a Ch	nanging Cli	mate,	Cermak, Fuchs

Legend: Bonline, 🕄 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.

Modeled Conditions

The following conditions have to be fulfilled:

- 1. The course T-BGU-106333 Remote Sensing of a Changing Climate, Prerequisite must not have been started.
- 2. The course T-BGU-101732 Image Processing and Computer Vision must not have been started.

7.55 Course: Scientific Concept Development [T-PHYS-109617]

Organisation: KIT Department of Physics

Part of: M-PHYS-100955 - Specialisation Phase

	Type Completed co		Credits 30	Grading scale pass/fail		r rence term	Expansion 1 terms	Version 1	
Events									
ST 2022	4052904	Semin	ar on Specia	alization Phase	2 SWS	Seminar / 🕃		Braesicke, Hoose, Knij Kunz, Leisr Werner Pin	opertz, ier, Ginet
Exams	•	•							
ST 2022	7800098	Scient	ific Concept	Development				Hoose	
WT 22/23	7800070	Scient	ific Concept	Development			Hoose		

Legend: Dolline, 🕸 Blended (On-Site/Online), 🗣 On-Site, 🗙 Cancelled

Prerequisites

see module information or module handbook

Modeled Conditions

You have to fulfill one of 4 conditions:

- 1. The module M-PHYS-100951 Components of the Climate System must have been passed.
- 2. The module M-PHYS-100952 Atmospheric Processes must have been passed.
- 3. The module M-PHYS-100953 Experimental Meteorology must have been passed.
- 4. The module M-PHYS-100954 Applied Meteorology must have been passed.

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



Seminar on Specialization Phase

4052904, SS 2022, 2 SWS, Language: English, Open in study portal

Seminar (S) Blended (On-Site/Online)

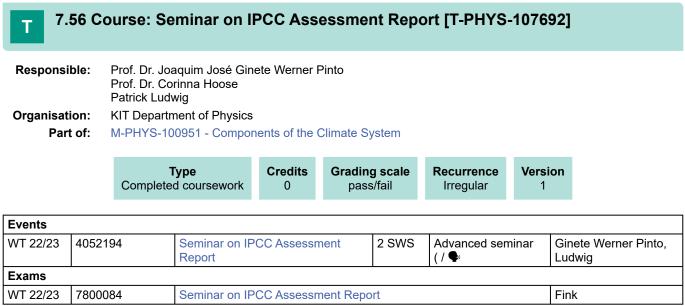
Content

In the Seminar on Specialization Phase students present their final theses in the context of the TL T-PHYS-109617 "Scientific Concept Development" (Master)

The registration takes place via Ilias and by mail to katharina.maurer@kit.edu

Organizational issues

• The organization will still take place online. Therefore please register for the ILIAS course to recieve further information



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

Competence Certificate

Study of a chapter of the current IPCC report with subsequent presentation (~ 20-25 min) and submission of a written summary (1 page).

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

V	Seminar on IPCC Assessment Report 4052194, WS 22/23, 2 SWS, Language: English, Open in study portal	Advanced seminar (HS) On-Site

Content

Causes of climate change and paleoclimate (external and internal influence factors on

the climate, results and structure of simple climate models with and without feedbacks,

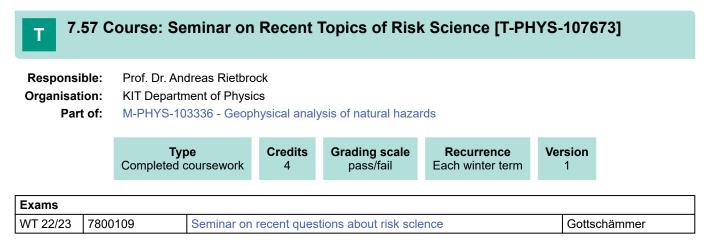
radiation effect and importance of greenhouse gases, results of model projections of

the global climate, IPCC process structure and importance for the life on earth).

The objectives of this Seminar are to provide an overview of the last IPCC Report (currently 2013) and to develop scientific presentation and discussion skills.

Organizational issues

Please sign up for more information in the Ilias course.



Modeled Conditions

The following conditions have to be fulfilled:

1. The course T-PHYS-105113 - Geophysical Risk Seminar must not have been started.

Т

7.58 Course: Tropical Meteorology [T-PHYS-107693]

 Responsible:
 Prof. Dr. Peter Knippertz

 Organisation:
 KIT Department of Physics

 Part of:
 M-PHYS-100951 - Components of the Climate System



Events					
WT 22/23	4052111	Tropical Meteorology	2 SWS	Lecture / 🕃	Knippertz
WT 22/23	4052112	Exercises to Tropical Meteorology	1 SWS	Practice / 🕄	Knippertz, Lemburg
Exams					
WT 22/23	7800085	Tropical Meteorology (Prerequisite)			Fink

Legend: Doline, 🕃 Blended (On-Site/Online), 🗣 On-Site, 🗙 Cancelled

Competence Certificate

Students must achieve 50% of the points on the exercise sheets.

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

V

Tropical Meteorology

4052111, WS 22/23, 2 SWS, Language: English, Open in study portal

Lecture (V) Blended (On-Site/Online)

Content

Dynamics and climate of the Tropics (tropical circulation, Hadley and Walker cells, monsoons, El Niño, equatorial waves, Madden-Julian Oscillation, easterly waves, tropical cyclones, tropical squall lines).

Organizational issues

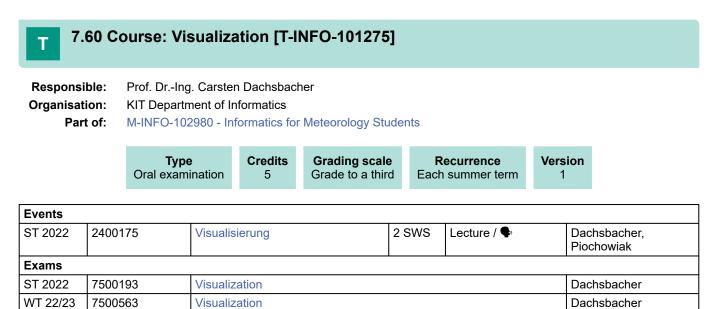
Please sign up for more information in the Ilias course.

7.59 Course: Turbulent Diffusion [T-PHYS-108610] **Responsible:** Prof. Dr. Corinna Hoose Dr. Gholamali Hoshyaripour **Organisation:** KIT Department of Physics Part of: M-PHYS-100954 - Applied Meteorology Туре Credits Grading scale Recurrence Version Completed coursework 0 pass/fail Each summer term 5 **Events** ST 2022 4052081 **Turbulent Diffusion** 2 SWS Lecture / 🗣 Hoshyaripour, Hoose ST 2022 1 SWS Practice / 🗣 4052082 Exercises to Turbulent Diffusion Hoshyaripour, Hoose, Bruckert Exams Ginete Werner Pinto ST 2022 7800019 Turbulent Diffusion (Prerequisite) Legend: Bonline, 🕄 Blended (On-Site/Online), 🗣 On-Site, 🗙 Cancelled **Competence Certificate** There are 7 exercises with 100 points in total. To be admitted for the oral exam the students must: Obtain at least 50 points from exercises. · Present and explain at least one of the ICON-ART exercises in the class. Prerequisites noone Below you will find excerpts from events related to this course: **Turbulent Diffusion** Lecture (V) On-Site 4052081, SS 2022, 2 SWS, Language: English, Open in study portal Content 1. Life cycle of air pollutants 2. Relevant processes and substances 3. Quantification of trace substances 4. Emissions 5. Turbulence and averaging 6. The diffusion equation 7. Chemical Transformations 8. Aerosol processes 9. Atmospheric models: ICON-ART modeling system 10. Parametrisation of turbulent fluxes 11. Aerosol interactions **Organizational issues** · Please register for the ILIAS course to receive further information **Exercises to Turbulent Diffusion** Practice (Ü) **On-Site** 4052082, SS 2022, 1 SWS, Language: English, Open in study portal Content There are 7 exercises with 100 points in total. To pass the prerequisite the students must:

- Obtain at least 50 points from exercises.
- Present and explain at least one of the ICON-ART exercises in the class.

Organizational issues

• Please register for the ILIAS course to receive further information

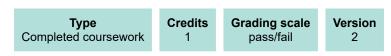


Legend: Dolline, 🕄 Blended (On-Site/Online), 🗣 On-Site, 🗙 Cancelled

7.61 Course: Wildcard [T-PHYS-112124]

Organisation: KIT Department of Physics

Part of: M-PHYS-102352 - Interdisciplinary Qualifications



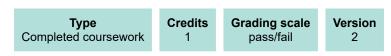
Self service assignment of supplementary stdues

- House of Competence
- Sprachenzentrum
- · Zentrum für Angewandte Kulturwissenschaft und Studium Generale
- Studienkolleg
- MINT-Kolleg
- Personalentwicklung und Berufliche Ausbildung

7.62 Course: Wildcard [T-PHYS-112125]

Organisation: KIT Department of Physics

Part of: M-PHYS-102352 - Interdisciplinary Qualifications



Self service assignment of supplementary stdues

- House of Competence
- Sprachenzentrum
- · Zentrum für Angewandte Kulturwissenschaft und Studium Generale
- Studienkolleg
- MINT-Kolleg
- Personalentwicklung und Berufliche Ausbildung

7.63 Course: Wildcard [T-PHYS-112122]

Organisation: KIT Department of Physics

Part of: M-PHYS-102352 - Interdisciplinary Qualifications



Self service assignment of supplementary stdues

- House of Competence
- Sprachenzentrum
- · Zentrum für Angewandte Kulturwissenschaft und Studium Generale
- Studienkolleg
- MINT-Kolleg
- Personalentwicklung und Berufliche Ausbildung

7.64 Course: Wildcard [T-PHYS-112123]

Organisation: KIT Department of Physics

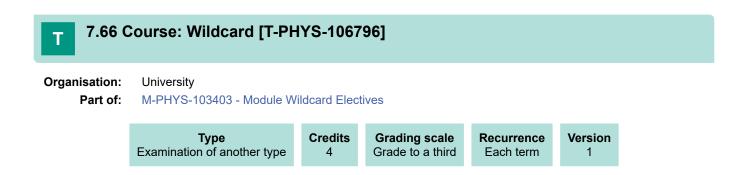
Part of: M-PHYS-102352 - Interdisciplinary Qualifications



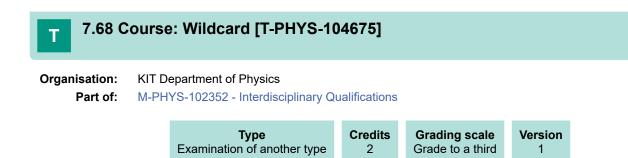
Self service assignment of supplementary stdues

- House of Competence
- Sprachenzentrum
- · Zentrum für Angewandte Kulturwissenschaft und Studium Generale
- Studienkolleg
- MINT-Kolleg
- Personalentwicklung und Berufliche Ausbildung

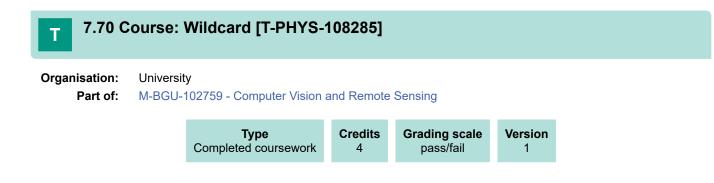


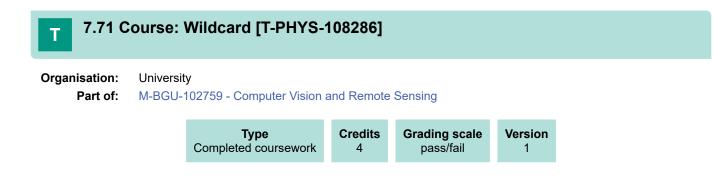


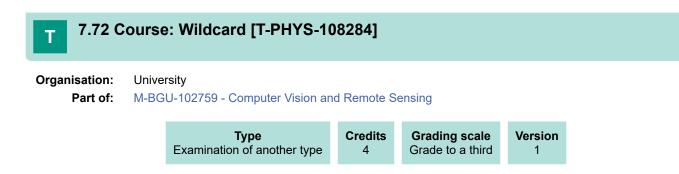




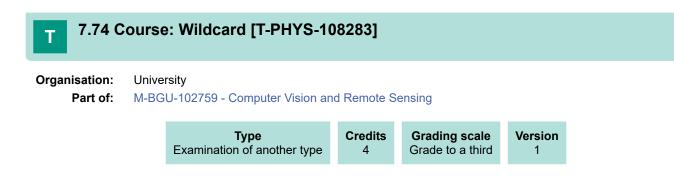












Guidelines to Master's Thesis

In the following, the most important steps and necessary formalities related to the compilation and submission of the Master's thesis are described. The description comprises the closely interlinked modules "Specialization Phase" and "Master's Thesis", thus two semesters or a 12-month period. It is a guideline, not a legally binding regulation document. Questions can be directed to Andreas Fink (andreas.fink@kit.edu) or Kathi Maurer (kathi.maurer@kit.edu).

4. Finding a topic and supervisor

The "standard" case is that you will obtain a topic and supervisor from the list at our homepage. Please approach the respective supervisor(s) for more details in case you are interested. Please note that it is possible to choose topics that were not listed under the above-mentioned URL. In this case, approach professors, "Privatdozenten", and group leaders directly.

In this context, it shall be noted that the Institute of Meteorology and Climate Research (IMK) has three departments: **TRO** focuses on the troposphere, **AAF** on aerosols, **ASF** on atmospheric trace gases and remote sensing. Master theses can be written in all three departments.

5. Registration and Deadlines

Before the start of the module *Specialization Phase*, students need to personally visit the Examination Office of the KIT Faculty of Physics:

Prüfungssekretariat, Ms. Anja Müller

Physics Building 30.21, 9th floor, Room 9-13;

email: pruefungssekretariat@physik.kit.edu

Phone 0721 608-43438

If all requirements are met, a signed and stamped form will be issued.

Students use this form to contact their Advisor to discuss and fill in, amongst others, the fields "Advisor/ Co-Advisor", "Preliminary title of thesis", and "Start of the thesis".

The Advisor signs the form and sends it back to the Examination Office.

The Examination Office will register the start of the *Specialization Phase* in the Campus Management System. As soon as the module *Specialization Phase* is passed by presenting a talk in the Seminar on Specialization Phase (6 months after starting date) the thesis is registered in Campus Management System with the preliminary working title, the advisors and the start date. The deadline for submission of the thesis is calculated by the system and monitored by the Examination Office (12 months after starting date). These information are visible for the student in the Campus student portal. The following points are worthy of note:

- The application for the Specialization Phase will be accepted by Ms. Müller, if all four meteorology modules of the 1st and 2nd MSc semester are entered in the Campus Management System. The modules Soft Skills and Complementary Elective may still be incomplete and should be completed in the course of the Specialization Phase.
- If the oral module exam has already been passed in one or more of the meteorological modules but has not yet been entered, an e-mail from the Responsible Lecturer to Ms. Müller, confirming the successful completion of the module, is sufficient.
- Important: If one of the four Master modules has not been passed because course components ("Teilleistungen") have not yet been completed and therefore the prerequisites for the oral examination have not yet been met, please speak to the study advisor Prof. Dr. Andreas H. Fink, to prevent an unnecessary delay of the study by one semester.
- Deadline extensions are handled very restrictively and are only possible in justified individual cases.

6. The module Specialization Phase

Formally, the first six months of final thesis work belong to the module *Specialization Phase*. In these six months, a seminar will be given in the *Seminar on the Specialization Phase ("*Studierendenseminar") in the context of the *Scientific Concept Development*. It should be noted that this seminar must be given in the *"*Studierendenseminar" that usually takes place during the lecture period on Wednesdays from 16:00-17:30 o'clock. After booking a date in the respective Ilias course dates and seminar titles should be sent to <u>Kathi</u> <u>Maurer</u>.

<u>Important:</u> Please register in the Campus Management System before the seminar on the Specialization *Phase*. Formally, this is possible when all of the 4 master modules in meteorology in the Campus Management System have been passed.

The seminar talk should take 20-25 minutes, followed by a discussion. The total duration should not exceed 45 minutes. After the seminar, there should be a feedback discussion with the Advisors and the Supervisor, in which the progress made so far is evaluated and next steps are discussed.

Advisors or Supervisors sign a <u>form</u>, which documents the presentation of the lecture with date and title.

Please forward the signed form to Prof. Hoose or Kathi Maurer, who will enter the Specialization Phase in the Campus Management System.

7.

The module Master's Thesis

Within the 12-month period, the Master's thesis is to be submitted to Ms. Müller as a written scientific paper.

<u>Five</u> bound copies must be made, with three copies being submitted to Ms. Müller, all three signed by the first Examiner with a text like for example:

"Accepted as an examination copy."

<u>Please note: With this signature the first examiner declares that the work is graded at least with a mark of 4.0!</u> If doubts as to the latter grading exists, the examiner will write on all three copies a text like:

"Inspection copy."

Ms. Müller confirms the receipt of the copies, which are then submitted to the first and second Examiners and on the basis of which the reports are prepared. This delivery is relevant for the 12-month deadline.

Please give the fourth and fifth bound copy to Frau Gräbner for the library at Campus South and the DWD library. Please send a PDF of the submitted work to <u>Mr. Daub</u>, the IT administrator at Campus South. This PDF file is available for free download on the *IMK* website pending on the consent of the Advisor.

After submission, a 20-25 minute seminar must be held in the respective seminars of the department TRO, ASF, or AAF (cf. Section 4.1), where the thesis was written. This seminar can be held after the 12-month period and should take place at one of the next possible dates. <u>Note:</u> This final seminar can only take place during the lecture period.

After the seminar, a <u>form</u> must be completed, signed by the Advisor and the Co-Advisor or Supervisor and sent to Ms. Müller for recognition. The reports will be prepared by the Advisors only after the final presentation, as this is part of the assessment and is included in the evaluation.

8. Glossary

- Advisor ("Berichterstatter or" Gutachter"): This is usually a professor or a "Privatdozent" who acts as the first examiner.
- Co-Advisor ("Zweitgutachter"): This is usually a professor or a "Privatdozent" who acts as the second examiner.
- Supervisor ("Betreuer"): He/she supervises the Master Student, is often the Advisor or Co-Advisor, but can also be research staff (see also "group leader").
- Privatdozent": This is an habilitated staff member. He can act as an Advisor. However, the second examiner must be a full professor in this case. This is also true for so-called "apl. Professor".
- Group Leader ("Gruppenleiter"): Group leaders in Campus North are senior scientists. They can act as Supervisors, but not as Advisors if they are not habilitated or are an "apl. Professor" (please see "Privatdozent").
- "Responsible Lecturer": This is the "Modulverantwortliche" who enters the final grade of his/her module into the Campus Management System.

- "Examination Office" ("Prüfungssekretariat"): This is the "Prüfungssekretariat" of the Faculty of Physics. The Examination Office is currently managed by Ms. Müller.
- **©** Campus Management System (CAS): Amongst others, results of modules are entered in CAS.
- **Course Component":** This is the so-called "Teilleistung", often a lecture.
- **①** "Seminar on the Specialization Phase": This is also referred to as "Studierendenseminar", in which also BSc students give their talks. It is currently scheduled on Wednesdays 16:00-17:30 hours. Registration takes place via booking a timeslot in the respective Ilias course and by sending a mail with the booked date at <u>Kathi Maurer</u>.