

Study information for the international post-graduate course *Tropical Hydrogeology and Environmental Engineering (TropHEE)* leading to the Master of Science (M.Sc.)

1. Objective of the Course

The objective of this master course, which builds on a qualifying degree in a suitable geoscientific or comparable field, is the scientific education and specialization of German and international geoscientists in order to deal with resource-, hazard-, hydrology-, and management-related topics. The program aims to provide students with the necessary knowledge for solving problems associated with water exploitation, groundwater protection and soil conservation as well as provide an introduction to the geoscientific concerns associated with land use planning in tropical and subtropical areas. It is a further aim of the course to foster the understanding of the student about the responsibility of scientists towards society and nature in terms of sustainable development, and to increase their ability to cooperate with specialists from other disciplines on national and international levels. The post-graduate course concludes with a Master of Science examination.

The *TropHEE* course aims at enabling the candidates to use geoscientific knowledge and methods for the evaluation and solution of practical as well as scientific problems on economic, administrative, research-related or educational levels. It also aims at providing the qualification for taking up independent scientific studies within the frame of a PhD thesis. Students of the course will acquire the following skills and competences:

- ability to comprehend the geoscientific background of local, regional and global water and environment related issues;
- sound knowledge of the fields and topics taught in the *TropHEE* curriculum and the ability to make use of the specific methodology;
- ability to recognize the complexity of specific problems and tasks in the fields of water and environment;
- ability to independently develop and/or improve solutions for complex geoscientific and interdisciplinary problems in research and development;
- ability to independently acquaint themselves with new areas and methods in the selected subject area as well as in neighboring fields;
- ability to act creatively, for example, to develop new ideas, methods and solutions;
- ability to assess and take into account the subject specific effects of their action while appreciating the globalization and internationalization of technical, socio-economic and sociological developments;

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- willingness to evaluate different approaches and present them in a factual and intelligible way; the willingness to make decisions;
 - ability to identify upcoming problems and developments from scientific/technical to geopolitical level (e.g. Millennium Development Goals) and to incorporate them into their work;
 - ability and willingness to take part in interdisciplinary and international co-operations beyond professional, administrative and political boundaries; and
 - preparedness for exercising managerial responsibility on the basis of the expertise and soft skills acquired in the course.

2. Entrance Requirements

Applicants are required to prove geoscientific or civil engineering competences, or competences in a related subject on at least Bachelor level, as documented through a Bachelor of Science or Bachelor of Engineering degree or a comparable examination. The *TropHEE* Examination Board decides on the equivalency of the degrees. In individual cases the *TropHEE* Examination Board may request interviews or tests to assess the eligibility of candidates, or impose other additional requirements.

Candidates must provide proof of English language proficiency in form of a certificate (UNICERT III, TOEFL (PBT 570, CBT 230, iBT 88), IELTS 6.5 or CAE (Grade C1)). English language proficiency is regarded as proven if your previous degree (e.g. Bachelor) was taught entirely in English.

3. Learning and Teaching Methods

The main objectives of the study program courses are to introduce students to a particular topic and to provide the guidelines and the motivation for the independent acquisition of specialist knowledge and skills. Libraries, learning centers and the Internet are available for this purpose. The students' openness to teamwork and discussion is fostered by seminars, practical courses, exercises and field trips.

The courses will be supplemented by e-learning measures as provided by the university, to support individual and flexible ways of learning. Contents of the courses will be available through an online web-based learning environment. Courses utilizing e-learning measures participate in the e-learning label process of the university. E-learning contents will be highlighted in the university course catalog.

In each semester the Institute of Applied Geosciences is conducting an evaluation of all courses following an acknowledged standardized procedure for quality management.

The following generally accepted course types, which will be continuously evaluated and improved, are included in the *TropHEE* course:

- Lecture

Presentation of basic and specialized scientific and methodological knowledge supported by lecture notes and specialized literature. Additional material is provided in electronic form through a central web-based server. In the future, lectures will be recorded and provided in a web-based online environment which also facilitates interactive and communicative ways of learning. Lecture material will be made available on the OpenLearnware platform of the university.

- Exercise

Exercises supplement the lectures. Students are given the opportunity for applying and intensifying the acquired matter by solving exemplary problems on their own. The exercises are also a chance for students to check their standard of knowledge. For this reason, the exercises are carried out in small groups enabling students to obtain first-hand discussion experience. The contents of the exercises are also provided in electronic form through a central web-based server.

- Seminar

Compilation, evaluation and presentation of complex problems and scientific knowledge using general scientific approaches, typically followed by a discussion. The main objective of the seminars is to encourage students to research topical problems using scientific methods and learn scientific skills such as literature survey, organizational working, presentation techniques, correct citation, and the ability to give and receive criticism in an open discussion.

- Project seminar

Compilation, evaluation and presentation of complex problems and scientific knowledge through interdisciplinary work in small project teams. The objective of this is to learn and train team work by addressing exemplary real-life projects. If applicable electronic means of communication (e.g., *CLIX*) will be used within the project teams. The results of the team work are presented in a seminar in the form of, e.g., presentations or posters.

- Field trips

Excursion away from the university environment, direct observation of features in the field and explanation by the instructor or through own survey by the students. Follow-up through reports or presentations or processing of samples in the laboratory.

- Laboratory exercises

Application of specific experimental and analytical methods in the laboratory. Acquisition of qualitative and quantitative measurement results using standard analytical methods and data evaluation. Objective of the laboratory exercises is to acquaint the students with experimental work and up-to-date analytical procedures.

- Field exercises

Field courses are of special importance in the geosciences. They include the teaching and training of geoscientific field methods, data acquisition and evaluation, and reporting. Field courses may also include training in geological mapping. The field exercises also aim at training observational skills and team work. The results are compiled into reports and presentations.

- Scientific Training

The *Scientific Training* is a form of independent study, specially conceived for this study program. During this part of the program students will put into practice special geoscientific methods such as terrain analysis and mapping, chemical analyses and the collection and interpretation of external data to investigate a specific topic. The results will be summarized in a final report and presented in a seminar. Students may carry out the *Scientific Training* in their home countries.

- Master Thesis

In the Master Thesis, students should apply and intensify their knowledge and skills acquired in the preceding courses in the frame of an actual research work. Under individual guidance, students will actively, and with increasing independence, work on a specific problem which is part of an industrial or scientific research project. This work will promote the ability to recognize new problems, find new solutions, discover the limits of knowledge pertaining to a specific research area, and to present the results in a coherent and scientific form.

4. Course Structure

Curriculum

Generally, the start of the course is in the winter semester since all courses follow an annual cycle. The course is structured in modules which are completed by examinations. The examinations complement the studies. The prescribed study period including the Master Thesis is four semesters.

The required sum of credits is 120, including the master thesis. The structure of the course should allow the acquisition of around 30 credits per semester. The course language is English.

The course is divided into the following phases:

- a. A preliminary phase (distance course and learning control) without matriculation, which takes place before the applicant begins his/her studies at the Technische Universität Darmstadt. This ensures that all participants are on the same level of knowledge in the field of basic geosciences.
- b. An attendance phase over three semesters at the Technische Universität Darmstadt, comprising semester courses as well as block courses (78 credits).
- c. The Scientific Training (6-8 weeks, 12 credits) which can be done during the course and, if applicable, in the home country of the student; its results are documented in a written report.
- d. The 4th semester, in which the Master thesis is prepared (6 months, 30 credits).

The structure of the course is outlined in detail in the Study and Examination Schedule. The modules are divided into Basic Modules and Special Modules which can be selected and combined according to the individual specialisation interests of the student. The specialisation process is supported by the *TropHEE* instructors and lecturers and the institute's student advisor through individual guidance and counselling.

Compulsory Modules (CM1 - CM3)

Compulsory modules include a field trip to a semiarid region (CM1) to study geoscience and water management issues in regions with scarce water resources, a project seminar (CM2) to foster inter-disciplinarity and teamwork skills, and the Scientific Training (CM3).

Basic Modules (BM1 - BM5, elective)

The lectures of the Basic Modules cover essential geoscientific knowledge and methods for a water- and environment-related education in Applied Geosciences. They are held in preparation of the contents in the Special Modules. The students decide on their choice of Basic Modules in an orientation meeting with the student advisor, under consideration of their previous knowledge in geosciences.

Special Modules (SM1 – SM12, elective)

Objective of the Special Modules is to deepen the scientific and methodological knowledge of the students, with focus on the specific conditions of the target region of this course. This should enable the students to develop and apply problem solving strategies and methods. Special focus is given to problem-oriented application and further development of the knowledge obtained in the course.

Master Thesis

With the Master Thesis the students prove that they are able to perform – under guidance – research work on a specific geoscientific problem. If applicable, the student should be integrated in the institute's ongoing research projects. The high amount of credits awarded for a successful Master Thesis (30 credits) reflects the significance of the master Thesis as an independent scientific work.

Mentors

At the start of the first semester a lecturer actively participating in the *TropHEE* Master Course is assigned to each student as a mentor. The mentors provide advice to the students during their course of study in the fields of curriculum planning, examinations, potential stays abroad, and in potential crisis or conflict situations. The students consult with their mentors at the end of the first semester to discuss potential fields of specialization and to individually plan the further course of study.

5. Course Contents

The contents are detailed in the Module Handbook.

6. Examinations

All examinations are regulated by the *Allgemeinen Prüfungsbestimmungen (APB) der Technischen Universität Darmstadt* (general examination regulations of the university) and the *Ausführungsbestimmungen des Masterstudiengangs TropHEE vom 01.10.2012 zu den Allgemeinen Prüfungsbestimmungen (APB) der Technischen Universität Darmstadt* (supplemental regulatory statutes for the TropHEE Master Course).

The learning progress of the students is monitored and verified through examinations. Innovative teaching and learning techniques (e-learning) support the students in their preparation for the examinations, e.g. through online material and online consultation. The examinations complement the studies and are held at the end of each lecture term or at the start of the following lecture term. In case of failing an examination the student should have the chance to do a re-examination in the semester break following the actual examination.

The courses are combined into modules. The overall module grade is calculated from the grades of the courses of the module weighted with the credits awarded for the respective courses.

The type of examination ("Studienleistung" or "Fachprüfungen"), the examination form (e.g., oral or written), and the examination duration is regulated in the Study and Examination Schedule. Additional to the grading as regulated by the *Allgemeinen Prüfungsbestimmungen (APB) der Technischen Universität Darmstadt* (general examination regulations of the university) a certain amount of credits is awarded for each successfully passed course.

Written examinations will be carried out in English. As a rule, oral examinations will be held in English, but can also be held in German if requested.

The topic of the Master Thesis can only be issued after the candidate has acquired at least 84 credits, including the credits of all *Compulsory Modules* (CM1 - Semiarid Field Hydrogeology, CM2 - Project Seminar, CM3 - Scientific Training). The Master Certificate can only be issued after the candidate has acquired at least 120 credits (incl. the Master Thesis).

The final grade is calculated from the credit-weighted means of the grades achieved by the candidate in the modules, the Scientific Training and the Master Thesis, following the procedures laid out in the *Allgemeinen Prüfungsbestimmungen (APB) der Technischen Universität Darmstadt* (general examination regulations of the university).

A report is issued with the certificate which lists the course topics and modules ("Transcript of Records"), the title of the Master thesis, the grades obtained in the modules and Master thesis, the final grade and the rating scale.