TECHNISCHE UNIVERSITÄT WIEN

Bachelor's degree

Master

Doctorate

University course

Study plan (curriculum) for the

Master's programme Geodesy and Geoinformation UE 066 421

Vienna University of Technology

Resolution of the Senate of the Vienna University of Technology on 13 May 2024

Valid from 1 October 2024

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§1 Basis and scope of application

This curriculum defines and regulates the engineering, English-language Master's degree programme in *Geodesy and Geoinformation* at the Vienna University of Technology. This Master's programme is based on the Universities Act 2002 - UG (Federal Law Gazette I No. 120/2002 as amended) - and the *study regulations of the statutes of the Vienna University of Technology* as amended. The structure and design of this degree programme are based on the qualification profile according to section §2.

§2 Qualification profile

The Master's degree programme in *Geodesy and Geoinformation* provides an in-depth, scientifically and methodologically high-quality education geared towards long-term knowledge, which qualifies graduates for further qualification, especially in the context of a relevant doctoral programme, as well as for employment in the following fields of activity, for example, and makes them internationally competitive:

- Engineering consultant for surveying.
- Independent planning, management and execution of demanding surveying work in connection with other engineering sciences such as civil engineering, geotechnics or mechanical engineering.
- Managerial activity in authorities and companies involved in the acquisition, administration or utilisation and cartographic communication of geodata.
- Leading activity in the development of instruments or software for the acquisition and processing of geodata.
- Independent planning, management and execution of complex geodata management tasks in the context of spatial issues in a wide range of disciplines.

Against the backdrop of growing challenges in the areas of resource management, development of urban and natural space, environmental protection and climate change, our modern society needs reliable information about the underlying processes and their interactions. The ability to record, model, link and communicate spatial data to society therefore plays a key role. The degree programme has an international focus and is aimed at the tasks as well as the students and the labour market.

Due to the professional requirements, the Master's degree programme in *Geodesy and Geoinformation* teaches qualifications in the following categories.

Technical and methodological competences

- In-depth knowledge of the equalisation calculation
- In-depth knowledge of engineering geodesy methods and sensors
- Knowledge of building law and basic knowledge of land register law and measurement law

- Theory of the gravitational field
- Theory and practice of geodetic space procedures and atmospheric influences
- Theory of the Earth's rotation and geodynamic processes
- In-depth knowledge of photogrammetry and remote sensing
- Analysis and fusion of spatial information
- In-depth knowledge of cartography

Cognitive and practical skills

- Ability to independently plan and carry out demanding technical tasks in the field of surveying and geoinformation
- Critical analysis of current, especially English-language specialised literature
- Presentation and discussion of own and other students' work
- Project management and dealing with time pressure
- Writing scientific papers

Social skills and self-competences

- Leading teams in the execution of demanding technical tasks
- Critical assessment of specified requirements or framework conditions and development of proposals for appropriate adaptation (consulting)
- GRADUATES are able to work in multicultural teams and have the specialised vocabulary in English thanks to the training held in English
- Dealing with contradictory information
- Cost and quality awareness

§3 Duration and scope

The workload for the Master's degree programme in *Geodesy and Geoinformation* is 120 ECTS credits. This corresponds to a planned duration of study of 4 semesters as a full-time programme.

ECTS credits (ECTS) are a measure of the workload of students. One academic year comprises 60 ECTS points, whereby one ECTS point corresponds to 25 hours of work (in accordance with § 54 para. 2 UG).

§4 Admission to the Master's programme

Admission to the Master's degree programme in *Geodesy and Geoinformation* requires the completion of a relevant Bachelor's degree programme or another relevant degree programme of at least the same higher education level at a recognised domestic or foreign post-secondary educational institution. Relevant studies include basic scientific subjects

such as maths and physics or computer science. The Bachelor's degree programme in *Geodesy and Geoinformation* at the Vienna University of Technology and the Bachelor's degree programme in *Geodesy* at the Graz University of Technology are definitely worth considering.

Supplementary examinations may be prescribed to compensate for significant subject-related differences and must be taken by the end of the second semester of the Master's degree programme.

The language of instruction is English. [illegible] whose first language is not English must provide proof of the required language skills. The form of proof is specified in a regulation issued by the Rectorate.

English language skills are proven if the requirements of the Rectorate's Ordinance on the language skills and certificates required for admission to degree programmes are met or if relevant English-language courses have been completed in the Bachelor's degree programme. No knowledge of German is required to complete this degree programme. However, German language skills are recommended for students who wish to pursue a career as [illegible] consultant for surveying, as the relevant elective courses (see Appendix F) are only offered in German.

§5 Structure of the degree programme

The content and qualifications of the degree programme are taught in *modules.* A module is a teaching and learning unit that is characterised by entry and exit qualifications, content, forms of teaching and learning, the standard workload and the assessment of performance. Modules are completed in the form of individual or several interrelated *courses*. Thematically similar modules are grouped into *examination subjects*, the designation of which is shown on the degree certificate together with the scope and overall grade.

Examination subjects and associated modules

The Master's degree programme in *Geodesy and Geoinformation is* divided into the following examination subjects with the modules assigned to them.

In-depth Study of Fundamentals (11.0 ECTS)

Parameter Estimation (6.0 ECTS)
Seminars (5.0 ECTS)

Specialisation in Subjects of Geodesy and Geoinformation (45.0-55.0 ECTS)

As part of the examination subject *Specialisation in Subjects of Geodesy and Geoinformation, students* must complete courses from the following modules totalling at least 45 ECTS and a maximum of 55 ECTS:

Applied Geoinformation (8.0 ECTS)
Applied Cartography (7.5 ECTS)
Earth Observation (7.5 ECTS)
Climate and Environmental Remote Sensing (6.0 - 8.0 ECTS)
Space Geodesy (9.0 ECTS)
Advanced Engineering Geodesy (9.0 ECTS)
Real Estate and Cadastre (7.5 ECTS)
Microwave Remote Sensing (6.0 ECTS)
Advanced Photogrammetry (6.0 ECTS)
Law and Economics (5.0 ECTS)
Gravity Field and Earth Rotation (9.0 ECTS)
Statistical Pattern Recognition (6.0 ECTS)
Theoretical Cartography (6.0 - 9.0 ECTS)
Geoinformation Theory (8.0 ECTS)

Broadening in Subjects of Geodesy and Geoinformation (15.0-25.0 ECTS)

As part of the examination subject *Broadening in Subjects of Geodesy and Geoinformation*, courses from the following modules totalling at least 15 ECTS and a maximum of 25 ECTS must be completed in such a way that, together with the courses in the examination subject *Specialisation in Subjects of Geodesy and Geoinformation,* at least 70 ECTS have been completed:

Areal and Kinematic Measurement Methods in Engineering Geodesy (6.0
ECTS) Geo-Data and Data Processing (6.0 - 9.0 ECTS)
Supplementary Mathematics (5.5 - 8.5 ECTS)
Supplementary Specialisation (4.0 - 10.0 ECTS)
Environment (6.0 - 9.0 ECTS)
Environmental Geophysics (6.5 - 9.5 ECTS)
Navigation and Space (7.5 - 10.5 ECTS)

As part of the *Supplementary Specialisation* module, courses from other modules that are not used for the completion of these modules can also be completed. With the approval of the responsible study law body, courses for which there are no equivalences but which represent a specialisation of the degree programme can also be completed as part of a period of study abroad (e.g. in the ERASMUS programme).

Free electives and transferable skills (9.0 ECTS)

Free electives and transferable skills (9.0 ECTS)

The courses for the Free Electives and Transferable Skills module can be freely selected from the courses offered by all recognised universities in Austria and abroad, although at least 4.5 ECTS must be completed in the area of transferable skills; this also includes all courses in the *Seminars* module. If courses from other modules with a higher number of ECTS credits than required for this module are completed, the number of ECTS credits to be completed in the *Free Electives and Transferable Skills* module is reduced by the same amount, although a total of 4.5 ECTS credits from the subject areas of Transferable Skills must be completed in the Master's degree programme.

Diploma thesis (30.0 ECTS)

See section §9.

Brief description of the modules

This section briefly characterises the modules of the Master's degree programme in *Geodesy and Geoinformation.* A detailed description can be found in Appendix A.

Parameter Estimation (6,0 ECTS) The module Parameter Estimation starts from the standard least squares method and delves into problems connected with this method. Main aspects are quality issues, identification of gross errors using robust estimation, and various applications relevant to geodesy and geoinformation. In addition, statistical analysis is extended from the treatment of simple values to spatially distributed phenomena.

Seminars (5,0 ECTS) In the seminars contained in this module, researching existing literature connected to a narrow topic and presenting an overview of the findings to an audience are trained. An additional focus lies on the active and critical listening to and engagement in scientific presentations.

Free electives and transferable skills (9.0 ECTS) The courses in this module serve to deepen the subject and to acquire extracurricular knowledge, skills and competences as well as transferable skills. The courses can be selected from the range offered by all recognised domestic and foreign post-secondary educational institutions.

Applied Geoinformation (8,0 ECTS) The module investigates current methods of data storage, retrieval, and analysis including non-relational databases, distributed systems, and web-based solutions. The focus lies on the selection of suitable tools for a practical problem and the implementation of information systems in form of a prototype.

Applied Cartography (7,5 ECTS) The module Applied Cartography deals with applying cartographic methodology for producing maps and cartographic visualisations in

media-adequate manners. A particular focus lies on the combination of competences of data management, usage of various media and cartographic design skills.

Climate and Environmental Remote Sensing (6,0 - 8,0 ECTS) This module provides insights into the mechanisms and drivers of Earth system variability and change in time and space. In particular, it focuses on how Earth observation can be used to quantify these dynamics, to develop statistical predictive models, and to improve existing process-based models through model-data integration.

Earth Observation (7,5 ECTS) The Earth Observations module involves employing sensors mounted on spaceborne, airborne, and ground-based platforms to gather data about Earth's physical, chemical, and biological systems. Its emphasis lies on utilizing remote sensing and photogrammetric methods to extract geophysical variables from measurements taken across the optical, infrared, and microwave spectrum.

Space Geodesy (9,0 ECTS) This module deals with space geodetic techniques, such as Very Long Baseline Interferometry (VLBI) and the Global Navigation Satellite Systems (GNSS). A particular focus is on the propagation delays of the signals from extragalactic radio sources and satellites in the atmosphere and on VLBI experiments, including technical aspects.

Advanced Engineering Geodesy (9,0 ECTS) This module covers typical sensor systems, measurement procedures and methods related to engineering geodetic monitoring. In addition to the theoretical content, the handling of the sensor systems and the use of dedicated software are demonstrated in practical exercises.

Real Estate and Cadastre (7.5 ECTS) Introduction to legal matters relevant to surveying. The focus is on the Austrian legal situation. General legal terms, the cadastre, the land register, the property database, zoning and development plans and subdivision plans are covered.

Microwave Remote Sensing (6,0 ECTS) This module deals with active and passive microwave remote sensing techniques and their applications. Beginning with the fundamental physical concepts, it explores various measurement principles and the manner in which microwave signals interact with elements in nature, including soil, vegetation, water and ice.

Advanced Photogrammetry (6,0 ECTS) Focus of Advanced Photogrammetry is the attainment of an in-depth understanding of observations and parameter estimation in the context of photogrammetry using cameras and laser scanners. Based on this, solutions for complex photogrammetric tasks are presented and analysed. The knowledge is strengthened and put into practice through exercises.

Law and Economics (5.0 ECTS) The programme covers business and legal principles relevant to the management of a civil engineering office as well as the basics of Austrian construction and planning law.

Gravity Field and Earth Rotation (9,0 ECTS) The gravity field is not spherically symmetric, and the Earth does not rotate around its axis in precisely 24 hours. This

module deals with the theory and observation of the gravity field, the Earth's rotation, and the interaction between these quantities. Global dynamic processes are critical in both aspects.

Statistical Pattern Recognition (6,0 ECTS) The module has three objectives: I) Review and consolidation of basics of statistics and probability theory (both, from frequentist and Bayesian point of view), including distributions, estimation theory and statistical tests. II) Introducing the basics of decision theory and classification. III) Dis- cussing various applications from the above areas, from dimensionality reduction via PCA to the treatment of confounding via regression.

Theoretical Cartography (6,0 - 9,0 ECTS) This module deals with the main paradigms of scientific cartography, the contemporary schools of thoughts and the derived body of knowledge as well as research agenda. A focus is given on applying theoretical knowledge into research orientation.

Geoinformation Theory (8,0 ECTS) The module covers core theories necessary for geoinformation systems, including computational geometry, relational algebra, and va- rious algorithms and their implementation. The focus is on the efficient treatment of space and time, access methods, and solution strategies and their application for spatial problems.

Areal and Kinematic Measurement Methods in Engineering Geodesy (6,0 ECTS) This module covers the basic and advanced concepts of areal and kinematic measurement and analysis methods in a research-oriented approach. Hands-on demonstrations and various own developments are used to illustrate and put the theoretical content into practice.

Geo-Data and Data Processing (6,0 - 9,0 ECTS) Informed use of (geo-)data requires understanding of given tasks, given data, and the competence to formulate and analyse data quality. The courses of this module cover concepts of data quality, statistical computation, processing and visualisation of data using various types of geodata including point clouds and vector data.

Supplementary Mathematics (5.5 - 8.5 ECTS) This module provides an introduction to discrete mathematics and numerical computation.

Supplementary Specialization (4,0 - 10,0 ECTS) Supplementary specialisation, which goes beyond the content of the other selected specialisation modules. Any course explicitly listed in this curriculum which has been completed without completing the module containing it is recognised as a course.

Environment (6.0 - 9.0 ECTS) This module covers the physics of the earth's atmosphere, climate-relevant physical relationships, geodetic methods for recording environmental changes and areas of law relevant to environmental protection.

Environmental Geophysics (6,5 - 9,5 ECTS) Most of the processes that maintain life as we know it happen within the soil, from the growth of plants to the storage of organic carbon and water. Environmental Geophysics provides a palette of methods

that allow us to understand subsurface processes without disrupting them. This module revises these geophysical methods and relevant physical properties, with the particular focus on understanding biogeochemical processes.

Navigation and Space (7.5 - 10.5 ECTS) Navigation is an essential aspect of our life. This module details different techniques for positioning and navigation with a focus on methods using satellites, such as the Global Navigation Satellite Systems (GNSS). The module also includes an introduction to astronomy and an excursion to a space geodetic observatory.

§6 Courses

The subject areas of the modules are taught through courses. The courses of the individual modules are specified in Annex A in the respective module descriptions. Courses are assessed by examinations in accordance with the Universities Act. The types of course assessments are specified in the examination regulations (section §7).

With regard to the possibilities of the Study Commission to add courses to modules for a semester and of the Study Law Body to assign courses individually to elective modules for individual students, reference is made to § 27 of the Study Law Part of the Statutes of TU Wien.

Requirements for courses and examinations from the Universities Act 2002

An electronic list of courses must be published before the start of each semester (title, name of the lecturer, type, form including details of the location and dates of the course). This must be updated on an ongoing basis.

In addition to the published list, course instructors must inform students in an appropriate manner before the start of each semester about the objectives, form, content, dates and methods of their courses as well as about the content, form, methods, dates, assessment criteria and assessment standards of the examinations.

For examinations that are conducted in the form of a single examination procedure, examination dates must be scheduled at least three times in each semester (at the beginning, middle and end according to the statutes), whereby students must be informed of the content, form, methods, dates, assessment criteria and assessment standards of the examinations before the start of each semester.

In the case of examinations by means of electronic communication, the proper conduct of the examination must be ensured, whereby the following minimum requirements must be complied with in addition to the general regulations on examinations:

- Announcement before the start of the semester of the standards that students' technical devices must fulfil in order to take part in these examinations

can.
- Technical or organisational measures must be taken to ensure that the student can complete the examination independently.
- In the event of technical problems that occur through no fault of the student, the examination must be cancelled and does not count towards the permitted number of examination attempts.

Requirements for courses from the statutes of TU Wien

(SSB stands for Statutes of TU Wien, Study Law Provisions)

- The scope of the course must be specified in ECTS credits and semester hours (§ 9 SSB, modules and courses).
- It is possible to hold courses as "block courses" with the approval of the Dean of [illegible] (§ 9 SSB, modules and teaching events).
- Courses and examinations may be held in a foreign language with the approval of the Dean of Studies (Section 11 SSB, Foreign Languages).
- Course examinations serve as proof of the learning outcomes conveyed by an individual course (§ 12 SSB, course examination).
- The course examinations are to be held by the head of the course. If necessary, the body responsible for study law must [illegible] (§ 12 SSB, course examination).
- In any case, for examinations in compulsory and compulsory elective courses that end in a single examination, three examination dates must be set for the beginning, middle and end of each semester. These dates must be announced before the start of the semester (§ 15 SSB, examination dates).
- Examinations may also be held at the beginning and end of course-free periods (§ 15 SSB, examination dates).
- The examination dates must be publicised in an appropriate manner (§ 15 SSB, examination dates).

Description of course types:

VO: Lectures are courses in which the content and methods of a subject are presented with special consideration of its specific questions, concepts and approaches. The examination is carried out with a single examination procedure. The examination procedure for each course (written or oral, or written and oral) must be specified in the module description. Attendance is not compulsory for lectures, but the achievement of the learning outcomes must nevertheless be ensured.

EX: Excursions are courses that take place outside the premises of the TU

take place in Vienna. They serve to deepen teaching content in the respective local context.

LU: Laboratory exercises are courses in which students solve experimental tasks individually or in groups under the guidance of supervisors in order to learn how to use equipment and materials as well as the experimental methodology of the subject. The experimental equipment and workstations are made available.

PR: Projects are courses in which the understanding of sub-areas of a subject is deepened and supplemented by solving specific experimental, numerical, theoretical or artistic tasks. Projects are geared towards the qualification profile of the degree programme and complement the vocational training or scientific education.

SE: Seminars are courses in which students deal with a given topic or project and work on it using scientific methods, whereby reflection on the problem solution and a scientific discourse are required.

Exercises**:** Exercises are courses in which concrete tasks - for example computational, constructive, artistic or experimental - are to be worked on. The students' skills and abilities are developed for application to specific tasks under specialist guidance or supervision.

VU: Lectures with integrated exercises are courses in which the two course types VO and UE are combined in a single course. The respective exercise and lecture component may not be less than a quarter of the total course length. In the case of the course type VU, the exercise part is in any case immanent to the examination, the lecture part can be examined in an examination or immanent to the examination. It is therefore not permitted to examine the exercise part and the lecture part together in a single examination process.

Description of courses and examinations in the information system on study programmes and teaching:

- Type of course (VO, EX, LU, PR, SE, UE, VU)
- Form (face-to-face, online, hybrid, blended)
- Dates (specify the dates and, if applicable, the attendance required for positive completion)
- Contents (description of contents, previous knowledge)
- References
- Learning outcomes (comprehensive description of the learning outcomes)

- Methods (description of methods in coordination with learning outcomes and performance record)
- Proof of performance (in coordination with learning outcomes and methods)
  - Identification of the partial performances, including labelling of which partial performances can be repeated. This point is omitted for type VO.
- Examinations:
  - Contents (description of contents, literature references)
  - Form (presence, online)
  - Exam type or mode
    - Type VO: written or oral, or written and oral;
    - for all other types: Identification of partial achievements including type and mode in relation to the learning outcomes aimed for in the course.
  - Dates (specify the dates)
  - Assessment criteria and assessment standards

§7 Examination regulations

The positive completion of the Master's programme requires:

1. positive completion of the modules prescribed in the curriculum, whereby a module is deemed to have been successfully completed if the courses assigned to it in accordance with the module description have been successfully completed,

2. the writing of a positively assessed diploma thesis and

3. the positive completion of the final examination. This takes place orally before an examination senate in accordance with § 13 and § 19 of the *study regulations of the statutes of the Vienna University of Technology* and serves to present and defend the diploma thesis and to demonstrate mastery of the scientific environment. Particular attention must be paid to understanding and overview knowledge. The registration requirements for the final board examination according to § 17 (1) of the *study regulations of the statutes of the Vienna University of Technology* are fulfilled if points 1 and 2 have been met.

The final certificate includes

(a) the examination subjects with their respective scope in ECTS credits and their grades,

(b) the topic and grade of the thesis,

(c) the grade of the final examination,

(d) the overall assessment and

(e) at the student's request, the overall grade of the completed degree programme in accordance with
§72a UG.

The grade of the examination subject "Diploma thesis" is calculated from the grade of the diploma thesis. The grade of each other examination subject is calculated by averaging the grades of those courses that are assigned to the examination subject via the modules contained therein, whereby the grades are weighted with the ECTS scope of the courses. If the fractional part is less than or equal to 0.5, it is rounded down, otherwise it is rounded up. If none of the examination subjects were graded worse than "good" and at least half were graded "very good", the *overall assessment is* "passed with distinction" and otherwise "passed".

Courses of the type VO (lecture) are assessed on the basis of a final oral and/or written examination. All other courses have an immanent examination character, i.e. assessment is carried out on an ongoing basis by means of an accompanying performance review and optionally by means of an additional final partial examination.

In addition, comprehensive examinations for courses with an immanent examination character can be offered in order to increase the studyability, whereby these must be held as an examination date for a lecture and § 15 (6) of the *study law part of the statutes of the Vienna University of Technology* is not applicable here.

The positive success of examinations and scientific and artistic work is to be assessed as "very good" (1), "good" (2), "satisfactory" (3) or "sufficient" (4), the negative success is to be assessed as "not sufficient" (5). Courses that cannot be assessed in the above form are graded as "successfully completed" (E) or "unsuccessfully completed" (O).

§8 Studiability and mobility

Students on the Master's degree programme in *Geodesy and Geoinformation* should be able to complete their studies with reasonable effort in the time allotted.

Students are recommended to complete their studies according to the semester recommendation in Appendix C. Students who begin their studies in the summer semester are recommended to complete their studies according to the semester recommendation in Appendix D.

Recognition of academic achievements completed abroad is carried out by the competent study law body. The options listed in § 27 para. 1 to 3 of the *Study Law Provisions* of the Statutes of the Vienna University of Technology are available to facilitate mobility. In individual cases, these provisions can also be used to improve the ability to study.

The number of places available in courses with limited resources is determined by the course director and announced in advance.

The course director is authorised to allow exceptions to the attendance restriction for his/her course.

§9 Diploma thesis

The diploma thesis is an artistic-scientific piece of work that serves to demonstrate the ability to work independently on a topic in terms of content and methodology. The topic of the thesis can be freely chosen by the student and must be in line with the qualification profile.

The *diploma thesis* subject comprises 30 ECTS credits and consists of the academic paper (diploma thesis), which is assessed with 27 ECTS credits, and the final examination with a board of 3 ECTS credits.

The thesis can be written in German or English. In particular, diploma theses dealing with engineering consultancy topics can be written in German.

§10 Academic degree

Graduates of the Master's degree programme in *Geodesy and Geoinformation are* awarded the academic degree "Diplom-Ingenieur"/"Diplom-Ingenieurin" - abbreviated to "Dipl.-Ing." or "Dipl.-Ing.".
"DI" (internationally comparable to "Master of Science").

§11 Quality management

The quality management of the Master's degree programme in *Geodesy and Geoinformation* ensures that the programme is designed consistently with regard to the study-related quality objectives of TU Wien and is carried out efficiently and effectively and reviewed regularly. The quality management of the degree programme is carried out in accordance with the Plan-Do-Check-Act model using standardised processes and is designed with the target group in mind. The target groups of quality management are the students and teaching staff within the university as well as society, the economy and the administration, including the labour market for graduates.

In view of the defined target groups, six objectives are defined for the quality of studies at TU Wien: (1) With regard to the quality and topicality of the curriculum, the relevance of the qualification profile for society and the labour market is guaranteed. With regard to the quality of the content implementation of the curriculum, (2) the learning outcomes in the modules of the curriculum are suitably designed to implement the qualification profile, (3) the learning activities and methods are suitably selected to achieve the learning outcomes, and (4) the performance records are suitable for verifying the achievement of the learning outcomes. (5) With regard to the

The framework conditions are in place to ensure the academic feasibility of the curricula. (6) With regard to teachability, teaching staff have the professional and time resources to ensure high-quality teaching.

To ensure the quality of the studies, progress in planning, development and assurance of all six quality objectives is recorded and published separately. Quality assurance reviews the achievement of the six quality objectives. In order to measure the first and second quality objectives, the study commission reviews the qualification profile and module descriptions at least once per term of office. In order to review quality objectives two to five, the ongoing evaluation by students, as well as individual feedback on the operation of the programme to the Academic Board, provides a continuous overall picture of the implementation of the curriculum. The ongoing review also serves to identify critical courses, for which suitable adjustment measures are derived and implemented in coordination between the academic law body, the study commission and course instructors. The sixth quality objective is covered by quality assurance instruments in the personnel area. In addition to internal quality assurance, an external evaluation of the degree programmes is carried out every seven years.

§12 Entry into force

This curriculum comes into force on 1 October 2024.

§13 Transitional provisions

The transitional provisions can be found in Annex B.

A Module descriptions

The courses assigned to the modules are listed in the following form:
9.9/9.9 XX Title of the course
The first number denotes the number of ECTS credits and the second the number of semester hours. ECTS points are a measure of the workload of the students, whereby one academic year comprises 60 ECTS points and one ECTS point corresponds to 25 hours of 60 minutes each. One semester hour corresponds to as many teaching units as the semester comprises teaching weeks. A teaching unit lasts 45 minutes. The type of course (XX) is explained in detail in §6 under *Course types* on page 11.

Parameter Estimation

Standard workload: 6.0 ECTS

Learning outcomes:

Professional and methodological competences: After completing this module, students will be able to explain the principles of parameter estimation with the least squares method, statistics, and datum determination, discuss quality concepts, and apply the methods to problems in geodesy. Furthermore, they will be able to reproduce the principles of robust estimation methods, describe concepts such as auto/cross-correlation, collocation, and regression and explain objectives and methods of geostatistics.

Cognitive and practical competences: After completing the course, students will be able to recognise and analyse problems of parameter estimation, independently set up and solve adjustment tasks, and independently carry out statistical tests.

Contents:

- Assessment of the quality of measurements and results
- Treatment of singular problems (geodetic datum)
- Robust estimation methods
- Parameter estimation in geometric and geodetic tasks
- Spatial statistics and time series

Expected prior knowledge:

Professional and methodological competences: Students can describe the mathematical principles of geodesy and reproduce statistical principles (including least squares method).

Mandatory requirements: None.

Forms of teaching and learning used and appropriate performance assessment:

The forms of teaching and learning used must be specified in the information system for studies and teaching for each course before the start of the semester, as must the examination modalities.

Courses of the module:
3.0/2.0 VO Parameter Estimation
3.0/2.0 UE Parameter Estimation

Seminars

Standard workload: 5.0 ECTS

Learning outcomes:

Professional and methodological competences: After completing this module, students are able to present in-depth knowledge on a given seminar topic.

Cognitive and practical competences: After completing the course, students will be able to find specialised literature on a given topic, recognise differences between methods or results proposed in the literature and compile different methods or results.

Social competences and self-competences: Students can present a scientific paper, respond to critical questions and argue in this regard, listen critically and discuss actively and demonstrate an understanding of their own discipline in a social context.

Contents:

- Selection of topics
- Presentation
- Where possible, invited lectures by external experts on technical, economic, legal and socio-political topics
- Discussion

Expected prior knowledge:

Professional and methodological competences: Students can describe the mathematical principles of geodesy.

Cognitive and practical competences: Students are able to use presentation software.

Social competences and self-competences: Students demonstrate curiosity and a willingness to deal with non-subject-specific but relevant topics.

Mandatory requirements: None.

Forms of teaching and learning used and appropriate performance assessment:

The forms of teaching and learning used must be specified in the information system for studies and teaching for each course before the start of the semester, as must the examination modalities.

Courses of the module: From the courses *Seminar in Geodesy, Engineering Geodesy and Geophysics*, *Seminar in Photogrammetry and Remote Sensing* and *Seminar in Geoinformation and Cartography* only ONE seminar has to be completed.
2,0/1,0 SE Seminar in Geodesy, Engineering Geodesy and Geophysics

2,0/1,0 SE Seminar in Photogrammetry and Remote Sensing
2,0/1,0 SE Seminar in Geoinformation and Cartography
3,0/2,0 SE Seminar in Geosciences

Free electives and transferable skills

Standard workload: 9.0 ECTS

Learning outcomes: The courses of this module serve to deepen the subject and to acquire non-subject-specific knowledge, skills and competences.

Content: Depending on the selected courses.

Expected prior knowledge: Depending on the chosen courses.

Mandatory prerequisites: Depending on the chosen courses.

Forms of teaching and learning used and appropriate performance assessment:
The forms of teaching and learning used must be specified in the information system for studies and teaching for each course before the start of the semester, as must the examination modalities.

Courses of the module: The courses of this module can be freely selected from the range of scientific and artistic courses offered by all recognised domestic and foreign post-secondary educational institutions, which serve to deepen the subject or to acquire extracurricular knowledge, skills and competences, with the restriction that at least 4.5 ECTS must be selected from the subject areas of transferable skills; this also includes all courses in the *Seminars* module. For the subject areas of transferable skills, courses from the central elective subject catalogue of TU Wien for "Transferable Skills" are particularly recommended.

If courses from other modules with a higher number of ECTS credits than required for this module are completed, the number of ECTS credits to be completed in the module *Free Electives and Transferable Skills* is reduced by the same amount, although a total of 4.5 ECTS credits from the subject areas of Transferable Skills must be completed in the Master's degree programme.

Applied Geoinformation

Standard workload: 8.0 ECTS

Learning outcomes:

Professional and methodological competences: After completing this module, students will be able to implement complex geoinformation applications using state-of-the-art methods and discuss and test new approaches (e.g. spatial databases).

Cognitive and practical competences: After completing the courses, students will be capable of analysing applications in a practical setting, designing solutions using appropriate technology, and crafting reports and presentations.

Social competences and self-competences: The students can solve practical problems and work in teams

Contents:

- Recognising the requirements of a potential user of spatial information
- Converting the requirements into a technical solution
- Characteristics of GIS software
- Comparison of commercial and open source software
- Data sources: Administration, open access, web practice and legal issues
- WebGIS solutions: Structure, components, limitations
- Mobile and distributed applications - Database and communication requirements
- "New" database structuring (non-relational)
- Replication as a solution for distributed, not always connected applications
- Application development for autonomous mobile applications

Expected prior knowledge:

Technical and methodological competences: The students have basic GIS knowledge.

Cognitive and practical competences: The students have a basic knowledge of WebGIS.

Mandatory prerequisites: None.

Forms of teaching and learning used and appropriate performance assessment:

The forms of teaching and learning used must be specified in the information system for studies and teaching for each course before the start of the semester, as must the examination modalities.

Courses of the module:

1,0/1,0 VO Implementation of a GIS
3,0/2,0 UE Implementation of a GIS
1,0/1,0 VO Mobile GIS
3.0/2.0 UE Mobile GIS

Applied Cartography

Standard workload: 7.5 ECTS

Learning outcomes:

Technical and methodological competences: The courses of this module are held in English. The students learn to know the principles of extending cartographic communication pro- cesses into different media. They understand the concepts, constraints and requirements of location-based services. They can implement and program components of cartographic information systems, especially in the domain of LBS.

Contents:

- Concepts and components of Location Based Services
- Positioning techniques for indoor and outdoor positioning
- Data modelling for LBS
- Architecture of LBS
- Cartography on small display devices
- Application scenario navigation and wayfinding
- Extending cartographic communication processes into different media
- Cross media publishing
- Programming methods and tools for cartographic purposes

Expected prior knowledge:

Professional and methodological competences: The students know the foundations of topo- graphic and thematic cartography and web publishing.

Mandatory requirements: None.

Forms of teaching and learning used and appropriate performance assessment:

The forms of teaching and learning used must be specified in the information system for studies and teaching for each course before the start of the semester, as must the examination modalities.

Courses of the module:

4.5/3.0 VU Location-based Services
3,0/2,0 VU Programming Cartographic Tasks

Climate and Environmental Remote Sensing

Standard workload: 6.0 - 8.0 ECTS

Learning outcomes:

Professional and methodological competences: After completion of the module, the students know the main properties and processes of weather and the climate system. They under- stand the main global drivers of climate change at various temporal and spatial scales. Students are able to select and apply appropriate remote sensing techniques and datasets to observe climate and environmental change. They have a basic understanding of Earth system modelling and methods to improve such models by integrating Earth observations.

Cognitive and practical competences: After completion, the students are able to understand and disentangle complex, non-linear interactions in the Earth system and find creative solutions based on Earth observations, Earth system modelling, and model-data integration to quantify change. The students are able to use Python to process and analyse global Earth observation datasets and for basic Earth system modelling.

Social competences and self-competences: The students can work both independently and in teams to solve problems, implement processing chains, create reports, and communicate results.

Contents:

- Principles of meteorology and climatology
- Earth system dynamics across scales
- Earth observation and Earth system modelling, as well as their uncertainties, for studying climate and environmental variability and change
- Theory and applications of stochastic and process-based Earth system modelling, with a focus and hydrological, land surface, and climate models
- Model-data-integration to improve Earth system modelling

Expected prior knowledge:

Technical and methodological competences: The students have good programming skills in Python and bring working knowledge in mathematics, physics, and informatics to the lectures. Knowledge of remote sensing theory is required. Acquaintance with microwave remote sensing and pattern recognition methods is of advantage.

Cognitive and practical competences: The students are able to find creative solutions to processing tasks, data exploration and analysis. Students are able to present and critically discuss results in front of an audience.

Social skills and self-competences: The students are able to work in teams and manage work according to schedule.

Mandatory requirements: None.

Forms of teaching and learning used and appropriate performance assessment:

The forms of teaching and learning used must be specified in the information system for studies and teaching for each course before the start of the semester, as must the examination modalities.

Courses of the module: Courses totalling at least 6.0 ECTS must be selected from the following list:

3,0/2,0 VU Climate and Environmental Remote Sensing
2,0/1,5 VO Introduction to Meteorology and Climatology
3,0/2,0 VU Model-Data Integration in Earth System Science

Earth Observation

Standard workload: 7.5 ECTS

Learning outcomes:

Professional and methodological competences: The students are able to select and apply photogrammetric and remote sensing techniques for observing the Earth. They can work with multi-spectral imaging, lidar and radar data for the monitoring of environmental processes and urban areas.

Cognitive and practical competences: Based on the requirements of the intended application students shall be able to select the best earth observation technology and

processing methods. They have the practical know-how for processing airborne laser scanner data, multi-spectral imagery, and microwave measurements.

Social competences and self-competences: The students can work in teams in order to solve problems, implement processing chains and create reports.

Contents:

- Overview of earth observation techniques and applications
- Application of imaging and laser scanning technology for vegetation studies and urban modelling
- Parameter retrieval in earth observation
- Monitoring of dynamic hydrologic processes

Expected prior knowledge:

Technical and methodological competences: The students bring working knowledge in mathematics, physics and informatics to the lectures. Acquaintance with remote sensing theory microwave remote sensing and pattern recognition methods is of advantage.

Cognitive and practical competences: The students have computer skills.

Social competences and self-competences: The students are able to solve tasks according to schedule, find creative solutions to SAR processing task, data exploration and analysis and present results.

Mandatory requirements: None.

Forms of teaching and learning used and appropriate performance assessment:

The forms of teaching and learning used must be specified in the information system for studies and teaching for each course before the start of the semester, as must the examination modalities.

Courses of the module:

1,5/1,0 VU Introduction to Earth Observation
3,0/2,0 VU Applied Earth Observation
3,0/2,0 VU Data Retrieval in Earth Observation

Space Geodesy

Standard workload: 9.0 ECTS

Learning outcomes:

Professional and methodological competences: Students are able to describe space geodetic techniques from a theoretical and practical point of view and their application in astronomy, geodynamics, or weather forecasting. They understand the different physical and geometric methods used in space geodesy.

Cognitive and practical competences: Students are able to address tasks in space geodesy, as required in professional and scientific activities. They understand the concept of reference frames and their application in positioning and navigation.

Social competences and self-competences: Students have competences in planning, coordination, and project management.

Contents:

- Theory and practice of modern space geodetic techniques (VLBI, Satellite and Lunar Laser Ranging, GNSS, DORIS, satellite altimetry, space gravity missions)
- Treatment of other methods based on the observation of extraterrestrial objects
- Global terrestrial and celestial reference frames
- Atmospheric effects on space geodetic observations
- Assimilation of tropospheric delays in numerical weather model
- Carrying out all steps required for geodetic Very Long Baseline Interferometry

Expected prior knowledge: Basic knowledge in Higher Geodesy.

Mandatory requirements: None.

Forms of teaching and learning used and appropriate performance assessment:
The forms of teaching and learning used must be specified in the information system for studies and teaching for each course before the start of the semester, as must the examination modalities.

Courses of the module:
3,0/2,0 VO Modern Space Geodetic Techniques
3,0/2,0 VU Very Long Baseline Interferometry
1,5/1,0 VO Atmospheric Effects in Space Geodesy
1,5/1,0 UE Atmospheric Effects in Space Geodesy

Advanced Engineering Geodesy

Standard workload: 9.0 ECTS

Learning outcomes:

Professional and methodological competences: After completing this module, students will be able to describe and handle sensors, sensor systems and data processing methods of advanced engineering geodesy within the framework of taught content and to create interfaces between engineering geodesy and neighbouring disciplines like civil engineering and mechanical engineering.

Cognitive and practical competences: After completing the module, students will be able to independently plan and carry out challenging metrological tasks in the field of engineering geodesy, design and implement specialised engineering geodetic sensor systems and acquire independently knowledge based on specialised scientific literature.

Social competences and self-competences: Students will be able to lead interdisciplinary teams in carrying out challenging metrological tasks.

Contents:

- Static and dynamic properties of sensors
- Principle, design and properties of sensors and sensor systems for structural monitoring (Strain gauges, Inclinometers, Pendulum measuring systems)
- Principle and measurement methods of geodetic gyroscopes
- Engineering geodesy for tunnel construction and monitoring
- Theory of deformation analysis and monitoring of structures as well as of natural objects (Models of deformation analysis)
- Introduction to technical mechanics
- Practical identification, localisation and modelling of deformations in a geodetic network
- Hands-on practical measurements with above mentioned sensors and sensor systems

Expected prior knowledge: The following prior knowledge can be acquired as part of a bachelor study programme in the field of Geodesy and Geoinformation as well as in the module *Parameter Estimation*.

Professional and methodological competences: Students will be able to describe and handle parameter estimation and quality control in linear models of quasi-static networks. They are familiar with the fundamentals of statistics and of engineering geodesy. They can handle the instruments and explain methods of applied geodesy.

Cognitive and practical competences: Students are able to handle basic geodetic metrology equipment, write technical reports and carry out simple technical work in the field of applied geodesy.

Social competences and self-competences: Students are able to work in a group.

Mandatory requirements: None.

Forms of teaching and learning used and appropriate performance assessment:

The forms of teaching and learning used must be specified in the information system for studies and teaching for each course before the start of the semester, as must the examination modalities.

Courses of the module:

4,5/3,0 VO Advanced Engineering Geodesy
1,5/1,0 UE Advanced Engineering Geodesy
3,0/2,0 LU Measuring Exercise on Engineering Geodetic Metrology

Property and cadastre

Standard workload: 7.5 ECTS

Learning outcomes:

Professional and methodological competences: After completing this module, students will be able to understand property law, in particular real estate law, rights to real estate and their publicity, legal transactions involving real estate and their publicity.

Understand and reproduce the processing and technical aspects of legal transactions.

Cognitive and practical competences: After completing the course, students are able to convey the relevant provisions of federal and provincial laws for drawing up subdivision plans for building land, including practical application examples.

Social skills and self-competences: Students master the basic principles of team leadership in a civil engineering office.

Contents:

- General legal concepts, basic principles of property law, rights in rem, special forms of ownership, acquisition and loss of rights in rem, legal protection, property restrictions, neighbouring rights, land register, changes in the property portfolio (divisions, unification), division restrictions, boundary cadastre, basic principles of administrative procedure
- Historical development of the cadastre, responsibilities and competences in the cadastre in Austria, the tasks and role of the BEV
- Procedures and processes in the cadastre taking into account the land register, the fixed point field, development of the cadastral map, structure and management of the property database
- Zoning plan according to Wr. building regulations and N.Ö. Spatial Planning Act: Procedure, content of a development plan
- Building regulations: content, authorised use, building ban, amendment, announcement of building regulations
- Subdivision plan according to Wr. and N.Ö. Building regulations: requirements, assessment, cession of land, building prohibitions, expiry of subdivision authorisation, boundary adjustment, expropriation, neighbouring property, compensation, structural usability of building plots

Expected prior knowledge:

Specialist and methodological competences: Students have knowledge of the rules and procedures involved in the drafting of zoning plans, building regulations and subdivision plans.

Cognitive and practical competences: Students can create division plans.

Mandatory requirements: None.

Teaching and learning methods used and appropriate assessment: The courses in this module are held in German.

The forms of teaching and learning used must be specified in the information system for studies and teaching for each course before the start of the semester, as must the examination modalities.

Courses of the module:

3,0/2,0 VO Real estate law

1.5/1.0 VO Cadastre specialisation
3.0/2.0 UE Cadastre specialisation

Microwave Remote Sensing

Standard workload: 6.0 ECTS

Learning outcomes:

Professional and methodological competences: The students are able to describe the physical fundamentals of microwave remote sensing. They can explain and discuss the working principles of active (altimeters, scatterometers, SAR) and passive microwave sensors, along with the physical mechanisms for scattering and emission of microwaves by the Earth s surface.

Cognitive and practical competences: After completing the module, students are able to demonstrate the theoretical understanding of measurement principles and application areas and have experience of processing SAR data and create reports about this data.

Social competences and self-competences: The students can work in teams in order to solve complex SAR processing tasks.

Contents:

- Electromagnetic waves
- Sources and detection of microwaves
- Microwave sensors
- Dielectric properties of natural media
- Physical mechanisms of scattering
- Physical mechanisms of emission
- SAR interferometry
- SAR processing, classification, and interpretation

Expected prior knowledge:

Technical and methodological competences: The students bring working knowledge in mathematics, physics and informatics to the lectures. Acquaintance with remote sensing theory is of advantage.

Cognitive and practical competences: The students have computer skills.

Social competences and self-competences: The students are able to solve tasks according to schedule, find creative solutions to SAR processing task, data exploration and analysis.

Mandatory requirements: None.

Forms of teaching and learning used and appropriate performance assessment:

The forms of teaching and learning used must be specified in the information system for studies and teaching for each course before the start of the semester, as must the examination modalities.

Courses of the module:
3,0/2,0 VO Microwave Remote Sensing
3,0/2,0 UE Microwave Remote Sensing

Advanced Photogrammetry

Standard workload: 6.0 ECTS

Learning outcomes:

Professional and methodological competences: Students are able to explain the mathematical and geometrical foundations of photogrammetry and laser scanning in the context of ob- servation models, parameter estimation, and geo-referencing of hybrid observations. For images, they can further explain the computation of image orientation, shape parameters and point locations as well as the respective accuracies.

Cognitive and practical competences: The students are able to extract geometric information from images and laser scanning data. They can describe, analyse and evaluate quality measures of estimated parameters to make a statement about data quality based on adjustment theory.

Social skills and self-competence: Work in small teams.

Contents:

- Collinearity equation and bundle block adjustment
- Methods of projective geometry
- Modelling of observations
- Handling of random, systematic, and gross errors
- Interpretation of adjustment results in the photogrammetric context
- Methods for automating bundle block adjustment of unorganised photo sets
- Adjustment of laser scanning strips

Expected prior knowledge:

Professional and methodological competences: Students bring working knowledge in linear algebra, parameter estimation, adjustment calculus, modelling of cameras, and methods for the orientation of photos.

Cognitive and practical competences: Students can operate command line programs and work with scripting languages. They possess a trained spatial ability.

Mandatory requirements: None.

Forms of teaching and learning used and appropriate performance assessment:

The forms of teaching and learning used must be specified in the information system for studies and teaching for each course before the start of the semester, as must the examination modalities.

Courses of the module: 3,0/2,0 VO
Advanced Photogrammetry 3,0/2,0 UE
Advanced Photogrammetry

Law and economics

Standard workload: 5.0 ECTS

Learning outcomes:

Professional and methodological competences: After completing this module, students are able to reproduce and explain the rules that must be observed when running a business, especially a civil engineering office in Austria, as well as knowledge of construction and planning law.

Cognitive and practical competences: After completing the courses, students are able to analyse economic issues and solve questions that arise in the management of a civil engineering office, in particular the assessment of planning problems brought in by clients.

Social skills and self-competences: Students master the basic principles of team leadership in a civil engineering office.

Contents:

- Legal framework for civil engineers in Austria: specialisations, training requirements, access regulations
- Business forms of professional practice: sole proprietorship, company formations
- Outline of business administration: cameralistics, tariffs, fees, levies, standards, office organisation, parameters of a ZT office, relevant parts of labour law
- Basics of building law and Austrian building and planning law at a glance, distribution of competences, delimitation, approval procedures and substantive building law, legal protection
- Basic principles of planning law: objectives and measures of supra-local and municipal spatial planning
- Interactions between building and planning regulations

Expected prior knowledge:

Specialist and methodological skills: Students have a basic knowledge of constitutional and administrative law, business administration and cadastre. Knowledge of property law is an advantage.

Mandatory requirements: None.

Teaching and learning methods used and appropriate assessment: The courses in this module are held in German.

The forms of teaching and learning used must be specified in the information system for studies and teaching for each course before the start of the semester, as must the examination modalities.

Courses of the module:

3,0/2,0 VO Management of a Civil Engineering Office 2,0/2,0 VO Building and Planning Law

Gravity Field and Earth Rotation

Standard workload: 9.0 ECTS

Learning outcomes:

Professional and methodological competences: Students are able to describe the observations and the mathematical representation of the Earth gravity field. They can explain the influence of the Earth gravity field on geodetic techniques, and they have theoretical and practical knowledge in Earth rotation and its determination.

Cognitive and practical competences: Students are able to use real and simulated data to apply and extend their knowledge in Earth gravity field and rotation.

Social competences and self-competences: Students are able to work through the lecture material and present the results.

Contents:

- Theory of Earth rotation
- Changes in length of day, polar motion, and nutation
- Observation of Earth rotation
- Tidal effects on Earth rotation and interactions in system Earth
- Basics in potential theory and theory of Earth gravity field
- Global and local geoid determination
- Gravity space missions

Expected prior knowledge:

Professional and methodological competences: Students have basic knowledge in physics (me- chanics), mathematics and higher geodesy

Cognitive and practical competences: Students have a good spatial imagination.

Mandatory requirements: None.

Forms of teaching and learning used and appropriate performance assessment:

The forms of teaching and learning used must be specified in the information system for studies and teaching for each course before the start of the semester, as must the examination modalities.

Courses of the module:

3,0/2,0 VO The Gravity Field of the Earth
1,5/1,0 UE Global Gravity Field Models
3,0/2,0 VO Earth Rotation and Global Dynamic Processes
1,5/1,0 UE Earth Rotation and Global Dynamic Processes

Statistical Pattern Recognition

Standard workload: 6.0 ECTS

Learning outcomes:

Professional and methodological competences: After completing this module, students are able to explain the theoretical statistical fundamentals as well as the methods used to assess classification results. They can provide an overview of the most important methods of statistical pattern recognition.

Cognitive and practical competences: After completing the course, students are able to select suitable statistical pattern recognition methods for a given problem and implement classifications.

Contents:

- Elementaryclassifiers
- Basics of parameter estimation
- Bayes theorem
- Feature extraction

Expected prior knowledge:

Professional and methodological competences: Students know the basics of statistics (inclu- ding normal distribution, measures of a distribution) and of linear algebra.

Cognitive and practical skills: Students are able to programme.

Mandatory requirements: None.

Forms of teaching and learning used and appropriate performance assessment:

The forms of teaching and learning used must be specified in the information system for studies and teaching for each course before the start of the semester, as must the examination modalities.

Courses of the module:

3,0/2,0 VO Statistical Pattern Recognition
3,0/2,0 UE Statistical Pattern Recognition

Theoretical Cartography

Standard workload: 6.0 - 9.0 ECTS

Learning outcomes:

Professional and methodological competences: The students are able to describe the major theories and methods of scientific cartography. They can understand cartographic mode- ling methodology in the domain of generalization, visualisation and interactivity. They can describe the principles of cartographic data handling in the context of interactive systems and interoperability.

Contents:

- Current topics of cartographic research
- Cartographic modelling incl. generalisation
- GeoVisualisation
- Cartographic data handling incl. interoperability
- Maps as interfaces
- Maps as metaphors
- Methods and techniques of interactivity with cartographic data

Mandatory requirements: None.

Forms of teaching and learning used and appropriate performance assessment:
The forms of teaching and learning used must be specified in the information system for studies and teaching for each course before the start of the semester, as must the examination modalities.

Courses of the module: Lectures in the amount of at least 6,0 ECTS have to be chosen from the list below:
3,0/2,0 VO Theoretical Cartography
3,0/2,0 VU Cartographic Interfaces
3,0/2,0 VU Cartographic Information Systems

Geoinformation Theory

Standard workload: 8.0 ECTS

Learning outcomes:
Professional and methodological competences: After completing this module, students will be able to explain the theoretical foundations of geoinformation processing and mathematical-formal methods of spatial information computing. They will acquire knowledge of state-of-the-art approaches for the efficient processing of spatial data, access mechanisms and the basics of computational geometry.
Cognitive and practical competences: After completing the courses, students will be able to establish the relationship between mathematical theories and application programming.

Contents:

- Vector algebra for calculating coordinates
- Projective geometry for the determination of intersections between lines and the management of surface partitions
- Simplices and simplicial complexes for the representation of geometric figures
- Relational algebra for data storage
- Functions for handling time-variable facts
- Spatial access mechanisms, developed from general methods of search algorithms
- Principles of computational geometry
- Basic methods: Divide and conquer, incremental and plane sweep

Expected prior knowledge:

Cognitive and practical competences: The students can implement geometric tasks in a command line programme.

Mandatory requirements: None.

Forms of teaching and learning used and appropriate performance assessment:

The forms of teaching and learning used must be specified in the information system for studies and teaching for each course before the start of the semester, as must the examination modalities.

Courses of the module:

4.0/3.0 VU Advanced GIS
4,0/3,0 VU Geometrical Algorithms for GIS

Areal and Kinematic Measurement Methods in Engineering Geodesy

Standard workload: 6.0 ECTS

Learning outcomes:

Technical and methodological competences: After completing this module, students will be able to report on current research and developments in the field of engineering geodesy.

Cognitive and practical competences: Students will be able to plan and also carry out an engineering geodesy research and development project, critically assess given requirements or framework conditions, draw up proposals for appropriate adaptation and present and discuss their own and others' work.

Social skills and self-competences: Students can manage a research and development project, recognise and solve critical situations in an R&D project. They have an awareness of costs and quality and can also complete projects under pressure.

Contents:

- Principles, design and properties of sensors and sensor systems for industrial metrology and for the areal capturing of geometry (Laser tracking, Terrestrial and close-range laser scanning)
- Advanced methods for processing areal data (Estimation of regular geometry and free-forms)
- Design and implementation of state estimation methods for trajectory estimation (Kalman filter)
- External control of geodetic sensors and sensor systems for their implementation in kinematic applications
- Control of unmanned ground vehicles (UGV)
- Presentation and critical discussion of the results

Expected prior knowledge:

Professional and methodological competences: Students will have in-depth knowledge of the methods and sensors used in engineering geodesy.

Cognitive and practical skills: Students are able to plan and carry out challen- ging technical tasks, acquire knowledge independently using specialised literature and write technical reports. They can solve problems with the help of scripting programming language.

Social skills and self-competences: Students can self-organise in teams and carry out challenging technical tasks in the field of engineering geodesy.

Mandatory requirements: None.

Forms of teaching and learning used and appropriate performance assessment:

The forms of teaching and learning used must be specified in the information system for studies and teaching for each course before the start of the semester, as must the examination modalities.

Courses of the module:

3,0/2,0 VU Geometric Shape Determination in Engineering Geodesy
3,0/2,0 VU Selected Topics of Engineering Geodesy

Geo-Data and Data Processing

Standard workload: 6.0 - 9.0 ECTS

Learning outcomes:

Professional and methodological competences: Students are able to explain quality parameters and standards of geo-data. They can further describe and apply methods to process, analyse and visualize geo-data of varying size, scope and complexity, including point cloud data

Cognitive and practical competences: Students have a broad overview of common data standards and processing workflows of geo-data. They are able to choose suitable software and methods to visualise data of various size and complexity and its quality measures. They can apply statistical and point cloud processing software to analyse large data sets. The students can assess the quality of data and reason on the fitness for specified applications based on quality measures.

Contents:

- Quality parameters
- Quality standards
- Description of point clouds, feature extraction
- Segmentation and classification of point clouds
- Graphical data visualisation
- Regression

Expected prior knowledge:

Professional and methodological competences: Students are familiar with the basics of statis- tics, linear algebra, and geo-coordinate systems.

Cognitive and practical competences: Students know how to handle geo-data.

Mandatory requirements: None.

Forms of teaching and learning used and appropriate performance assessment:

The forms of teaching and learning used must be specified in the information system for studies and teaching for each course before the start of the semester, as must the examination modalities.

Courses of the module: Courses totalling at least 6.0 ECTS must be selected from the following list:

3.0/2.0 VO Data quality
3,0/2,0 VU Point Cloud Processing
3,0/2,0 VU Statistical Computing

Supplementary Mathematics

Standard workload: 5.5 - 8.5 ECTS

Learning outcomes:

Specialist and methodological competences: After completing this module, students are able to explain special and advanced mathematics and reproduce in-depth knowledge. They can solve typical numerical problems, from theoretical to practice-oriented ones.

Cognitive and practical competences: Students are able to use alternative calculation methods. They understand the usual forms of calculation used in geodesy. They can independently handle small projects (partly on the computer).

Social competences and self-competences: Students can provide alternative solutions.

Contents:

- Graph theory and elements of topology
- Introduction to numerics: Error analysis - model errors, procedural errors, rounding errors, condition number (sensitivity of the solution to changes in input information)
- Linear systems of equations, linear fitting, non-linear systems of equations
- Interpolation, best approximation
- Numerical quadrature - Newton-Cotes formulas, Gaussian quadrature
- Numerical solution of ordinary differential equations

Expected prior knowledge:

Technical and methodological competences: Students have a basic knowledge of mathematics.

Mandatory requirements: None.

Forms of teaching and learning used and appropriate performance assessment:
The forms of teaching and learning used must be specified in the information system for studies and teaching for each course before the start of the semester, as must the examination modalities.

Courses of the module:
3,0/2,0 VU Discrete Mathematics for Computer
Science 5,5/4,0 VU Numerical Computation
The course 5,5/4,0 VU *Numerical Computation* is mandatory.

Supplementary Specialisation

Standard workload: 4.0 - 10.0 ECTS

Learning outcomes: Every explicitly listed course in this curriculum that has been additionally completed is recognised as a course.

Content: Depending on the selected courses.

Expected prior knowledge: Depending on the chosen courses.

Mandatory prerequisites: Depending on the chosen courses.

Forms of teaching and learning used and appropriate performance assessment:
The forms of teaching and learning used must be specified in the information system for studies and teaching for each course before the start of the semester, as must the examination modalities.

Courses of the module: Any explicitly listed course in this curriculum that was additionally completed, i.e. was not otherwise used for the degree programme, is recognised as a course. It is not necessary to include complete modules. In addition, courses that were completed as part of a period of study abroad (e.g. in the ERASMUS programme), for which there are no equivalences in the curriculum, but which represent a specialisation of the degree programme, can be included. Courses totalling at least 4.0 ECTS credits, but no more than 10.0 ECTS credits, must be selected.

Environment

Standard workload: 6.0 - 9.0 ECTS

Learning outcomes:
Professional and methodological competences: After completing this module, students are able to develop and explain an understanding of interdisciplinary problems in the environmental field, e.g. climate change, atmospheric processes and interdependencies between real environmental protection and the legal system. They can

report on current international and European developments and their impact in Austria.

Cognitive and practical competences: Students are able to combine subject-specific knowledge and recognise creative solutions for interdisciplinary problems at the interface between technologies, law and applications.

Social competences and self-competences: Students can contribute to discussions and recognise the advantages and disadvantages of different problem-solving approaches.

Contents:

- Earth observation and GIS for recording environmental changes
- Global environmental issues, incl. climate and greenhouse gas effect
- Structure and dynamics of the earth's atmosphere and climate-relevant physical relationships
- Fundamentals and instruments of environmental protection law
- Treatment of individual areas of law, general environmental law, climate protection under the Kyoto Protocol, commercial law, waste law, water law, forest law, mining law, regional planning law, construction law, nature conservation law, EU environmental law and international environmental law.

Expected prior knowledge:

Specialist and methodological skills: Students have basic knowledge of physics, geodesy, geoinformation and earth observation.

Cognitive and practical competences: Students are able to think in a problem-orientated and structured way in order to solve environmental issues.

Social competences and self-competences: Students are interested in environmental issues.

Mandatory requirements: None.

Teaching and learning methods used and appropriate assessment: Some of the courses in this module are held in German.

The forms of teaching and learning used must be specified in the information system for studies and teaching for each course before the start of the semester, as must the examination modalities.

Courses of the module: Courses totalling at least 6.0 ECTS must be selected from the following list:

3,0/2,0 VU Global Change Monitoring
3,0/2,0 VO Physics of the Atmosphere
3,0/2,0 VO Legal issues of environmental protection

Environmental Geophysics

Standard workload: 6.5 - 9.5 ECTS

Learning outcomes:

Professional and methodological competences: After finishing this module, the students are able to design geophysical surveys and analyse geophysical signatures to address envi- ronmental processes.

Cognitive and practical competences: The students are able to understand the physical principles of different geophysical methods and their application to characterise environmental processes. The module comprises numerical and field exercises to develop the skills necessary to design geophysical surveys and the interpretation of results.

Social competences and self-competences: The students work in teams to provide solutions to different environmental questions using geophysical methods. Through presentations, the students learn how to present geophysical results to an audience with different background and other geoscientists.

Contents:

- Understanding the mechanistic models explaining geophysical signatures associated to hydrogeological processes
- Data collection of field measurements
- Processing and analysis of field and numerical data
- Modelling and inversion of geophysical imaging data sets
- Use of petrophysical models for the quantitative interpretation of geophysical re- sults
- Integration of geophysical results into environmental and engineering studies

Expected prior knowledge:

Technical and methodological competences: The students require a good understanding of basic concepts in Physics, Mathematics. Experience with the scripting in Python is helpful to complete this module successfully.

Cognitive and practical competences: The students are interested in understanding the link between physical properties and environmental processes.

Social competences and self-competences: The students are interested in environmen- tal and Earth-science topics.

Mandatory requirements: None.

Forms of teaching and learning used and appropriate performance assessment:

The forms of teaching and learning used must be specified in the information system for studies and teaching for each course before the start of the semester, as must the examination modalities.

Courses of the module: Courses totalling at least 6.5 ECTS must be selected from the following list:

3,0/2,0 VU Seismic Methods in Near-Surface Geophysics
2,0/2,0 UE Geophysical Data Processing
3,0/2,0 VO Exploration with Electric and Electromagnetic Methods
1,5/1,0 VO Biogeophysics and Environmental Geophysics

Navigation and Space

Standard workload: 7.5 - 10.5 ECTS

Learning outcomes:

Professional and methodological competences: Students are able to describe methods and techniques of global and local navigation. They can evaluate and use products of GNSS- services including the Galileo system of the European Union. The students understand the basics of the solar system with the planets as well as the basics of galaxies and cosmology.

Social skills and self-competences: Students are able to analyse, assess and explain current research.

Contents:

- Space geodetic sites
- Inertial sensors and multi-sensor systems
- Overview of static point positioning with satellite techniques
- GNSS reference station networks and regional satellite navigation services
- Global GNSS services (IGS, EUREF)
- Basics in astronomy

Expected prior knowledge:

Professional and methodological competences: Presentations and performace assessment with oral exams and presentations. Visit of a space geodetic station.

Mandatory requirements: None.

Forms of teaching and learning used and appropriate performance assessment:

The forms of teaching and learning used must be specified in the information system for studies and teaching for each course before the start of the semester, as must the examination modalities.

Courses of the module: Courses totalling at least 7.5 ECTS must be selected from the following list.
3.0/2.0 VO Astronomy
3.0/2.0 VO Navigation
3,0/2,0 VO Satellite Navigation Systems and
Services 1,5/1,0 EX Excursion Space Geodesy

B Transitional provisions

1. Unless otherwise stated, the term "degree programme" in the following refers to the *Master's degree programme in Geodesy and Geoinformation (study code UE 066 421).* The term new curriculum refers to the curriculum valid from 1 October 2024 for this degree programme at the Vienna University of Technology and old curriculum refers to the curriculum valid until then. Accordingly, new or old courses are understood to be those of the new or old curriculum (old also includes previous curricula). The body responsible for study law refers to the body responsible for study law for the Master's degree programme in Geodesy and Geoinformation at the Vienna University of Technology.

2. The transitional provisions apply to students who submit their degree in accordance with the new curriculum at the Vienna University of Technology and who were admitted to the Master's degree programme in Geodesy and Geoinformation at the Vienna University of Technology before 1 July 2024. The extent to which the transitional provisions are used is at the discretion of these students.

3. At the student's request, the body responsible for study law may individually modify the transitional provisions or extend them to students not covered by paragraph 2.

4. Certificates for courses that are equivalent in terms of content cannot be submitted simultaneously for the degree programme. In case of doubt, the degree programme authority decides on equivalence.

5. Certificates for old courses can, unless otherwise specified below, be used for graduation if the course was completed by the student in the summer semester 2024 or earlier.

6. Students who have completed the course "3.0/2.0 VO Introduction to Potential Theory" can continue to use the module "Gravity Field and Earth Rotation" to the extent of 12 ECTS credits for their degree.

7. Final examinations of the courses are held in the language of the course. Deviations from this are permitted after timely consultation with the examiners. In accordance with the study regulations of the statutes of the Vienna University of Technology, the achievement of the educational objectives and not the level of language proficiency is the yardstick for assessment.

   In the following, each course (*old* or *new*) is described by its scope in ECTS credits (first number) and semester hours (second number), its type and its title. It is the ECTS scope of the course actually completed that counts.

The courses on the left-hand side of the following table refer to the old courses. The right-hand side shows the combinations of courses for which the (combinations of) old courses can be used. (Combinations of) courses that are listed under the same point in the equivalence lists are considered equivalent.

Old	New
1,5/1,0 VO Introduction to Earth Observation	1,5/1,0 VU Introduction to Earth Observation
1.5/1.0 UE Theory and observation of the earth's gravitational field	1.5/1.0 UE Global gravity field models
4,5/3,0 VU Introduction to Numerics	5.5/4.0 VU Numerical Computation
3,0/2,0 VO Seismic Exploration	3,0/2,0 VU Seismic Methods of near-surface geophysics
3,0/2,0 VO Equalisation Calculation Vertie- function	3.0/2.0 VO Parameter Estimation
3,0/2,0 UE Equalisation Calculation Vertie- function	3.0/2.0 UE Parameter Estimation
2,0/1,0 SE Seminar for Geodesy, Engineering geodesy and geophysics	2,0/1,0 SE Seminar in Geodesy, Engineering Geodesy and Geophysics
2.0/1.0 SE Seminar for Photograms- and remote sensing	2,0/1,0 SE Seminar in Photogrammetry and Remote Sensing
2,0/1,0 SE Seminar for Geoinformation and cartography	2.0/1.0 SE Seminar in Geoinformation and Cartography
3,0/2,0 SE Seminar of Geosciences partnerships	3,0/2,0 SE Seminar in Geosciences
1,0/1,0 VO Implementation of a GIS	1,0/1,0 VO Implementation of a GIS
3,0/2,0 UE Implementation of a GIS	3,0/2,0 UE Implementation of a GIS
3,0/2,0 VO Modern geodetic world geodesy spatial procedure	3,0/2,0 VO Modern Space Geodetic Techniques
4,5/3,0 VO Engineering geodesy deepening function	4,5/3,0 VO Advanced Engineering Geodesy
1.5/1.0 UE Engineering geodesy specialisation function	1.5/1.0 UE Advanced Engineering Geodesy
3,0/2,0 PR Engineering Geodesy Measuring practice tic	3,0/2,0 LU Measuring Exercise on Engineering Geodetic Metrology
3,0/2,0 VO Photogrammetry Deepening function	3,0/2,0 VO Advanced Photogrammetry
3,0/2,0 UE Photogrammetry Deepening function	3.0/2.0 UE Advanced Photogrammetry

3,0/2,0 VO Theory and observation of the earth's gravitational field	3,0/2,0 VO The Gravity Field of the Earth

Old	New
1.5/1.0 UE Global gravity field models	1.5/1.0 UE Global Gravity Field Models
3,0/2,0 VO Earth rotation and global dynamic processes	3,0/2,0 VO Earth Rotation and Global Dynamic Processes
1.5/1.0 UE Earth rotation and global dynamic processes	1.5/1.0 UE Earth Rotation and Global Dynamic Processes
3.0/2.0 VO Statistical modelling ning	3,0/2,0 VO Statistical Pattern Recognition tion
3.0/2.0 UE Statistical modelling ning	3.0/2.0 UE Statistical Pattern Recognition tion
4,0/3,0 VU Geometric Algorithms for GIS	4,0/3,0 VU Geometrical Algorithms for GIS
3,0/2,0 VU Geometric Shape Determination mation in engineering geodesy	3,0/2,0 VU Determination of Geometric Shape in Engineering Geodesy
3,0/2,0 VU Selected chapters of the Inengineering geodesy	3,0/2,0 VU Selected Topics of Engineering Geodesy
3.0/2.0 VO Data quality	3.0/2.0 VO Data quality
3,0/2,0 VU Discrete Mathematics for Informatting	3,0/2,0 VU Discrete Mathematics for Computer Science
3,0/2,0 VU Seismic Methods of near-surface geophysics	3,0/2,0 VU Seismic Methods in Near-Surface Geophysics
2.0/2.0 UE Evaluation of geophysical data cal data	2,0/2,0 UE Geophysical Data Processes- sing
3,0/2,0 VO Exploration with electric motors and electromagnetic procedures	3,0/2,0 VO Exploration with Electric and Electromagnetic Methods
1.5/1.0 VO Biogeophysics	1,5/1,0 VO Biogeophysics and Environmental Geophysics
3.0/2.0 VO Satellite navigation services te	3,0/2,0 VO Satellite Navigation Systems and Services
1,5/1,0 EX Excursion Space Geodesy them	1.5/1.0 EX Excursion Space Geodesy

C Semester organisation of the courses

Some courses are listed in several of the first three semesters. Students should create a semester plan that is favourable for them from the respective semester offerings, whereby the courses not listed here, which are to be completed as part of the modules in the examination subject *Broadening in Subjects of Geodesy and Geoinformation* and the compulsory module *Free Electives and Transferable Skills,* should also be taken into account.

Students are advised to select courses in such a way that they can be studied in the respective semesters.

1. Semester (WS) **30 ECTS**

3,0 VO Parameter Estimation

3,0 UE Parameter Estimation

One of the following three seminars:

2,0 SE Seminar in Geodesy, Engineering Geodesy and Geophysics

2,0 SE Seminar in Photogrammetry and Remote Sensing

2,0 SE Seminar in Geoinformation and Cartography

3,0 VO Management of a civil engineering office 3,0 VO Modern Space Geodetic Techniques 3,0 VU Very Long Baseline Interferometry

1,5 VO Atmospheric Effects in Space Geodesy 1,5 UE Atmospheric Effects in Space Geodesy 1,5 VU Introduction to Earth Observation

3,0 VO Microwave Remote Sensing

3,0 UE Microwave Remote Sensing

3,0 VO Statistical Pattern Recognition

3,0 UE Statistical Pattern Recognition

4,0 VU Advanced GIS

3,0 VU Discrete Mathematics for Computer Science

3,0 VU Point Cloud Processing

3,0 VO Data

quality 3,0 VO

Astronomy

3.0 VO Navigation

3,0 VO Exploration with Electric and Electromagnetic Methods

2,0 UE Geophysical Data Processing

3,0 VU Global Change Monitoring

3,0 VO Physics of the Atmosphere

2. Semester (SS) **30 ECTS**

One of the following three seminars:

2,0 SE Seminar in Geodesy, Engineering Geodesy and Geophysics

2,0 SE Seminar in Photogrammetry and Remote Sensing

2,0 SE Seminar in Geoinformation and Cartography

3,0 SE Seminar in Geosciences

4.5 VO Advanced Engineering Geodesy

1.5 UE Advanced Engineering Geodesy

3,0 LU Measuring Exercise on Engineering Geodetic Metrology

2,0 VO Building and Planning Law

3,0 VO The Gravity Field of the Earth

1,5 UE Global Gravity Field Models

3,0 VU Applied Earth Observation

3,0 VU Data Retrieval in Earth Observation

3,0 VO Advanced Photogrammetry

3.0 UE Advanced Photogrammetry

4,0 VU Geometrical Algorithms for GIS

3,0 VO Theoretical Cartography

3,0 VU Cartographic Interfaces

3,0 VU Cartographic Information

Systems 4,5 VU Location-based Services

3,0 VU Programming Cartographic Tasks

5,5 VU Numerical Computation

3,0 VU Statistical Computing

3,0 VU Geometric Shape Determination in Engineering Geodesy

3,0 VO Satellite Navigation Systems and Services
1,5 EX Excursion Space Geodesy
3,0 VU Seismic Methods in Near-Surface Geophysics
1,5 VO Biogeophysics and Environmental Geophysics
3,0 VO Legal Issues in Environmental Protection
3,0 VU Climate and Environmental Remote Sensing
2,0 VO Introduction to Meteorology and Climatology

3. Semester (WS) **30 ECTS**

3,0 SE Seminar in Geosciences One

of the following three seminars:
2,0 SE Seminar in Geodesy, Engineering Geodesy and Geophysics
2,0 SE Seminar in Photogrammetry and Remote Sensing
2,0 SE Seminar in Geoinformation and Cartography

3,0 VO Management of a civil engineering office
3,0 VO Earth Rotation and Global Dynamic Processes
1,5 UE Earth Rotation and Global Dynamic Processes
1,0 VO Implementation of a GIS
3,0 UE Implementation of a GIS
1,0 VO Mobile GIS
3.0 UE Mobile GIS
3.0 VO Real estate law 1.5
VO Cadastre specialisation
3.0 UE Cadastre
specialisation
3,0 VU Discrete Mathematics for Computer Science
3,0 VU Point Cloud Processing
3,0 VO Data quality
3,0 VU Selected Topics of Engineering Geodesy
3,0 VO Astronomy
3.0 VO Navigation
3,0 VU Global Change Monitoring
3,0 VO Physics of the Atmosphere
3,0 VU Model-Data Integration in Earth System Science

4. Semester (SS)	**30 ECTS**
Diploma thesis	27.0 ECTS
Final examination by commission	3.0 ECTS

D Semester recommendation for students entering at an angle

Students who start their studies in the summer semester may have disadvantages in terms of the duration of their studies. It is advisable to attend courses at the beginning of the degree programme for which no major comprehension problems are to be expected if qualifications acquired in previous courses are missing; for example, courses from the module *Free Electives and Transferable Skills are* recommended.

E Recommendations for students who wish to pursue a career as an engineering consultant for surveying in Austria

According to the Civil Engineers Act (1993, as of 1.2013) § 4(2)b, "the engineering consultants for surveying are authorised to draw up partition plans for the cadastral and land register division of properties and site plans for the land register depreciation of entire properties, to determine boundaries according to the status of the cadastral map or on the basis of deeds, including marking and drawing up plans for the announcement of alignment lines". This requires not only the appropriate technical and professional training, but also mastery of the necessary legal principles. Successful completion of the civil engineer examination is a prerequisite for a career as an ENGINEERING consultant. The required areas of knowledge are listed in § 9(3) and (4) of the Civil Engineers Act.

As the current curriculum allows students a great deal of freedom in the development of their specialisation, the Federal Chamber of Architects and Engineering Consultants has compiled recommendations for those interested in a career as a surveying engineer in order to be prepared for the civil engineering examination during their studies. You should therefore cover as many of the required areas as possible through elective modules and courses as part of your degree programme, if necessary within the scope of free choice. Some suggestions are listed below:

Field of knowledge for civil engineer examination	Assignment in the curriculum
Earth's gravitational field	corresponding courses in the Elective module *Gravity Field and Earth Rotation*
Property and cadastre	Basics in the Bachelor's programme *Geodesy and Geoinformation* through the compulsory module *Law and Science*, in this Master's programme through elective modules *Property and cadastre*
Constitutional and administrative law	Basics in the Bachelor's programme *Geodesy and Geoinformation* through the compulsory module *Law and Science*
Building and planning law	Elective module *Law and Economics*
Business administration	Elective module *Law and Economics*

Completion of the elective module Property and Cadastre is required for admission to the civil engineering examination.

Only encyclopaedically covered by this curriculum, but important for obtaining the civil engineer licence, is knowledge of property valuation, applied engineering, the use of the

administrative law for technicians, basic principles of land register law, spatial planning, basic principles of road/track/tunnelling construction, systematics of Austrian building law, standards and public procurement. It is therefore recommended to complete as much as possible through suitable courses as part of the *Free Electives and Transferable Skills* module offered by TU Wien or other universities.

F Examination subjects with the assigned compulsory modules and courses

Examination subject "In-depth Study of Fundamentals" (11.0 ECTS)

Parameter Estimation" module (6.0 ECTS)

3.0/2.0 VO Parameter Estimation
3.0/2.0 UE Parameter Estimation

Seminars" module (5.0 ECTS)

2,0/1,0 SE Seminar in Geodesy, Engineering Geodesy and Geophysics
2,0/1,0 SE Seminar in Photogrammetry and Remote Sensing
2,0/1,0 SE Seminar in Geoinformation and Cartography
3,0/2,0 SE Seminar in Geosciences

Examination subject "Specialisation in Subjects of Geodesy and Geoinformation" (45.0-55.0 ECTS)

Module "Applied Geoinformation" (8.0 ECTS)

1,0/1,0 VO Implementation of a GIS
3,0/2,0 UE Implementation of a GIS
1,0/1,0 VO Mobile GIS
3.0/2.0 UE Mobile GIS

Module "Applied Cartography" (7.5 ECTS)

4.5/3.0 VU Location-based Services
3,0/2,0 VU Programming Cartographic Tasks

Module "Earth Observation" (7.5 ECTS)

1.5/1.0 VU Introduction to Earth Observation
3.0/2.0 VU Applied Earth Observation
3,0/2,0 VU Data Retrieval in Earth Observation

Module "Climate and Environmental Remote Sensing" (6.0 - 8.0 ECTS)

3,0/2,0 VU Climate and Environmental Remote Sensing
2,0/1,5 VO Introduction to Meteorology and Climatology
3,0/2,0 VU Model-Data Integration in Earth System Science

Module "Space Geodesy" (9.0 ECTS)

3,0/2,0 VO Modern Space Geodetic Techniques
3,0/2,0 VU Very Long Baseline Interferometry
1,5/1,0 VO Atmospheric Effects in Space Geodesy
1,5/1,0 UE Atmospheric Effects in Space Geodesy

Module "Advanced Engineering Geodesy" (9.0 ECTS)

4,5/3,0 VO Advanced Engineering Geodesy
1,5/1,0 UE Advanced Engineering Geodesy
3,0/2,0 LU Measuring Exercise on Engineering Geodetic Metrology

Module "Property and Cadastre" (7.5 ECTS)

3.0/2.0 VO Real Estate Law 1.5/1.0
VO Cadastre Specialisation 3.0/2.0
UE Cadastre Specialisation

Module "Microwave Remote Sensing" (6.0 ECTS)

3,0/2,0 VO Microwave Remote Sensing
3,0/2,0 UE Microwave Remote Sensing

Module "Advanced Photogrammetry" (6.0 ECTS)

3,0/2,0 VO Advanced Photogrammetry
3,0/2,0 UE Advanced Photogrammetry

Module "Law and Economics" (5.0 ECTS)

3.0/2.0 VO Management of a Civil Engineering
Office 2.0/2.0 VO Construction and Planning
Law

Module "Gravity Field and Earth Rotation" (9.0 ECTS)

3,0/2,0 VO The Gravity Field of the Earth
1,5/1,0 UE Global Gravity Field Models
3,0/2,0 VO Earth Rotation and Global Dynamic Processes
1,5/1,0 UE Earth Rotation and Global Dynamic Processes

Module "Statistical Pattern Recognition" (6.0 ECTS)

3,0/2,0 VO Statistical Pattern Recognition
3,0/2,0 UE Statistical Pattern Recognition

Module "Theoretical Cartography" (6.0 - 9.0 ECTS)

3,0/2,0 VO Theoretical Cartography
3,0/2,0 VU Cartographic Interfaces
3,0/2,0 VU Cartographic Information Systems

Module "Geoinformation Theory" (8.0 ECTS)

4.0/3.0 VU Advanced GIS
4,0/3,0 VU Geometrical Algorithms for GIS

Examination subject "Broadening in Subjects of Geodesy and Geoinformation " (15.0-25.0 ECTS)

Module "Areal and Kinematic Measurement Methods in Engineering Geodesy" (6.0 ECTS)

3,0/2,0 VU Geometric Shape Determination in Engineering Geodesy
3,0/2,0 VU Selected Topics of Engineering Geodesy

Module "Geo-Data and Data Processing" (6.0 - 9.0 ECTS)

3.0/2.0 VO Data quality
3,0/2,0 VU Point Cloud Processing
3,0/2,0 VU Statistical Computing

Module "Supplementary Mathematics" (5.5 - 8.5 ECTS)

3.0/2.0 VU Discrete Mathematics for Computer Science
5.5/4.0 VU Numerical Computation

Supplementary Specialisation" module (4.0 - 10.0 ECTS)

Module "Environment" (6.0 - 9.0 ECTS)

3.0/2.0 VU Global Change Monitoring 3.0/2.0 VO Physics of the Atmosphere
3,0/2,0 VO Legal issues of environmental protection

Module "Environmental Geophysics" (6.5 - 9.5 ECTS)

3.0/2.0 VU Seismic Methods in Near-Surface Geophysics
2.0/2.0 UE Geophysical Data Processing
3,0/2,0 VO Exploration with Electric and Electromagnetic Methods
1,5/1,0 VO Biogeophysics and Environmental Geophysics

Navigation and Space" module (7.5 - 10.5 ECTS)

3.0/2.0 VO Astronomy
3.0/2.0 VO Navigation
3,0/2,0 VO Satellite Navigation Systems and Services 1,5/1,0 EX Excursion Space Geodesy

Examination subject "Free electives and transferable skills" (9.0 ECTS)

Module "Free Electives and Transferable Skills" (9.0 ECTS)

Examination subject "Diploma thesis" (30.0 ECTS)

27.0 ECTS Diploma thesis
3.0 ECTS Commissioned final examination