Geodesy and Geoinformatics

Study plan for third-cycle subject

The subject plan was approved by Fakultetsnämnden (Faculty Board) November 30, 2010. Valid from Spring 11.

Subject title
Geodesy and Geoinformatics (Geodesi och Geoinformatik)

Subject description and programme outcomes

Scientific field
In geodesy and geoinformatics, spatial information is collected and analyzed. The third-cycle subject has two specialisations; geodesy and geoinformatics.

Geodesy (from the Greek geodaisia, division of land) is one of the oldest natural sciences. Geodesy studies spatial relationships on and near the Earth’s surface for mapping, urban planning, engineering design and other scientific studies, as well as the Earth’s gravity field and its shape, including the so-called geoid. Geodesy utilizes many different methods of measurement, calculation and visualization, based on mathematical, statistical and physical theories. Satellite-based methods such as GPS and satellite gravimetry are becoming increasingly important.

Geoinformatics is the science and technology for acquisition, management, analysis and presentation of geospatial data and information about objects, phenomena and processes on and around the Earth, such natural and built environment, their current state and undergoing changes. Geoinformatics includes remote sensing, cartography and GIS.

Description of possible specialisation
1. Common for all specialisations
2. Geodesy
3. Geoinformatics

Specification of how the programme outcomes are to be achieved
The goals of the education are achieved through courses according to the individual study plan, seminar participation, participation in national and international conferences as well as through supervision.

Common for all specialisations

Description of the specialisation
The information given is common information for all specialisations.

Current research
See each specialisation.
Programme structure

Doctoral studies consist of coursework and a thesis/dissertation part. Coursework may be in the form of lectures, literature studies and problem-solving, as well as active participation in seminars and conferences. Courses can be studied within the department or in collaboration with other Swedish or foreign research institutions.

Doctoral studies are conducted under the direction of a main supervisor, along with at least one assistant supervisor, according to the individual study plan. Students’ individual study plans will be adapted to their prior knowledge and to the contents of the dissertation/thesis. Doctoral students’ progress will be assessed at least once a year in connection with the review of the individual study plan and this will be carried out by the student and the main supervisor. The study plan is ratified by the Director of Third Cycle Education.

A licentiate degree may be taken as part of a doctor’s degree. Courses and dissertation work included in the licentiate degree may also be credited for a doctor’s degree.

A licentiate degree consists of coursework of 45-60 ECTS and a dissertation of 60-75 ECTS, totalling 120 ECTS. A doctor’s degree consists of coursework of 75 ECTS (Geodesy) / 60 ECTS (Geoinformatics) and a thesis of 165 ECTS (Geodesy), 180 ECTS (Geoinformatics), totaling 240 ECTS.

Seminars and conferences

The programme includes active participation in research seminars at the department, during which students regularly submit their own texts. Students must also participate in national and international conferences and research networks within the relevant fields.

Compulsory and recommended courses

Courses will be studied in accordance with the agreement made between the student and the main supervisor in the individual study plan.

Doctoral students who teach at first or second cycle must have completed initial university teacher training.

The programme has two specialisations: geodesy and geoinformatics. Course work for a doctor’s degree comprises of 75 ECTS for the geodesy specialisation and 60 ECTS for the geoinformatics specialisation. Courses within the chosen area of specialisation must amount to at least 37.5 ECTS. Coursework for a licentiate degree comprises 45 ECTS for both specialisations.

Percentage of courses that can be taken at the first cycle and second cycle is regulated by KTH's local policy.

Compulsory courses (7.5 credits each) for the Geodesy specialisation is Theory of Science and Research Method, FAG5129 Theory of Errors and FAG5130 Satellite-based Positioning.

Compulsory courses for the Geoinformatics specialisation is Theory of Science and Research Method, 1E5520 Visualization of Geoinformation and 1E5510 Knowledge-based Remote Sensing.

Thesis

Dissertation/thesis work is an obligatory part of doctoral studies. This part of the programme aims at the student developing the ability to make independent contributions to research and a capacity for scientific cooperation, within and outside their own subject. The dissertation/thesis shall contain new research results that the student has developed, alone or in cooperation with others. The main scientific results should meet the quality requirements for publication in internationally recognized journals with peer review. A doctoral student’s contribution to a dissertation/thesis text that has multiple authors must be distinguishable.

Dissertations and theses must be written in English. They can be either a monograph or a collection of scientific articles, together with a special written summary. A doctoral thesis is normally based on the licentiate thesis.
**Geodesy**

**Description of the specialisation**

Geodesy (from the Greek geodaisia, division of land) is one of the oldest natural sciences. Geodesy studies spatial relationships on and near the Earth's surface for mapping, urban planning, engineering design and other scientific studies, as well as the Earth's gravity field and its shape, including the so-called geoid. Geodesy utilizes many different methods of measurement, calculation and visualization, based on mathematical, statistical and physical theories. Satellite-based methods such as GPS and satellite gravimetry are becoming increasingly important.

**Current research**

The subject of geodesy is in itself quite wide, and this is reflected in the research conducted in the Division of Geodesy and Satellite Positioning.

Current research is in geoid modeling, modeling of the Earth's mass structure, satellite gravimetry, sea level change, movement of tectonic plains, design of networks for deformation surveillance and/or detection, methods for coordinate transformations, GNSS-based positioning and navigation, multi-GNSS, atmospheric effects on GNSS satellite signals, laser scanning, measurement science, theory of errors, and the integration of GNSS and terrestrial surveying technologies.

**Programme structure**

*See Common for all specialisations.*

**Compulsory and recommended courses**

The coursework includes 75 ECTS, of which courses within the chosen area of specialisation must amount to at least 37.5 ECTS. A licentiate degree has a course component of 45 ECTS.

The compulsory courses for the doctoral degree adds up to 22.5 ECTS.

The licentiate degree requires the course Theory of Science and Research Method, as well as one other compulsory course for the specialisation.

The optional courses should primarily be selected among the courses listed as recommended, according to the list below. Furthermore, it is desirable that at least one course from the specialisation Geoinformatics is included in the training.

**Compulsory courses**

- AG5129 Theory of Errors 7.5 hp.
- 1N5113 Theory of Science and Research Method, Technological and Natural Sciences 7.5 hp.
- AG5130 Satellite Based Positioning 7.5 hp.

**Recommended courses**

- AG5131 Inertial Navigation and Kalman Filtering 7.5 hp.
- AG5128 Advanced Topics in Geodesy 15.0 hp.
- AG5123 Atmospheric Effects on GNSS Signals 7.5 hp.
- 1E5007 Physical Geodesy 7.5 hp.
- AG5124 Net Optimization and Deformation Monitoring 7.5 hp.
- AG5127 Satellite Gravimetry 7.5 hp.
- AG5126 Advanced Theory of Errors 7.5 hp.
- 1E5008 Physical Geodesy, Advanced Course 15.0 hp.
- AG5125 Geodynamics 7.5 hp.
Thesis
See Common for all specialisations.

Geoinformatics

Description of the specialisation
Geoinformatics is the science and technology for acquisition, management, analysis and presentation of geospatial data and information about objects, phenomena and processes on and around the Earth, such natural and built environment, their current state and undergoing changes. Geoinformatics includes remote sensing, cartography and GIS.

Current research
For current research, please refer to the website https://www.kth.se/en/abe/inst/som/avdelningar/gis/research-1.585264

Programme structure
See Common for all specialisations.

Compulsory and recommended courses
The coursework for doctoral studies comprises of 60 ECTS and the coursework for a licentiate degree comprises of 45 ECTS.

For a doctoral degree, the compulsory courses comprising of 22.5 ECTS as described below, are required.

For the licentiate degree the requirements are; Theory of Science and Research Method, as well as one of the other obligatory courses for specialisation.

The optional courses should primarily be selected among the courses listed as recommended, according to the list below. Furthermore, it is desirable that at least one course from the specialisation Geodesy is included in the training.

Literature is ratified by the supervisor in consultation with the student. Literature in the dissertation/thesis area can be partially or completely replaced by literature in geoinformatics that contributes to the student’s general orientation and methodological expertise.

Compulsory in-depth courses
- 1E5520 Visualization of Geoinformation 7.5 hp.
- 1E5510 Knowledge-based Methods in Remote Sensing 7.5 hp.

Compulsory research proficiency courses
- 1N5113 Theory of Science and Research Method, Technological and Natural Sciences 7.5 hp.

Recommended courses
- AG3101 Seminar on Geographic Information Science 7.5 hp.
- AG3100 Seminar on Advanced Remote Sensing 7.5 hp.

Recommended in-depth courses
- AG3103 Network Analysis 7.5 hp.
- AG3104 Spatial Data Mining 7.5 hp.
- AG2426 Mobile GIS 7.5 hp. Second-cycle course
- AG2415 Web-GIS 7.5 hp. Second-cycle course
- 1E5580 Spatial Analysis 7.5 hp.
- AG5130 Satellite Based Positioning 7.5 hp.
- AG3102 Computational Methods and Algorithms in GIS 7.5 hp.
- 1E5570 Active Remote Sensing Systems 7.5 hp.
• AG2425 Spatial Databases 7.5 hp. Second-cycle course

Thesis

*See Common for all specialisations.*

Entry requirements and selection

General and special admission requirements and prior knowledge

The KTH general eligibility requirements for admission to doctoral studies apply.

Doctoral students are expected to read and write scientific English and speak English fluently.

Selection rules and procedures

Admission to studies at the doctoral level is decided by the Dean after preparation by the programme council of the doctoral programme of geodesy and geoinformatics and the proposed main supervisor.

In addition, selection assesses the degree of maturity and capacity for independent judgement and critical analysis, as well as written scientific presentation, which forms the basis of the admissions decision and the selection of applicants. Of great significance in this assessment are previous study results in advanced courses at undergraduate level and independently conducted scientific studies. Selection of applicants for doctoral studies is carried out by the programme board in connection with admission.

The programme’s degrees and examinations

Degree of Licentiate and Degree of Doctor (PhD)

A licentiate degree consists of coursework of 45-60 ECTS and a dissertation of 60-75 ECTS, totalling 120 ECTS. A doctor’s degree consists of coursework of 75 ECTS (Geodesy) / 60 ECTS (Geoinformatics) and a thesis of 165 ECTS (Geodesy), 180 ECTS (Geoinformatics), giving a total of 240 ECTS.

The programme’s examinations

Doctoral courses include examinations, which may be written or oral. Examinations shall be designed so that examiners can be satisfied that the student has assimilated the full course content.