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Translation of Curriculum Statement for Graduate Level (Third-level) Education

Scientific Computing

Scientific Computing with specialization in Numerical Analysis

Swedish title: Beräkningsvetenskap; Beräkningsvetenskap med inriktning mot numerisk analys

TNBEVE00 (Scientific Computing)

TNBEVE01 (Scientific Computing with specialization in Numerical Analysis)

Swedish Curriculum adopted by the Board of the Faculty of Science and Technology (Board for Third-level Education) on 2008-07-02. Translation approved on 2010-08-10.

The Curriculum Statement for Third-level Education consists of three parts: a general part, this subject specialized curriculum statement, and each doctoral student's individual study plan.

Objective

In relation to the first- and second-level education in the subject area, the graduate level education shall give additional insight into the central parts of the area and expert knowledge in at least one subarea. Supervision and thesis work shall prepare the doctoral student for critical and independent research activities or other professional activities with high demands for subject area expert knowledge and research competence.

The doctoral student shall also be able to present her/his own goals and results orally and in writing to different target groups in English and, in the case of Swedish-speaking doctoral students, in Swedish.

Subject description

Scientific Computing concerns the study of methods required for advanced computer-based computations. This includes Numerical Analysis, i.e., development and analysis of numerical methods for efficient computation of solutions to problems expressed as



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mathematical models. In addition, Scientific Computing includes the study of algorithms and software techniques that are required for efficient implementation of numerical methods on high-performance computers. Focus is on development of methods, but there is a close interaction with applications. The subject area of Scientific Computing is interdisciplinary with interfaces to Mathematics, Computer Science, and application areas, primarily within Science and Technology. The graduate education also includes the option to study the subject area from an education research point of view. The doctoral degree will be labeled “Scientific Computing”. Alternatively, doctoral students who specialize in development and analysis of numerical methods can choose to have the doctoral degree labeled “Scientific Computing with specialization in Numerical Analysis”

Eligibility

Basic Eligibility

The basic eligibility for third level education is described in the general part of the curriculum statement.

Special Eligibility

A person has special eligibility for a third level program in Scientific Computing if she/he has passed examinations in courses of relevance for Scientific Computing, corresponding to a minimum of 90 credits.

Admission

Applicants for third level program in Scientific Computing must submit an application to the head of the Department of Information Technology. Admissions to places in third level programs take place normally twice per year.

In connection with the admission it must be stated how it is planned to finance both the personal maintenance of the doctoral student, and her/his research.

Program structure

In connection with the admission, each doctoral student and her/his supervisor shall draw up an individual study plan after consultation with the professor in charge of the third level program. The plan is to be approved by the head of the department (by delegation of the Faculty Board), in connection with the admission.



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The individual study plan shall be reviewed jointly by the doctoral student and her/his supervisor, annually, and be provided with a summary of the achieved results and the plans for the coming year. Significant changes and any disagreement on the individual study plan shall be reported to the head of the department or, if deemed necessary, to the Board for Third-level Education.

Courses

Within the third level program there may be different kinds of courses, such as lectures, literature studies, practical training, field studies, etc. The courses are intended to provide wider insight into the subject as a complement to the specialist competence acquired in the research work. For examples of courses in Scientific Computing that can be included in the third-level education, see the web site <http://www.it.uu.se/>.

It is presumed that all courses taken by doctoral students are third-level courses. Some first- and second-level courses of importance for the third-level education in Scientific Computing can be included in the doctoral degree, after approval by the supervisor. Such approval should be applied very restrictively. It must not relate to courses that the student had taken prior to being accepted to the third-level program and that were a partial basis for the decision to accept the student.

The range of courses offered is revised continuously. The individual study plan shall be in accordance with the following guidelines:

- *Outlook*: The individual curriculum must include such courses that give a sufficiently broad overview of numerical methods for problems in linear algebra, ordinary differential equations, and partial differential equations. Moreover, the individual curriculum must include parts of Scientific Computing that intersect with Computer Science, in particular algorithms and programming techniques for high-performance computers. In addition, it is recommended to include some course in an application area within, e.g., science or engineering. This part of the education should normally encompass ca. 50 credits.
- *Specialization*: The curriculum shall provide specialization in aspects of Scientific Computing of particular relevance for the doctoral student's research. This part of the education shall encompass at least 20 credits.
- *Other perspectives*: An additional objective for the curriculum is to provide non subject-specific perspectives on research. To this



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end, the curriculum should include at least philosophy of science and research ethics. Normally, the university's basic university teacher training course should also be included. In addition, the curriculum can for example include courses that give complementing knowledge in Mathematics and Computer Science as well as courses providing a preparation for a career in industry.

- *Independence*: Some of the credits taken by the doctoral student must be for independent literature studies that have not been supported by organized, course-like education.

For doctoral students who wish to get the doctoral degree label "Scientific Computing with specialization in Numerical Analysis", the curriculum must include at least 50 credits of courses in Numerical Analysis. For doctoral students with an education research profile, the curriculum must include ca. 30 credits of Education/Pedagogics.

Requirements for doctoral degree

The requirements for a doctoral degree consist of on the one hand passed examinations in the courses included in the approved individual study plan of each doctoral student, and on the other hand a passed public defense of the doctoral thesis. The program leading to the doctoral degree amounts to 240 higher education credits (four years of full-time studies), of which the thesis part amounts to a minimum of 120 higher education credits and the course part to a minimum of 90 higher education credits.

Requirements for licentiate degree

A stage of at least 120 higher education credits (two years of full-time studies) in the third level program may be completed with a licentiate degree. The requirements for this are that the doctoral student both has passed the examinations included in the program stage and has received the grade pass for a thesis amounting to a minimum of 60 higher education credits. The course part amounts to a minimum of 60 higher education credits.