General syllabus for doctoral (third-cycle) studies in Dependable Communication and Computation Systems at Luleå University of Technology

Decided by the Chair of the Board of Faculty of Science and Technology on 22 February 2022.

1. Subject description

Swedish name: Kommunikations-och beräkningssystem
English name: Dependable Communication and Computation Systems

The research subject focuses on an integrated development of network architectures, resource efficient algorithms, and programming paradigms for enabling an application-tailored design of dependable communication and computation systems.

2. Programme aim and intended learning outcome

The aim of the doctoral (third-cycle) studies in Dependable Communication and Computation Systems at the University is to give the doctoral student specialised knowledge in Dependable Communication and Computation Systems, in-depth knowledge of different research methods and a good understanding of the challenges related to research and its practical application.

Dependable Communication and Computation Systems is a discipline that covers design, analysis and development of algorithms and software. The applied focus is on mission-critical computer-based information systems in general and on computation control and communication systems in various industries in particular. Central research areas are related to distributed information and control systems design, such as (but not limited to): Industrial automation systems; material handling and transport infrastructures; new energy generation and consumption infrastructure (i.e., SmartGrid or Energy Internet); communication infrastructures of coming generations (5G and beyond), novel computing paradigms for next generation computer architectures (e.g., brain inspired neuromorphic computers); Algorithms for power-efficient Artificial Intelligence and Methods for modeling, analysis and implementation of resource constrained real-time systems.

The overall objective of the programme is that the doctoral student develops into a critical and autonomous researcher in Dependable Communication and Computation Systems, able to plan and carry out research projects. The doctoral student shall fulfil all the qualitative targets specified in

the Higher Education Ordinance as well as in the locally decided qualitative targets, if any (see attached Annex A).

3. Admission requirements and selection

3.1 General entry requirements
An applicant meets the general entry requirements for doctoral (third-cycle) studies if he or she has been awarded a Master's (second-cycle) qualification, has satisfied the requirements for courses comprising at least 240 credits, of which at least 60 second-cycle credits, or has acquired substantially equivalent knowledge in another way, in Sweden or elsewhere (Higher Education Ordinance (2010:1064) Chapter 7 Section 39).

3.2 Specific entry requirements
In addition to the requirement for basic qualifications, the following requirements are applied:
− Main area at advanced level: Computer Science, Engineering Physics, Electronic Engineering, Mathematics or related area.

3.3 Selection
In selecting among applicants who meet the requirements, their ability to benefit from the course or the study programme shall be taken into account. However, the fact that an applicant may be credited for previous courses and study programmes or for professional or vocational experience may not alone give the applicant priority over other applicants (Higher Education Ordinance (2010:1064) Chapter 7 Section 41). The University's local guidelines in the Admissions procedure for doctoral (third-cycle) studies must also be applied.

The following criteria will be used in the selection of applicants for doctoral (third-cycle) studies in Dependable Communication and Computation Systems.
In the selection of third-cycle education in Dependable Communication and Computation Systems the following applies to the selection criteria:
− Knowledge relevant to the project in question,
− The quality of the applicant's degree project,
− Work experience,
− Personal qualities relevant to education at post-graduate level.
 Good command of oral and written communication in English.

4. The degree

The doctoral (third-cycle) studies lead to a Degree of Doctor. Within the Dependable Communication and Computation Systems research subject, a student admitted to doctoral studies has the right to be awarded a licentiate degree after having completed at least 120 credits of the programme leading to a Degree of Doctor.

4.1 Degree requirements
For a Degree of Doctor, the doctoral student shall
- have been awarded a pass grade for courses of at least 60 credits

For each subject in which doctoral (third-cycle) courses and study programmes are offered, a general study syllabus is required (Higher Education Ordinance (2010:1064) Chapter 6 Section 26). The general study syllabus must include the details specified in this template. The admission of a doctoral student presupposes that the Chair of the relevant Faculty Board has adopted a general study syllabus for the doctoral (third-cycle) subject area. The relevant Head of Department is responsible for proposing a general study syllabus to the Chair of the relevant Faculty Board in accordance with the established template. Text in italics describes how to complete the template and should thereafter be deleted.

– have been awarded a pass grade for a research thesis (doctoral thesis) of at least 120 credits.

The thesis and the courses shall together amount to 240 credits for a Degree of Doctor.

For a Degree of Licentiate, the doctoral student shall
- have been awarded a pass grade for courses of at least 30 credits.
- have been awarded a pass grade for a licentiate thesis of at least 60 credits.

The thesis and the courses shall together amount to 120 credits for a Degree of Licentiate.

4.2 Titles of degree
- After the completion of the Degree of Doctor in Dependable Communication and Computation Systems the doctoral student is awarded the title Doctor of Philosophy in Science.
- After the completion of the Degree of Licentiate in Dependable Communication and Computation Systems, the doctoral student is awarded the title Degree of Licentiate of Science.

A request of a title of degree other than the stipulated may be submitted in accordance with laid down guidelines.

5. Programme structure and implementation

5.1 Programme scope and structure

The doctoral (third-cycle) programme includes two blocs; courses and thesis work. The programme comprises four years (two years for the licentiate degree). In case the doctoral student has a doctoral studentship and carries out departmental duties to a certain extent (no more than 20% of the whole programme), a corresponding prolonged period may be approved.

5.2 Individual study plan and supervision

An individual study plan outlining the implementation of the studies is drawn up for each doctoral student. The plan is established in consultation with the supervisor is decided by the Head of Department by delegation of the Vice-Chancellor. The plan is reviewed and revised at least once a year.

The Head of Department shall appoint at least two supervisors, one of whom is appointed principal supervisor, for each doctoral student. The person appointed principal supervisor shall have at least qualifications required for appointment as a docent and be employed by the University. A principal supervisor who no longer meets the job requirements may continue as supervisor until the doctoral student completes his or her studies, by an individual agreement with the relevant department. The doctoral student is entitled to supervision during the studies, unless the Vice-Chancellor has decided otherwise in accordance with the Higher Education Ordinance (2010:1064) Chapter 6 Section 30. A doctoral student who so requests may have another supervisor (Higher Education Ordinance (2010:1064) Chapter 6 Section 28). The request does not need a justification.

5.3 Courses

For each subject in which doctoral (third-cycle) courses and study programmes are offered, a general study syllabus is required (Higher Education Ordinance (2010:1064) Chapter 6 Section 26). The general study syllabus must include the details specified in this template. The admission of a doctoral student presupposes that the Chair of the relevant Faculty Board has adopted a general study syllabus for the doctoral (third-cycle) subject area. The relevant Head of Department is responsible for proposing a general study syllabus to the Chair of the relevant Faculty Board in accordance with the established template. Text in italics describes how to complete the template and should thereafter be deleted.

The individual study plan shall specify the courses to be included in the doctoral student's education. The goal attainment is examined according to the examination procedure specified in the course syllabus. Credits may be transferred in accordance with the local guidelines in the Admissions procedure for doctoral (third-cycle) studies.

For each admitted doctoral student, an individual study plan is established, comprising a course part and a thesis work part. As a rule, the program is determined gradually based on the doctoral student's needs (need for specific knowledge, in-depth or subject-broadening or other) and in dialogue between supervisor and doctoral student.

Courses can be read individually or in groups. In the latter case, teacher-led seminars are often organized. Some courses are lectured while others are mainly based on self-study. Smaller projects are often included in the courses. In general, the courses require great independence in the work.

The course content is chosen to create the necessary skills deepening and broadening of the projects in which the student works. The courses given in the subject area vary from one year to another in order to satisfy current specializations in the research activities. Goal fulfilment is tested via the examination form that appears in the syllabus.

It is also mandatory for the PhD student to acquire knowledge about diversity and gender equality.

5.4 Thesis
The thesis may take the form of either a single coherent work (a monographic thesis) or a compilation comprising a number of scientific articles interrelated by an introductory summary chapter (a compilation thesis). Quality and scope requirements for the research activities do not differ between the two alternatives. The scientific articles or, as appropriate, the monograph must be of such quality that they meet reasonable requirements for publication in a peer-reviewed scientific forum.

In the thesis work, the student shall, with the guidance of the supervisor, independently formulate and solve a qualified research assignment. The student shall further independently discuss and present results at, e.g., internal seminars, national and international seminars and / or conferences, as well as to the surrounding community. The research task can be part of a larger project with several parties where there are requirements for collaboration and sometimes it may be relevant with certain project management tasks, e.g., management of work packages or activities.

For a doctoral degree, the scientific articles in the thesis work must meet the publication standards that apply to reputable international journals and conferences in the subject.

The introductory summary chapter shall include a separate section describing the doctoral student's contribution to the articles.

The doctoral thesis shall be defended at a public defence seminar. The grades for the thesis are either 'pass' or 'failed'. When grading the thesis, the content and the defence of thesis shall be

taken into account. The grade of a doctoral thesis is decided by an examining committee, appointed anew for each thesis.

A doctoral student wanting to be awarded a Degree of Licentiate shall, after consultation with his or her supervisor, request approval from the responsible Head of Department. The doctoral student defends his or her licentiate thesis at a licentiate seminar after which the thesis is graded 'pass' or 'failed'. When grading the thesis, the content and the defence of the thesis is taken into account. An examiner, appointed by the Head of Department, grades the licentiate thesis.

6. Entry into effect and interim regulations

The previous general syllabus will cease to apply for third-cycle students who are admitted to studies at third-cycle level after 2022-02-22.

If agreed between the third-cycle student and the supervisors, the new general syllabus, LTU dnr 4739-2021, may be used as a steering document for a previously admitted third-cycle student.

It must be documented in the third-cycle student´s individual study plan which general syllabus that applies.

For each subject in which doctoral (third-cycle) courses and study programmes are offered, a general study syllabus is required (Higher Education Ordinance (2010:1064) Chapter 6 Section 26). The general study syllabus must include the details specified in this template. The admission of a doctoral student presupposes that the Chair of the relevant Faculty Board has adopted a general study syllabus for the doctoral (third-cycle) subject area. The relevant Head of Department is responsible for proposing a general study syllabus to the Chair of the relevant Faculty Board in accordance with the established template. Text in italics describes how to complete the template and should thereafter be deleted.