



## **General syllabus for third-cycle studies in Computer Science TEEDAFD2**

The syllabus was approved by the Board of the Faculty of Engineering/LTH 2019-12-16 (reg. no U2019/511).

### **1. Subject description**

Computer science comprises theory, technical solutions, and methodology for computational processes and for systems with software, both in general and for different application domains.

Example areas include theoretical computer science, programming languages and tools, distributed systems, embedded systems, computer graphics, artificial intelligence, natural language processing, robot programming, software engineering, and human-computer interaction.

Analytical, design, and empirical research methods are used in different branches/fields of computer science.

### **2. Objective of third-cycle studies at LTH**

The Board of LTH established the following objective for third-cycle studies on 15 February 2007.

The overall objective of third-cycle studies at LTH is to contribute to social development and prosperity by meeting the needs of business and industry, academia and wider society for staff with third-cycle qualifications. LTH shall primarily provide education leading to a PhD or licentiate in the fields of LTH's professional degrees. The programmes are first and foremost intended for the education of engineers and architects. The programmes are designed to encourage personal development and the individual's unique qualities.

Third-cycle graduates from LTH shall demonstrate:

- proficiency in research theories and methods and in a critical, scientific approach
- both breadth and depth of knowledge within the subject of his or her third-cycle studies

The programmes aim to develop:

- creativity and independence with the ability to formulate advanced research issues, solve problems and plan, carry out and evaluate projects within a set time frame
- openness to change
- personal networks, both national and international
- social skills and communication skills
- teaching ability
- innovation skills, leadership and entrepreneurship

In order to enable students to achieve these skills and abilities, LTH provides:

- high-quality supervision and good conditions for study in a creative environment
- a good balance between basic and applied research, with openness to wider society
- a range of advanced third-cycle courses at both departmental and faculty level
- a good balance between courses and thesis work
- opportunities to present research findings at national and international conferences and in internationally recognised journals, or by another equivalent method which leads to wide exposure and circulation
- opportunities to spend time in international research environments for short or extended periods

### 3. Learning outcomes for third-cycle studies

The learning outcomes for third-cycle studies are given in the Higher Education Ordinance.

#### 3.1 Licentiate

##### *Knowledge and understanding*

For a Licentiate the third-cycle student shall:

- demonstrate knowledge and understanding in the field of research including current specialist knowledge in a limited area of this field as well as specialised knowledge of research methodology in general and the methods of the specific field of research in particular.

##### *Competence and skills*

For a Licentiate the third-cycle student shall:

- demonstrate the ability to identify and formulate issues with scholarly precision critically, autonomously and creatively, and to plan and use appropriate methods to undertake a limited piece of research and other qualified tasks within predetermined time frames in order to contribute to the formation of knowledge as well as to evaluate this work
- demonstrate the ability in both national and international contexts to present and discuss research and research findings in speech and writing and in dialogue with the academic community and society in general, and
- demonstrate the skills required to participate autonomously in research and development work and to work autonomously in some other qualified capacity.

*Judgement and approach*

For a Licentiate the third-cycle student shall:

- demonstrate the ability to make assessments of ethical aspects of his or her own research
- demonstrate insight into the possibilities and limitations of research, its role in society and the responsibility of the individual for how it is used, and
- demonstrate the ability to identify the personal need for further knowledge and take responsibility for his or her ongoing learning.

**3.2 Doctor of Philosophy***Knowledge and understanding*

For the degree of Doctor of Philosophy the third-cycle student shall:

- demonstrate broad knowledge and systematic understanding of the research field as well as advanced and up-to-date specialised knowledge in a limited area of this field, and
- demonstrate familiarity with research methodology in general and the methods of the specific field of research in particular.

*Competence and skills*

For the degree of Doctor of Philosophy the third-cycle student shall:

- demonstrate the capacity for scholarly analysis and synthesis as well to review and assess new and complex phenomena, issues and situations autonomously and critically
- demonstrate the ability to identify and formulate issues with scholarly precision critically, autonomously and creatively, and to plan and use appropriate methods to undertake research and other qualified tasks within predetermined time frames and to review and evaluate such work
- demonstrate through a thesis the ability to make a significant contribution to the formation of knowledge through his or her own research
- demonstrate the ability in both national and international contexts to present and discuss research and research findings authoritatively in speech and writing and in dialogue with the academic community and society in general
- demonstrate the ability to identify the need for further knowledge, and
- demonstrate the capacity to contribute to social development and support the learning of others both through research and education and in some other qualified professional capacity.

**Judgement and approach**

For the degree of Doctor of Philosophy the third-cycle student shall:

- demonstrate intellectual autonomy and disciplinary rectitude as well as the ability to make assessments of research ethics, and
- demonstrate specialised insight into the possibilities and limitations of research, its role in society and the responsibility of the individual for how it is used.

**4. General and specific admission requirements**

A person meets the general admission requirements for third-cycle courses and study programmes if he or she:

1. has been awarded a second-cycle qualification

2. has satisfied the requirements for courses comprising at least 240 credits of which at least 60 credits were awarded in the second cycle, or
3. has acquired substantially equivalent knowledge in some other way in Sweden or abroad.

The higher education institution may permit an exemption from the general entry requirements for an individual applicant, if there are special grounds. Ordinance (2010:1064).

A person meets the specific admission requirements if he or she has

1. at least 60 second-cycle credits at an advanced level with relevance for the research topic, or
2. an MSc in Engineering in Computer Science and Engineering, Electrical Engineering, Information and Communication Technology, Engineering Physics or Engineering Mathematics.

Finally, the student must be judged to have the potential to complete the programme. Exemptions from the admission requirements may be granted by the Board of LTH.

## 5. Selection

Selection for third-cycle studies is based on the student's potential to profit from such studies.

The assessment of potential in accordance with the first paragraph is made primarily on the basis of academic results from the first and second cycle. Special attention is paid to the following:

1. Knowledge and skills relevant to the thesis project and the subject of study. These may be demonstrated through documents appended to the application and at a possible interview.
2. An assessment of ability to work independently and to formulate and tackle research problems. The assessment could be made on the basis of the student's degree project and a discussion of this at a possible interview.
3. Written and oral communication skills
4. Other experience relevant to the third-cycle studies, e.g. professional experience.

## 6. Degree requirements

Third-cycle studies lead to a PhD or, if the student wishes or if it has been specified in the decision on admission, to a licentiate. The student also has the right to complete a licentiate as a stage in his or her third-cycle studies, but is not obliged to do so.

The requirements for a licentiate are

- passed courses of at least 60 credits, and
- a passed thesis of a scope corresponding to studies of at least 60 credits

The thesis and courses shall comprise at least 120 credits in total.

The requirements for a PhD are

- passed courses of at least 90 credits, and
- a passed thesis of a scope corresponding to studies of at least 150 credits

The thesis and courses shall comprise at least 240 credits in total.

### 6.1 Degree title

On completion of the programme, the research student will be awarded one of the following titles:

Licentiate in Engineering/*Teknologie licentiatexamen*

Doctor of Philosophy in Engineering/*Teknologie doktorsexamen*

Or

Licentiate of Philosophy/*Filosofie licentiatexamen*

Doctor of Philosophy/*Filosofie doktorsexamen*

## 7. Course component

The programme is to include courses. For each course, an examiner shall be appointed at the department that delivers the course. The examiner shall draw up a written syllabus which states the course title in Swedish and English, the learning outcomes of the course, the course content and the number of credits.

The individual study plan is to include details of which courses the individual student shall or may include in his or her studies and how many credits for each course may be included in the degree. Courses taken at other faculties or higher education institutions may also be included in the study plan.

Participation and approved examination in the *Introductory Workshop for Newly Admitted PhD Students at LTH* (GEM056F) and the department's *Introduction to Research Methodology, Ethics, and Innovation for Computing Disciplines* are mandatory.

A degree of licentiate or doctor in Computer Science may include courses in the following three categories:

1. Computer science and its research methodology
2. Associated fields such as mathematics, electrical engineering or automatic control, or courses of immediate relevance to the student's research specialisation
3. General courses, such as research methods, theory of science, information searching and teaching.

Continuing courses within the framework of the MSc in engineering degree, or other relevant education, may be credited, if they are related to the field of study. Qualified courses shorten the postgraduate education by the corresponding time (e.g. 15 credits corresponding to 3 months).

Upon completion of the postgraduate education, the doctoral student must have a breadth in the subject of computer science, acquired during the undergraduate and

postgraduate education, which corresponds to at least 7.5 credits at basic level in each computer science theory, technical solutions, and development methodology.

### **7.1 Licentiate**

For a degree of licentiate, the course component comprises 60 credits, at least 40 of which must be from courses in computer science and its research methodology (category 1).

### **7.2 Doctor of Philosophy**

For a degree of doctor, the course component comprises 90 credits, at least 60 of which must be from courses in computer science and its research methodology (category 1) and a maximum of 15 of which may be from category 3.

## **8. Thesis**

The programme shall include a research project documented in a licentiate or doctoral thesis.

Research students are obliged to present problems and findings from their research projects at a short seminar every year.

### **8.1 Licentiate thesis**

The licentiate thesis must include a research project summarised in (at least) one research paper that is to be of a quality that meets the requirements for publication in recognised research journals. The research project is to be reviewed by a specially appointed reviewer and presented at a public seminar.

### **8.2 PhD thesis**

The PhD thesis is to be designed either as a short summary of research papers written by the doctoral student individually or in cooperation with others (compilation thesis) or as a unified and coherent research study (monograph thesis). The thesis is to be written in English as a rule. It is to be of a quality that meets the requirements for publication in internationally recognised research journals. Such publication is to be actively sought. The thesis is to be orally defended at a public defence.

## 9. Other rules and regulations

### 9.1 Admission

The number of doctoral students admitted to third-cycle studies will be limited to the number that can be provided with qualified supervision, necessary resources and acceptable general conditions for study. The financial terms and funding shall be clarified to the doctoral student on admission. Decisions on admission are made by the head of department in consultation with a group including the intended principal supervisor, a doctoral student representative and a specially appointed member of teaching staff who is not intended to be the principal supervisor.

### 9.2 Programme design

A principal supervisor and at least one assistant supervisor are to be appointed for each research student in computer science on admission. To be qualified for the role of principal supervisor, the individual must have a permanent academic position at the faculties of engineering or science at Lund University. The first draft of the individual study plan is to specify what courses the new doctoral student should start with in order to achieve sufficient breadth of knowledge in the field. The doctoral student is to update his or her individual study plan each year in consultation with his or her supervisors. The study plan is to be discussed at a doctoral student appraisal attended by the doctoral student, all the supervisors and the director of third-cycle studies. The revised individual study plan is to be approved by the head of department.

The doctoral student is entitled to supervision throughout the period deemed reasonable for the relevant programme. The doctoral student is entitled to a change of supervisor on request.