LUNDS UNIVERSITET
NATUR-
VETENSKAPLIGA
FAKULTETEN

SYLLABUS

Reg. no
U 2024/383

Date 12 June 2024

Faculty Board

General syllabus for third-cycle studies in Computational Science, NABERV01

This syllabus was approved by the Faculty Board on 12 June 2024 and applies to doctoral students admitted from 2 September 2024.

The syllabus is based on Chapter 6, Sections 1–11, 25–36, Chapter 7, Sections 34–41 of the Higher Education Ordinance (1993:100) and Annex 2, which is the Qualifications Ordinance.

1. Available degrees

Studies following this general syllabus can lead to one of the following degrees:

Doctor of Philosophy in Computational Science/ *Filosofie doktorsexamen i beräkningsvetenskap*

Licentiate of Philosophy in Computational Science / *Filosofie licentiatexamen i beräkningsvetenskap*

In consultation with the Faculty of Engineering, the Faculty Board has decided (NA35 643/2005) that those who have been admitted to third-cycle studies at the Faculty of Science with a Master of Science in Engineering as a qualifying criterium can be given the title of Doctor of Philosophy in Engineering or Licentiate of Philosophy in Engineering without special assessment.

2. Subject description

Computational science is in broad sense research that applies and develops computational methods for advanced computation with

the aim of solving research problems in science, engineering or medicine. Such research can involve simulation and modelling as well as data analysis and handling of data. This also includes the development of models, methods and software.

A PhD project in computational science is based on a scientific problem - the application - which is investigated using non-trivial computational methods, modelling, data analysis or software design. Such a PhD project is interdisciplinary in the sense that both the scientific questions within the application and the computational aspects form a significant part of the thesis.

3. Objectives

Third-cycle courses and study programmes are to be based on the knowledge acquired by students during first and second-cycle courses and study programmes, or the equivalent. In addition to what applies to first and second-cycle level education, third-cycle education is to develop specific knowledge and skills needed to be able to conduct independent research. It is also desirable for the doctoral student to acquire teaching experience.

Third-cycle education in computational science aims to train postgraduate students to conduct high-quality research, both individually and in groups, and to work in higher education or in the private or public sectors with advanced tasks which require research experience.

The overall objectives for third-cycle education are defined in Annex 2 of the Higher Education Ordinance, the Qualifications Ordinance.

3.1. Learning outcomes for a Degree of Doctor

Knowledge and understanding

For a Degree of Doctor, the doctoral 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,

– demonstrate familiarity with research methodology in general and the methods of the specific research field in particular.

Competence and skills

For a Degree of Doctor, the doctoral student shall

– demonstrate capacity for scholarly analysis and synthesis as well the capacity to review and assess new and complex phenomena, research questions and situations independently and critically,
– demonstrate ability to identify and formulate research questions with scholarly precision critically, independently and creatively, and to plan and use appropriate methods to undertake research and other advanced 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 their own research,
– demonstrate ability in both national and international contexts to present and discuss research and research findings authoritatively in speech and writing in dialogue with the academic community and society in general,
– demonstrate ability to identify the need for further knowledge, and
– demonstrate capacity to contribute to the development of society and support the learning of others both through research and education as well as in other qualified professional contexts.

Judgement and approach

For a Degree of Doctor, the doctoral student shall

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

3.2. Learning outcomes for a Degree of Licentiate

Knowledge and understanding

For a Degree of Licentiate, the doctoral student shall

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

Competence and skills

For a Degree of Licentiate, the doctoral student shall

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

Judgement and approach

For a Degree of Licentiate, the doctoral student shall

– demonstrate ability to make research ethical assessments of their 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 ability to identify needs for further knowledge and take responsibility for their learning.

4. Entry requirements

The requirements for entry to third-cycle studies are that the applicant meets the general and specific entry requirements and is considered in other respects to have the ability required to benefit from the programme.

General entry requirements

A person meets the general entry requirements for third-cycle studies if the individual

1. has been awarded a second-cycle qualification, or
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 head of department can permit an exemption from the general entry requirements for an individual applicant, if there are special grounds.

Specific entry requirements

To be admitted to a third-cycle programme in computational science, students must have completed course requirements in a scientific or engineering subject area of at least 60 credits at basic or advanced level. In addition, students must have completed at least 30 credits in mathematics (advanced or basic level) and at least 7.5 credits in programming. An independent degree project of at least 30 credits must have been completed. The specific qualification may also have been obtained through other equivalent education, which will be assessed on a case-by-case basis.

5. Selection

In selecting between applicants who meet the requirements, their ability to benefit from the study programme is to be taken into account. The fact that an applicant is considered able to transfer credits from prior courses and study programmes or from

professional or vocational experience may not alone give the applicant priority over other applicants.

The following selection principles are applied:

Results achieved in first and second-cycle (or equivalent) courses and study programmes. Broad, deep and relevant expertise from first and second-cycle (or equivalent) courses and study programmes. The quality of the degree project and other independent projects.

Other expertise or skills that are relevant to the chosen research specialisation.

Applicants who appear to be well-suited should, whenever possible, undergo an interview. The skills demonstrated during the interview are taken into account in the selection process.

When recruiting and selecting students for third-cycle education, diversity and an even gender distribution must always be considered in accordance with Lund University's gender equality policy, equal opportunities policy and diversity plan. The under-represented gender is to be given priority among equally qualified candidates, unless special reasons dictate otherwise.

There must also be coherence between the student's research interests and the department's ability to provide competent supervision.

6. Degree requirements

The third-cycle study programme ends with a Degree of Doctor or, if the doctoral student so wishes or if this has been stated in the admission decision, with a Degree of Licentiate. The doctoral student is also entitled, but not obliged, to complete a Degree of Licentiate as a stage in the education leading to a Degree of Doctor.

The Degree of Doctor comprises 240 credits while the Degree of Licentiate comprises 120 credits.

A doctoral or licentiate degree requires an approved scientific thesis and approved courses or other credit-earning components as described below.

6.1. Thesis

The education must include a research project documented in a doctoral or licentiate thesis. This project is to be defended at a public defence (Degree of Doctor) or a public seminar (Degree of Licentiate), in both cases with a reviewer.
The completed thesis should include both the scientific question and the contribution of the method, such as mathematical modelling or computational methods. The thesis does not have to cover both aspects equally.

Doctoral thesis

The thesis is to comprise 180 credits.

The doctoral thesis is to be a carefully thought-out and reasoned discussion of the candidate's own work in relation to the broader research area and can be produced either as a *compilation thesis* or a *monograph.*

A compilation thesis consists of attached copies of a number of research articles or manuscripts, along with a summarising chapter. The research articles are to be of a quality corresponding to the requirements for publication in recognised academic peer-review journals, and it should be possible to distinguish the doctoral student's contributions.

It is rarely the case that the research papers in a compilation thesis are solely authored by the doctoral student. For this reason, importance should be attached to the summarising chapter that in part gives the doctoral student the opportunity to display an independent intellectual achievement and in part enables assessment of the doctoral student's independent contributions. The summarising chapter is to provide an introduction to the papers and place the research questions and achieved results into an overall context. The summarising chapter must therefore be written in a different format to the papers in the thesis, and it must be possible to read it as an independent academic text. The summarising chapter must not contain extensive copying of text, figures and tables from the papers.

The monograph consists of a cohesive report detailing the research tasks, research questions, working methods, analysis, results and discussion. For monographs, it is particularly important that the candidate's own research is presented in such a way that the methods used, results achieved, and conclusions drawn can be understood and assessed.

The thesis must relate to the Higher Education Ordinance's formulation of learning outcomes, which means the objectives of both the compilation thesis and the monograph are principally to:

– demonstrate current specialist knowledge and a broad and deep understanding of the research area
– demonstrate ability to place the thesis into a broader theoretical and scientific context
– express clear objectives of the thesis work and its most important hypotheses and research questions
– demonstrate familiarity with the methods and analytical tools used within the research area, and demonstrate an ability to assess and evaluate them
– demonstrate an ability to reflect on the importance and limitations of the candidate's own research
– make a significant contribution to expanding knowledge in the field and identify needs for further knowledge.

The thesis must contain a popular science summary, which can be written in Swedish or English.

Licentiate thesis

The thesis is to comprise 90 credits.

The licentiate thesis can be designed either as a summary of at least one scientific article (or manuscript), which the doctoral student has written alone or jointly with others, or as a coherent scientific work (monograph). The licentiate thesis is to be of a quality corresponding to the requirements for publication in recognised scientific journals (with peer-review procedures), and it is to be possible to distinguish the different authors' contributions to the papers. For details regarding the compilation thesis and monograph, see the paragraphs on compilation thesis and monograph above.

6.2. Courses and other credit-earning components

The courses and other components of the third-cycle programme in computational science are to comprise 60 credits for a Degree of Doctor and 30 credits for a Degree of Licentiate.

The exact scope of the credit requirement in addition to the thesis project is to be specified in the individual study plan.

Courses or other credit-earning components that are included in the education may be completed both at or outside Lund University.

The following applies for a Degree of Doctor in Computational Science:

Compulsory courses and other credit-earning components

- Faculty-wide Introductory Course for Doctoral Students (0.5 credits)
- Introduction to the Department (1 credit)
- Research Ethics (3 credits)
- Mid-term report and presentation (5 credits)

Other courses and credit-earning components:

- At least 15 credits must relate to specific courses focusing on computational methods
- At least 15 credits must relate to courses focusing on the scientific application
- A maximum of 20.5 credits may relate to elective courses and other credit-earning components deemed relevant by the department representative.

Doctoral students who teach are to undergo basic training in teaching and learning in higher education corresponding to at least 3 credits.

The following applies for a Degree of Licentiate in Computational Science:

Compulsory courses and other credit-earning components

- Faculty-wide Introductory Course for Doctoral Students (0.5 credits)
- Introduction to the Department (1 credit)
- Research Ethics (3 credits)

Other courses and credit-earning components:

- At least 7.5 credits must relate to specific courses focusing on computational methods
- At least 7.5 credits must relate to specific courses focusing on the scientific application
- A maximum of 10.5 credits may relate to elective courses and other credit-earning components deemed relevant by the department representative

Doctoral students who teach are to undergo basic training in teaching and learning in higher education corresponding to at least 3 credits.