Faculty of Science and Technology
Umeå University, 901 87 Umeå
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2025-10-30

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Ref. No. FS 4.1.1-1311-25

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General syllabus for third-cycle studies in computational mathematics and statistics
for a degree of licentiate

Scope: 120 ECTS credits
The Degree: Licentiate
Study level: Third-cycle
Established by: General syllabus established by the Faculty of Science and Technology Board on October 20th, 2025
Enters into force: November 1st, 2026
Responsible body: Faculty of Science and Technology

1. Field of Study

Computational mathematics and statistics, in the sense of this syllabus, is the general scientific field that develops and applies computational methods for studies of phenomena in science and engineering. The subject involves mathematical and statistical modelling, development of numerical methods for computer solutions or simulation of such models, implementation in software, and application to specific application areas. The subject covers the full range of computational, mathematical, and statistical methods. Techniques for evaluating and assessing the efficiency and reliability of computational methods play a key role in the field.

Holders of a licentiate degree in computational mathematics and statistics are expected to have acquired good overall expertise in the subject and deep knowledge in their area of specialisation. The latter is demonstrated by the ability to conduct research that significantly contributes to the field, as outlined above.

2. Learning outcomes

2.1 Description of education at the current level

The education is at the third-cycle level. The goals for third-cycle study programmes are in the Higher Education Act, Chapter 1, Section 9a.

2.2 Learning outcomes for the current degree

The national learning outcomes for the degree can be found in Appendix 2 of the Higher Education Ordinance.

The learning outcomes for the licentiate degree in computational mathematics and statistics are those specified by the Higher Education Ordinance, Chapter 6, Sections 4 and 5 (see Appendix A), where the terms research field and area of specialisation are to be interpreted in accordance with the preceding section. These learning outcomes are complemented by a gender and equal opportunities perspective, integrated in the content and organisation of the programme. It provides the student with additional insights into how the upholding of inequality by traditional structures and perspectives can be counteracted.

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3. Entry requirements and prior knowledge required

To be admitted for studies at the third-cycle education, the applicant must meet both general and specific entry requirements described below and be assessed to possess the additional abilities necessary to benefit from the programme. (Higher Education Ordinance, Chapter 7, Section 35)

General entry requirements

To fulfil the general entry requirements, the applicant must have qualifications equivalent to a completed degree at the second-cycle level or completed course requirements of at least 240 ECTS credits, including at least 60 ECTS credits at the second-cycle level. The Faculty of Science and Technology Board may, in the case of a specific applicant, consent to an exemption from the general entry requirements if there are special reasons. (Higher Education Ordinance, Chapter 7, Section 39)

Specific entry requirements

To fulfil the specific entry requirements to be admitted for studies at the third-cycle level in computational mathematics and statistics, the applicant must have completed at least 90 ECTS credits within the subject of computational mathematics and statistics (including computer science, mathematics, mathematical statistics, and closely related fields), of which at least 30 ECTS credits shall have been acquired at the second-cycle level.

The entry requirements specified above are also considered fulfilled by applicants who have acquired essentially equivalent knowledge through other means.

4. Selection process

Selection among applicants who meet the entry requirements shall be made with consideration of their ability to benefit from the third-cycle studies. It shall be based on the following assessment criteria:

- personal suitability
- previous academic achievements, and
- other qualifications

However, during selection, the fact that an applicant is deemed able to have previous education or professional experience credited towards the programme shall not give that applicant priority over others. (Higher Education Ordinance, Chapter 7, Section 41)

Decisions regarding admission to the third-cycle studies leading to a doctoral degree are made in accordance with Umeå University's rules of delegation.

5. Contents and scheduling

5.1 General

An individual study plan shall be established for each doctoral student, specifying details such as funding, supervision, coursework, and thesis work. The programme comprises 120 ECTS credits for a Licentiate degree.

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Third-cycle education leading to a licentiate degree corresponds to two years of full-time study. It consists of coursework amounting to 30-45 ECTS credits and a licentiate thesis equivalent to 75-90 ECTS credits.

5.2 Contents

The programme consists of coursework and thesis work. The coursework consists of compulsory courses common to all licentiate students in the subject and a variable number of individually selected courses based on each student's specific needs. The compulsory courses provide generic skills, offer insight into the subject and its scientific methodology, and address issues of gender equality and equal opportunities as an integrated part of the curriculum. The elective courses provide skills relevant to the dissertation topic and general competence in computational mathematics and statistics.

The annual review of the doctoral student's individual study plan ensures an appropriate selection of courses and other activities to achieve the national goals for third-cycle education.

The programme has a strong international orientation. Many students participate in international collaborations, and all are expected to present their research findings in international contexts.

5.2.1 Courses

Compulsory Courses:

The following courses are compulsory for all licentiate students in computational mathematics and statistics.

Courses developing generic skills:

- Introduction to Doctoral Studies at the Faculty of Science and Technology, 1 ECTS credit
- Science, Ethics, and Society, 4 ECTS credits

Courses developing general competence in Mathematics and Mathematical Statistics:

- Seminars and Research Presentation, 4 ECTS credits

Additional compulsory course requirements for the individual licentiate student may be added and specified in the admission decision.

Elective Courses:

The remaining course requirements are fulfilled by taking elective courses that broaden or deepen the licentiate student's expertise in the subject (comprising at least 15 ECTS credits) or provide generic skills.

5.2.2 Licentiate thesis

Through the thesis, the licentiate student shall demonstrate that the national learning outcomes for the licentiate degree have been achieved.

The licentiate thesis shall comprise at least 75 ECTS credits. It may be presented either as a coherent and unified scientific work (*monograph thesis*) or as a compilation of scientific papers

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accompanied by an introduction, summary, and discussion (*compilation thesis*), which must also include a description of the author's contribution to each paper. The thesis must also contain a popular-science summary aimed at readers outside academia.

The licentiate thesis shall be defended orally as a public licentiate seminar. It is assessed with one of the grades, *Pass* or *Fail*. The assessment takes into account both the content of the thesis and its oral defence.

6. Examination

The Licentiate degree is awarded after the licentiate student has completed a third-cycle programme of 120 ECTS credits as specified above, obtained a *Pass* grade in all examinations included in the programme, and written and publicly defended a licentiate thesis at a licentiate seminar, which has been approved by the examiner following the examining committee's recommendation. The degree certificate is issued upon application to the Student Services/Examinations Office.

7. Other instructions

The applicable regulations governing third-cycle education are specified in:

- The Higher Education Ordinance: Chapter 5 (Employment of doctoral students), Chapter 6 (Courses and study programmes), and Chapter 7 (Admission to courses and study programmes), Annex 2 (Systems of qualifications).
- The Admission Regulations for Third-Cycle Education at Umeå University.
- The Local System of Qualifications at Umeå University.
- The Regulations for Third-Cycle Education at Umeå University.
- The Doctoral Education Guide at the Faculty of Science and Technology at Umeå University.

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Appendix A

Learning outcomes for the licentiate degree

(Higher Education Ordinance, Chapter 6, Sections 4 and 5)

Knowledge and understanding

For the degree of 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 specialized knowledge of research methodology in general and the methods of the specific field of research in particular.

Competence and skills

For the degree of 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 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 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 the degree of Licentiate, the third-cycle student shall
- demonstrate the ability to make assessments of ethical aspects 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 the ability to identify the personal need for further knowledge and take responsibility for their ongoing learning.