Faculty of Science and Technology
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General syllabus for third-cycle studies in mathematical statistics
For a degree of doctor

Scope: 240 ECTS credits
The Degree: Doctor
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, 2025
Responsible body: Faculty of Science and Technology

1. Field of Study

Mathematical Statistics, in the sense of this syllabus, is the general scientific field that deals with mathematical methods for analysing random phenomena. The subject Mathematical Statistics includes probability theory and statistical theory. It is the theoretical basis for many probabilistic models, computational techniques and algorithms and their application to empirical statistical problems, data analysis, and a wide range of subjects in applied science and society. The probability theory and statistical theory are intimately linked because the statistical theory is based on the former and often gives rise to probability-theoretical problems. Mathematical statistics is a rapidly developing area of research and has many interfaces with applied research, especially during the era of big data and artificial intelligence. At the same time, new techniques for data analysis based on theoretical computer science and computational mathematics have begun to be incorporated into mathematical statistics.

Holders of a doctoral degree in mathematical 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 independent 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 doctoral degree in Mathematical 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

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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.

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 mathematical statistics, the applicant must have completed at least 90 ECTS credits within the fields of mathematical statistics, statistics, mathematics, and computer science, 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.

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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 240 ECTS credits for a Doctoral degree. A doctoral student admitted to a programme leading to a Doctoral degree may, if they so wish, pursue a Licentiate degree as an intermediate goal.

Third-cycle education leading to a Doctoral degree corresponds to four years of full-time study. It consists of coursework amounting to 80-120 ECTS credits and a doctoral thesis equivalent to 120-160 ECTS credits.

5.2 Contents

The programme consists of coursework and thesis work. 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 doctoral students participate in international collaborations, and all are expected to present their research findings in international contexts.

5.2.1 Courses

The coursework component consists of compulsory courses common to all doctoral 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 mathematical statistics.

Compulsory Courses:

Courses developing generic skills:

- *Introduction to Doctoral Studies at the Faculty of Science and Technology*, 1 ECTS credit
- *Oral Presentation*, 1 ECTS credit
- *Science, Ethics, and Society,* 4 ECTS credits
- *Writing Science*, 5 ECTS credits

Courses developing general competence in mathematics and mathematical statistics:

- *Seminars and Research Presentation,* 7.5 ECTS credits

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

Elective Courses:
Courses relevant to the doctoral programme amounting to at least 61.5 ECTS credits. Of these, at least 50 ECTS credits must be within Mathematical Statistics, including a general component

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consisting of courses in inference theory (at least 15 ECTS credits), probability theory (at least 7.5 ECTS credits), and stochastic processes (at least 7.5 ECTS credits).

5.2.2 Doctoral thesis

The doctoral thesis shall comprise at least 120 ECTS credits. It may be presented either as a coherent and unified scientific work (*monograph thesis*) or as a compilation of scientific papers 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.

Through the thesis, the doctoral student shall demonstrate that the national learning outcomes for the doctoral degree have been achieved. The doctoral dissertation shall be defended orally as a public disputation and 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 Doctorate degree is awarded after the doctoral student has completed a third-cycle programme of 240 ECTS credits as specified above, obtained a *Pass* grade in all examinations included in the programme, and written and publicly defended a doctoral thesis that the examining committee has approved. The degree certificate is issued upon application to the Student Services/Examination 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 doctoral degree

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

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 as 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 dissertation the ability to make a significant contribution to the formation of knowledge through their 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 in 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 individual's responsibility for how this is used.