Programme syllabus

Master's Programme, Mathematics, 120 credits
Masterprogram, matematik
120.0 credits

Valid for students admitted to the education from autumn 07 (HT - Autumn term; VT - Spring term).

This is a translation of the Swedish, legally binding, programme syllabus.

Programme objectives

The main objective of this programme is to educate skilled mathematicians, well prepared for advanced industrial positions or continued graduate studies.

Knowledge and understanding

A Master of Science in Mathematics will:

- have a good broad knowledge in mathematics as well as a significantly deepened knowledge within the chosen area of specialization,
- have a good ability to in an independent manner apply mathematical theories and solution methods,
- be able to formulate and approach new problem settings in a scientific manner, by having a creative, critical and systematic attitude towards mathematics.

Skills and abilities

A Master of Science in Mathematics will be able to:

- work out solution strategies to important classes of mathematical problems, knowing the capabilities and limitations of different methods and tools,
- work efficiently in a teamwork environment in groups with different compositions,
- communicate results and conclusions in a competent and intelligible manner, both orally and in writing,
- follow and participate in research and development related to the chosen specialization.

Ability to make judgements and adopt a standpoint

A Master of Science in Mathematics will be able to:

- critically judge a situation and in an independent manner acquire the information and knowledge that is necessary to establish a qualified standpoint,
- have the ability to identify the need for further knowledge in the field and take responsibility for keeping their personal knowledge up to date.

Complete information on the degree requirements can found in the local degree policy of KTH, see http://www.kth.se/info/kth-handboken/II/19/1.html

Extent and content of the programme

Mathematics is a two-year (120 university credits) master programme on the advanced level (second cycle). The instruction language is entirely English. The programme consists of a basic curriculum followed by five specializations: (i) mathematics, (ii) mathematical statistics and financial mathematics, (iii) computational mathematics, (iv)
optimization and systems theory, and (v) discrete mathematics and theoretical computer science. The courses in the basic curriculum are compulsory and constitute about half of the course work. To obtain sufficient depth in a specialization, a student is normally required to complete courses worth at least 18 university credits among the profile courses for the specialization in question.

**Eligibility and selection**

**Basic eligibility requirements**

A completed Bachelor's degree, equivalent to a Swedish Bachelor's degree (180 university credits), from a university recognized by government or accredited by other recognized organisation. A good knowledge of written and spoken English. Applicants must provide proof of their proficiency in English.

**Specific eligibility requirements**

The prerequisites for the Master's programme in Mathematics is a Swedish or foreign degree equivalent to Bachelor of Science of 180 university credits, with at least 45 university credits in mathematics. The students are required to have documented knowledge corresponding to basic university courses in analysis, linear algebra, numerical analysis, differential equations and transforms, and mathematical statistics.

**Selection process**

The selection process for The Master of Science programme in Mathematics is based on a total evaluation of the following selection criteria: university, grade point average (GPA), course work related to the programme (mathematics in a wide sense), and references.

Complete information on the eligibility requirements can be found in the local admission policy of KTH, see http://www.kth.se/info/kth-handboken/II/11/inledning.html

**Implementation of the education**

**Structure of the education**

The academic year at KTH is divided into four periods. Each period lasts approximately seven weeks with at least 33 days of study. Each period is followed by an exam period consisting of two extra days and at least 5 exam days. In addition to the four regular exam periods, there are three additional re-examination periods: after Christmas, after May, and immediately preceding the first study period of the academic year. The academic year lasts for a duration of 40 weeks. Teaching activities may, if necessary, be scheduled outside the academic year.

The first year in the programme is mainly dedicated to the compulsory courses in the basic curriculum. However, some courses in the specializations are also given in the first year, in order to harmonise the master programme and the final part of the five-year engineering education at KTH. The second year mainly consists of elective courses and the final degree project, although it depends on the chosen specialization.

**Courses**

The programme is course-based. Lists of courses are included in appendix 1.

The basic curriculum corresponds to approximately 45 university credits. In each specialization, there is an additional set of profile courses, of which normally at least 18 university credits have to be taken. This leaves approximately 27 university credits for optional (elective) courses. These courses may be chosen among other higher level courses at KTH, or at the Department of Mathematics at Stockholm University, relevant to the student's profile.

**Grading system**

Courses in the first and the second cycle are graded on a scale from A to F. A-E are passing grades, A is the highest grade. The grades pass (P) and fail (F) are used for courses under certain circumstances.
Conditions for participation in the programme

No later than November 15 and May 15 each academic year, respectively, the students are required to make a study registration and course selection for the coming term. At least 40 university credits have to be completed during the first academic year (including the re-examination period in August) in order for the student to be promoted to the second year of the programme.

Students have to make a decision about the specialization during the first year of the programme.

Recognition of previous academic studies

Under certain circumstances, and in agreement with the programme director, credits for previous studies can be received according to the local policy of KTH, see http://www.kth.se/info/kth-handboken/II/13/3.html

Degree project

Students admitted to the programme are required to perform an independent study in the form of a thesis project corresponding to 30 university credits. To begin the thesis project, a student must normally have completed at least 65 university credits of the total course work and 18 university credits of the profile courses in the specialization.

The purpose of the thesis project is that the student should demonstrate the ability to perform independent project work, using and developing the skills obtained from the courses in the programme. It is the student’s responsibility to find a suitable thesis project, with assistance from KTH.

More information on the KTH policy on the degree project can be found at http://www.kth.se/info/kth-handboken/II/15/1.html

Degree

Students who fulfill all the requirements will be awarded a degree of Master of Science (two years). Students must apply for the degree and also show proof of their basic degree (bachelor or similar) and paid student union fee.

Complete information on the degree requirements can found in the local degree policy of KTH, see http://www.kth.se/info/kth-handboken/II/19/1.html

Appendix 1 - Course list
Appendix 2 - Programme syllabus descriptions
Appendix 1: Course list

Master's Programme, Mathematics, 120 credits (TMTHM), Programme syllabus for studies starting in autumn 2007

General courses

Year 1

Mandatory courses (37.5 credits)

<table>
<thead>
<tr>
<th>Course code</th>
<th>Course name</th>
<th>Credits</th>
<th>Edu. level</th>
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</thead>
<tbody>
<tr>
<td>DN2251</td>
<td>Applied Numerical Methods III</td>
<td>9.0</td>
<td>Second cycle</td>
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<tr>
<td>SF1841</td>
<td>Optimization</td>
<td>6.0</td>
<td>First cycle</td>
</tr>
<tr>
<td>SF2713</td>
<td>Foundations of Analysis</td>
<td>7.5</td>
<td>Second cycle</td>
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<tr>
<td>SF2714</td>
<td>Discrete Mathematics and Algebra</td>
<td>7.5</td>
<td>Second cycle</td>
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<tr>
<td>SF2940</td>
<td>Probability Theory</td>
<td>7.5</td>
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Year 2

Mandatory courses (7.5 credits)

<table>
<thead>
<tr>
<th>Course code</th>
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<tbody>
<tr>
<td>AK2036</td>
<td>Theory and Methodology of Science with Applications (Natural and Technological Science)</td>
<td>7.5</td>
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Computational Mathematics (COMP)

Year 1

Optional courses

<table>
<thead>
<tr>
<th>Course code</th>
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<tbody>
<tr>
<td>DD2257</td>
<td>Visualization</td>
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<td>Second cycle</td>
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<tr>
<td>DN2290</td>
<td>Advanced Numerical Analysis</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>DN2297</td>
<td>Advanced Individual Course in Scientific Computing</td>
<td>6.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td>Course code</td>
<td>Course name</td>
<td>Credits</td>
<td>Edu. level</td>
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<tr>
<td>SG2212</td>
<td>Computational Fluid Dynamics</td>
<td>7.5</td>
<td>Second cycle</td>
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<tr>
<td>SG2213</td>
<td>Applied Computational Fluid Dynamics</td>
<td>3.0</td>
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**Recommended courses**

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<tbody>
<tr>
<td>DN2255</td>
<td>Numerical Solutions of Differential Equations</td>
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<td>DN2281</td>
<td>Computational Methods for Stochastic Differential Equations</td>
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**Year 2**

**Optional courses**

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<tr>
<td>DN2258</td>
<td>Introduction to High Performance Computing</td>
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<td>Second cycle</td>
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<tr>
<td>DN2266</td>
<td>Mathematical Models, Analysis and Simulation Part 1</td>
<td>7.5</td>
<td>Second cycle</td>
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<tr>
<td>SF2812</td>
<td>Applied Linear Optimization</td>
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**Recommended courses**

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<tr>
<td>DN2253</td>
<td>Numerical Algebra, Methods for Large Matrices</td>
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<td>DN2260</td>
<td>The Finite Element Method</td>
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<tr>
<td>DN2264</td>
<td>Parallel Computations for Large-Scale Problems, Part 1</td>
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**Discrete Mathematics and Theoretical Computer Science (DM)**

**Year 1**

**Recommended courses**

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<td>DD2446</td>
<td>Complexity Theory</td>
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<td>DD2449</td>
<td>Foundations of Cryptography</td>
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<tr>
<td>SF2708</td>
<td>Combinatorics</td>
<td>7.5</td>
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### Year 2

#### Recommended courses

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<tr>
<td>DD2354</td>
<td>Algorithms and Complexity</td>
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<tr>
<td>SF2706</td>
<td>Algebra</td>
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### Mathematics (MAMA)

#### Year 1

#### Recommended courses

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<td>SF2705</td>
<td>Fourier Analysis</td>
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<td>SF2707</td>
<td>Functional Analysis</td>
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<td>SF2708</td>
<td>Combinatorics</td>
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#### Year 2

#### Recommended courses

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<td>SF2704</td>
<td>Topics in Mathematics I</td>
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<td>SF2706</td>
<td>Algebra</td>
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<td>Second cycle</td>
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<tr>
<td>SF2709</td>
<td>Integration Theory</td>
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<tr>
<td>SF2720</td>
<td>Chaotic Dynamical Systems</td>
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<tr>
<td>SF2721</td>
<td>Topology</td>
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<tr>
<td>SF2722</td>
<td>Differential Geometry</td>
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### Mathematical Statistics and Financial Mathematics (MSFI)

#### Year 1

#### Optional courses

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<tr>
<td>DN2269</td>
<td>Mathematical Models, Analysis and Simulation, part 2</td>
<td>7.5</td>
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<tr>
<td>Course code</td>
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<td>Credits</td>
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<tr>
<td>SF2955</td>
<td>Computer Intensive Methods in Mathematical Statistics</td>
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**Recommended courses**

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<tbody>
<tr>
<td>SF2701</td>
<td>Financial Mathematics, Basic Course</td>
<td>7.5</td>
<td>Second cycle</td>
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<tr>
<td>SF2950</td>
<td>Applied Mathematical Statistics</td>
<td>7.5</td>
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**Year 2**

**Optional courses**

<table>
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<tbody>
<tr>
<td>SF2872</td>
<td>Mathematical Economics</td>
<td>6.0</td>
<td>Second cycle</td>
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<tr>
<td>SF2960</td>
<td>Statistical Theory</td>
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<tr>
<td>SF2970</td>
<td>Martingales and Stochastic Integrals</td>
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<tr>
<td>SF2975</td>
<td>Financial Derivatives</td>
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<td>SF2976</td>
<td>Portfolio Theory, Advanced Course</td>
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<tr>
<td>SF2980</td>
<td>Risk Management</td>
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<td>SF2945</td>
<td>Time Series Analysis</td>
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<td>Second cycle</td>
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<tr>
<td>SF2974</td>
<td>Portfolio Theory and Risk Management</td>
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**Optimisation and Systems Theory (OS)**

**Year 1**

**Optional courses**

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<td>SF2827</td>
<td>Topics in Optimization</td>
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<tr>
<td>SF2867</td>
<td>Decision Support Methods - Project Course</td>
<td>7.5</td>
<td>Second cycle</td>
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<tr>
<td>SF2950</td>
<td>Applied Mathematical Statistics</td>
<td>7.5</td>
<td>Second cycle</td>
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### Recommended courses

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<tr>
<td>SF2852</td>
<td>Optimal Control Theory</td>
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<td>Second cycle</td>
</tr>
<tr>
<td>SF2862</td>
<td>Stochastic Decision Support Models</td>
<td>7.5</td>
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### Year 2

#### Optional courses

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<th>Course name</th>
<th>Credits</th>
<th>Edu. level</th>
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<tbody>
<tr>
<td>SF2872</td>
<td>Mathematical Economics</td>
<td>6.0</td>
<td>Second cycle</td>
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<tr>
<td>SF2945</td>
<td>Time Series Analysis</td>
<td>6.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td>SF2974</td>
<td>Portfolio Theory and Risk Management</td>
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<tr>
<td>SF2812</td>
<td>Applied Linear Optimization</td>
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<td>SF2822</td>
<td>Applied Nonlinear Optimization</td>
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<tr>
<td>SF2832</td>
<td>Mathematical Systems Theory</td>
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<td>SF2842</td>
<td>Geometric Control Theory</td>
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Appendix 2: Specialisations

Master's Programme, Mathematics, 120 credits (TMTHM), Programme syllabus for studies starting in autumn 2007

Computational Mathematics (COMP)
Discrete Mathematics and Theoretical Computer Science (DM)
Mathematics (MAMA)
Mathematical Statistics and Financial Mathematics (MSFI)
Optimisation and Systems Theory (OS)