Programme syllabus

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

Valid for students admitted to the education from autumn 16 (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 positions in industry and society, 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 apply mathematical theories and solution methods in an independent manner,
- 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.

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 courses in the programme are organized in three blocks, followed by the master thesis. The blocks correspond to one semester of studies each, but are taken in parallel. In the basic block (“basblock”), mandatory courses are taken in four different subject areas. In the profile block (“profileringsblock”) the student chooses courses to specialize and prepare for the master thesis. The broadening block (“breddningsblock”) contains a compulsory course on theory and methodology of science, compulsory courses on communication of mathematical subjects, and half a semester of freely elective courses.

Eligibility and selection

General Eligibility Requirements.

A completed Bachelor’s degree, corresponding to a Swedish Bachelor’s degree (180 ECTS), or equivalent academic qualifications from an internationally recognised university. Students in their final year of undergraduate education may also apply to KTH and if qualified, receive a conditional acceptance.

Specific eligibility requirements.

The specific requirements may be assessed as not fulfilled if the grade point average is below 75% of the scale maximum.

Selection process.

The selection process is based on the following selection criteria: University, previous studies (for instance GPA), motivation for the studies (for instance letter of motivation, references).

The evaluation scale is 1-75.

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. 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.

Courses

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

To ensure the necessary background and focus for the master thesis all course choices by the student must be done in consultation with the programme coordinators or equivalent.

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.

The grades pass (P) and fail (F) are used for thesis works.

Conditions for participation in the programme

Course application

All programme students apply for courses 1-15 November/1-15 May for the next semester. The application is done via universityadmissions.se
Semester registration

Everyone admitted to an educational programme at KTH must register for the semesters they intend to study. Semester registration is a prerequisite and is required for the registration and reporting of results on courses. You can carry out a web registration at the same time as the semester starts, provided that you have fulfilled requirements for the coming semester.

Semester registration is done by the “personal menu” at www.kth.se

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.

Studies abroad

After approval by the programme director, part of the studies may be carried out abroad (including the Master’s degree project). The condition is that the parts of the programme carried out abroad should fit in with the educational programme.

Degree project

A 30-credit Master’s degree project is carried out at the end of the educational programme (usually the fourth semester). The purpose of the project is to let the student study a problem in more depth than is possible in the courses. The project may be carried out in an academic or industrial environment in Sweden or abroad. To be allowed to start a degree project, a student must have accumulated at least 60 credits.

The choice of project must be approved by the programme director.

The Degree project is graded with P/F.

Degree

In order to earn a Degree of Master of Science, passing grades in all courses which are included in the student’s study plan are required. The study plan must comprise 120 higher education credits which include a degree project consisting of 30 higher education credits, in the second cycle.

KTH’s local degree ordinance can be found at KTH’s website, www.kth.se.

Application for degree certificate

When the studies at KTH are completed a degree certificate can be applied for.

Application is done by the “personal menu” at www.kth.se

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

Master's Programme, Mathematics, 120 credits (TMAKM), Programme syllabus for studies starting in autumn 2016

**General courses**

**Year 1**

**Mandatory courses (7.5 credits)**

<table>
<thead>
<tr>
<th>Course code</th>
<th>Course name</th>
<th>Credits</th>
<th>Edu. level</th>
</tr>
</thead>
<tbody>
<tr>
<td>AK2036</td>
<td>Theory and Methodology of Science with Applications (Natural and Technological Science)</td>
<td>7.5</td>
<td>Second cycle</td>
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</tbody>
</table>

**Optional courses**

<table>
<thead>
<tr>
<th>Course code</th>
<th>Course name</th>
<th>Credits</th>
<th>Edu. level</th>
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<tbody>
<tr>
<td>DD2352</td>
<td>Algorithms and Complexity</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>DD2440</td>
<td>Advanced Algorithms</td>
<td>6.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td>DD2442</td>
<td>Seminars on Theoretical Computer Science</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>DD2447</td>
<td>Statistical Methods in Applied Computer Science</td>
<td>6.0</td>
<td>Second cycle</td>
</tr>
<tr>
<td>DD2448</td>
<td>Foundations of Cryptography</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>SF2720</td>
<td>Chaotic Dynamical Systems</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>SF2722</td>
<td>Differential Geometry</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>SF2724</td>
<td>Topics in Mathematics IV</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>SF2812</td>
<td>Applied Linear Optimization</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>SF2822</td>
<td>Applied Nonlinear Optimization</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>SF2832</td>
<td>Mathematical Systems Theory</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>SF2842</td>
<td>Geometric Control Theory</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>SF2852</td>
<td>Optimal Control Theory</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>SF2863</td>
<td>Systems Engineering</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>SF2930</td>
<td>Regression Analysis</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>SF2940</td>
<td>Probability Theory</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
</tbody>
</table>
### Study Programme for Master’s Programme, Mathematics, 120 credits batch autumn 16.

#### Course Programme

<table>
<thead>
<tr>
<th>Course code</th>
<th>Course name</th>
<th>Credits</th>
<th>Edu. level</th>
</tr>
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<tbody>
<tr>
<td>SF2942</td>
<td>Portfolio Theory and Risk Management</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>SF2943</td>
<td>Time Series Analysis</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>SF2955</td>
<td>Computer Intensive Methods in Mathematical Statistics</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>SF2970</td>
<td>Martingales and Stochastic Integrals</td>
<td>6.0</td>
<td>Second cycle</td>
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<tr>
<td>SF2972</td>
<td>Game Theory</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>SF2975</td>
<td>Financial Derivatives</td>
<td>7.5</td>
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<tr>
<td>SF2980</td>
<td>Risk Management</td>
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<td>Second cycle</td>
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#### Conditionally elective courses

<table>
<thead>
<tr>
<th>Course code</th>
<th>Course name</th>
<th>Credits</th>
<th>Edu. level</th>
</tr>
</thead>
<tbody>
<tr>
<td>SF2741</td>
<td>Enumerative Combinatorics</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>SF2743</td>
<td>Advanced Real Analysis I</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
</tbody>
</table>

#### Supplementary information

Among the conditionally elective courses one in each area has to be studied (algebra and geometry, topology, analysis and discrete mathematics).

Here comes links to two websites with information:

http://www.math-stockholm.se/master/

https://www.kth.se/sci/institutioner/math/utb/avanceradniva/future

SF2721 (conditionally elective topology) is given at Stockholm University Spring 2017 with coursecode MM8002

SF2723 (elective) is given at Stockholm University Autumn 2016 with coursecode MM8031

SF2732 (elective) is given at Stockholm University Spring 2017 with coursecode MM8005

SF2737 (conditionally elective algebra and geometry) is given at Stockholm University Autumn 2016 with coursecode MM8019

SF2744 (conditionally elective analysis) is given at Stockholm University Spring 2017 with coursecode MM8309

Furthermore there are some courses at the programme which is not given during 16/17:

DD2445 (elective)

SF2704 (elective)

SF2705 (conditionally elective analysis)

SF2716 (elective)
SF2728 (conditionally elective discrete mathematics)
SF2730 (valfri)
SF2733 (valfri)
SF2734 (elective)
SF2735 (conditionally elective algebra and geometry)
SF2738 (elective)
SF2739 (conditionally elective analysis)
SF2740 (conditionally elective discrete mathematics)
SF2742 (elective)
SF2827 (elective)
SF2941 (elective)

**Year 2**

**Optional courses**

<table>
<thead>
<tr>
<th>Course code</th>
<th>Course name</th>
<th>Credits</th>
<th>Edu. level</th>
</tr>
</thead>
<tbody>
<tr>
<td>DD2445</td>
<td>Complexity Theory</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>SF2704</td>
<td>Topics in Mathematics I</td>
<td>7.5</td>
<td>Second cycle</td>
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<tr>
<td>SF2832</td>
<td>Mathematical Systems Theory</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>SF2863</td>
<td>Systems Engineering</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>SF2940</td>
<td>Probability Theory</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>SF2942</td>
<td>Portfolio Theory and Risk Management</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td>SF2980</td>
<td>Risk Management</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
</tbody>
</table>

**Conditionally elective courses**

<table>
<thead>
<tr>
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<th>Course name</th>
<th>Credits</th>
<th>Edu. level</th>
</tr>
</thead>
<tbody>
<tr>
<td>SF2735</td>
<td>Homological Algebra and Algebraic Topology</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td></td>
<td><em>Algebra and Geometry</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SF2740</td>
<td>Graph Theory</td>
<td>7.5</td>
<td>Second cycle</td>
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<tr>
<td></td>
<td><em>Discrete Mathematics</em></td>
<td></td>
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</tr>
<tr>
<td>SF2743</td>
<td>Advanced Real Analysis I</td>
<td>7.5</td>
<td>Second cycle</td>
</tr>
<tr>
<td></td>
<td><em>Analysis</em></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Supplementary information**

In addition MM7020 Mathematical communication, 7.5 cr, has to be studied. The course is given by Stockholms university.

Here comes links to two websites with information:

http://www.math-stockholm.se/master/

https://www.kth.se/en/sci/institutioner/math/utb/utbildning-1.50650

SF2739 Partial Differential Equations (conditionally elective Analysis) is given at Stockholm University Autumn 2017 with coursecode MM8008

Furthermore there are some courses at the programme which is not given during 17/18:

DD2442 Seminars on Theoretical Computer Science (elective)

SF2732 Galois Theory (elective)

SF2733 Elementary Differential Geometry (elective)

SF2737 Commutative Algebra and Algebraic Geometry (conditionally elective Algebra and Geometry)

**Year 3**

**Year 4**
Appendix 2: Specialisations

Master's Programme, Mathematics, 120 credits (TMAKM), Programme syllabus for studies starting in autumn 2016

This programme has no specialisations.