



Programme syllabus

[An accessible version of the syllabus can be found in the Course and programme directory.](#)

Master's Programme, Applied and Computational Mathematics 120 credits

Masterprogram, tillämpad matematik och beräkningsmatematik

Valid for students admitted to the education from autumn 14 (HT - Autumn term; VT - Spring term).

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

Programme objectives

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

Knowledge and understanding

A Master of Science in Applied and Computational Mathematics will:

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

Skills and abilities

A Master of Science in Applied and Computational Mathematics will be able to:

- formulate mathematical models, choose suitable methods to investigate those models including the efficient use of computer tools,
- analyze different mathematical models within science and technology and work creatively, systematically and critically,
- 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,
- communicate results and conclusions in a competent and intelligible manner, both orally and in writing, with management, experts, and society at large,
- 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 Applied and Computational Mathematics will be able to:

- critically judge validity and limitations of the results obtained from different types of mathematical models,
- identify the need for further knowledge in the field and take initiatives to keeping the personal knowledge up to date.

Extent and content of the programme

Applied and Computational Mathematics is a two-year (120 university credits) Master's program on the advanced level (second cycle). The instruction language is entirely English. The program consists of a basic curriculum followed by three tracks: (i) mathematical statistics and financial mathematics, (ii) computational mathematics, and (iii) optimization and systems theory. The courses in the basic curriculum are compulsory and worth 30 university credits. To obtain sufficient depth in a track, a student is required to complete courses worth approximately (not more than) 30 university credits among the profile courses for the track in question.

Eligibility and selection

General eligibility requirements

A completed Bachelor's degree (BSc, BEng of corresponding) comprising 180 university credits from a university approved by the Swedish authorities or accredited of an authorized organization. Working knowledge in written and spoken English. The applicant must present proof of knowledge in English. Complete information on the eligibility requirements can be found in the local admission policy of KTH.

Specific eligibility requirements

The prerequisites for the Master's program in Applied and Computational 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 in one and several variables, linear algebra, numerical analysis, differential equations and transforms, mathematical statistics, and basics of programming in a higher programming language.

The specific requirements may be assessed as not fulfilled if

- the average grade is in the lower half on the grading scale used (above pass level)
- the degree awarding institution is not considered to meet acceptable quality standards by the authorities of the country in which the institution is located
- the degree does not qualify for admission to equivalent Master's level in the country where the degree is awarded

Selection process

The selection process for the Master's programme in Applied and Computational Mathematics is based on a total evaluation of the following criteria: university, grades in courses relevant to the program: mathematics in a wide sense, and motivation letter. In addition, English language skills above the minimum requirements will give a higher overall evaluation score.

Implementation of the education

Structure of the education

The duration of the academic year at KTH is 40 weeks. The academic year is divided into four periods. Each period is followed by an examination period. Apart from these examination periods, there are three re-examination periods. Teaching activities may, if necessary, be scheduled outside the academic year. Details about the structure follow the general rules stated by KTH.

The program courses include 30 university credits worth of courses that are mandatory for all students of the program, and for each track approximately (not more than) 30 university credits worth of courses that are mandatory for that track. The courses not falling in either of the two categories above are optional courses that can be chosen freely if they are courses at the advanced level given by the department of mathematics. Courses worth 7.5 credits can be chosen freely. Courses corresponding to more than 7.5 credits in fields other than mathematics are typically accepted if those courses can be seen as a broadening of the studies towards an area where mathematics can be applied. Other choices of courses are possible when approved by the program director. Out of the 90 university credits courses, excluding the degree project course, at least two courses must be chosen that has project work as an essential part of the examination. Such courses are indicated with (P).

Courses

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

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 45 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 program.

Degree project

Students admitted to the program are required to perform an independent study in the form of a thesis project corresponding to 30 university credits. The requirement of at least 60 university credits on advanced level and sufficient depth in the chosen track must be met before the thesis work can start.

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 program. It is the student's responsibility to find a suitable thesis project.

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's or similar). Complete information on the degree requirements can be found in the local degree policy of KTH.

The application form for the degree is found at the personal menu at www.kth.se.

Appendix 1 - Course list

Appendix 2 - Programme syllabus descriptions



Appendix 1: Course list

Master's Programme, Applied and Computational Mathematics (TTMAM)

General courses

Year 1

Mandatory courses (22.5 Credits)

Code	Name	Credits	Edu. level
AK2036	Theory and Methodology of Science with Applications (Natural and Technological Science)	7.5 hp	Second cycle
SF2520	Applied Numerical Methods	7.5 hp	Second cycle
SF2940	Probability Theory	7.5 hp	Second cycle

Optional courses

Code	Name	Credits	Edu. level
BB2280	Molecular Modeling	7.5 hp	Second cycle
BB2300	Computational Chemistry	7.5 hp	Second cycle
BB2440	Bioinformatics and Biostatistics	7.0 hp	Second cycle
DD2257	Visualization	7.5 hp	Second cycle
DD2431	Machine Learning	6.0 hp	Second cycle
DD2435	Mathematical Modelling of Biological Systems	9.0 hp	Second cycle
DN2258	Introduction to High Performance Computing	7.5 hp	Second cycle
SD2611	Aerodynamic Design of Aircraft	9.0 hp	Second cycle
SF1811	Optimization	6.0 hp	First cycle
SF2522	Computational Methods for Stochastic Differential Equations	7.5 hp	Second cycle
SF2523	Topics in Scientific Computings	3.0 hp	Second cycle
SF2566	Advanced Individual Course in Scientific Computing	6.0 hp	Second cycle
SF2567	Project Course in Scientific Computing	7.5 hp	Second cycle
SF2701	Financial Mathematics, Basic Course	7.5 hp	Second cycle
SF2822	Applied Nonlinear Optimization	7.5 hp	Second cycle
SF2842	Geometric Control Theory	7.5 hp	Second cycle
SF2852	Optimal Control Theory	7.5 hp	Second cycle
SF2942	Portfolio Theory and Risk Management	7.5 hp	Second cycle
SF2943	Time Series Analysis	7.5 hp	Second cycle
SF2950	Applied Mathematical Statistics	7.5 hp	Second cycle
SF2955	Computer Intensive Methods in Mathematical Statistics	7.5 hp	Second cycle
SF2970	Martingales and Stochastic Integrals	6.0 hp	Second cycle
SF2972	Game Theory	7.5 hp	Second cycle
SF2975	Financial Derivatives	7.5 hp	Second cycle
SF2980	Risk Management	7.5 hp	Second cycle
SG2212	Computational Fluid Dynamics	7.5 hp	Second cycle
SG2224	Applied Computational Fluid Dynamics	5.0 hp	Second cycle

Conditionally elective courses

Code	Name	Credits	Edu. level
SF2812	Applied Linear Optimization	7.5 hp	Second cycle
SF2832	Mathematical Systems Theory	7.5 hp	Second cycle
SF2863	Systems Engineering	7.5 hp	Second cycle

Supplementary information

At least one of the conditionally elective courses during year one and two has to be studied.

Year 2

Optional courses

Code	Name	Credits	Edu. level
BB2280	Molecular Modeling	7.5 hp	Second cycle
BB2300	Computational Chemistry	7.5 hp	Second cycle
BB2440	Bioinformatics and Biostatistics	7.0 hp	Second cycle
DD2431	Machine Learning	6.0 hp	Second cycle
DD2435	Mathematical Modelling of Biological Systems	9.0 hp	Second cycle
DN2258	Introduction to High Performance Computing	7.5 hp	Second cycle
SD2611	Aerodynamic Design of Aircraft	9.0 hp	Second cycle
SF1811	Optimization	6.0 hp	First cycle
SF2866	Applied Systems Engineering	7.5 hp	Second cycle
SF2935	Modern Methods of Statistical Learning	7.5 hp	Second cycle
SF2942	Portfolio Theory and Risk Management	7.5 hp	Second cycle
SF2970	Martingales and Stochastic Integrals	6.0 hp	Second cycle
SF2980	Risk Management	7.5 hp	Second cycle

Conditionally elective courses

Code	Name	Credits	Edu. level
SF2832	Mathematical Systems Theory	7.5 hp	Second cycle
SF2863	Systems Engineering	7.5 hp	Second cycle

Supplementary information

At least one of the conditionally elective courses during year one and two has to be studied.

Track, Computational Mathematics (COMA)

Year 1

Mandatory courses (15.0 Credits)

Code	Name	Credits	Edu. level
SF2521	Numerical Solutions of Differential Equations	7.5 hp	Second cycle
SF2568	Parallel Computations for Large- Scale Problems	7.5 hp	Second cycle

Year 2

Mandatory courses (15.0 Credits)

Code	Name	Credits	Edu. level
SF2524	Matrix Computations for Large-scale Systems	7.5 hp	Second cycle
SF2561	The Finite Element Method	7.5 hp	Second cycle

Track, Financial Mathematics (FMIA)

Year 1

Mandatory courses (7.5 Credits)

Code	Name	Credits	Edu. level
SF2701	Financial Mathematics, Basic Course	7.5 hp	Second cycle

Conditionally elective courses

Code	Name	Credits	Edu. level
SF2943	Time Series Analysis	7.5 hp	Second cycle
SF2950	Applied Mathematical Statistics	7.5 hp	Second cycle
SF2975	Financial Derivatives	7.5 hp	Second cycle

Supplementary information

Among the conditionally elective courses SF2943 or SF2950 + SF2975 or SF2980 has to be studied.

Year 2

Mandatory courses (7.5 Credits)

Code	Name	Credits	Edu. level
SF2942	Portfolio Theory and Risk Management	7.5 hp	Second cycle

Conditionally elective courses

Code	Name	Credits	Edu. level
SF2975	Financial Derivatives	7.5 hp	Second cycle
SF2980	Risk Management	7.5 hp	Second cycle

Supplementary information

Among the conditionally elective courses SF2943 or SF2950 and SF2975 or SF2980 has to be studied.

Track, Mathematical Statistics (MASA)

Year 1

Conditionally elective courses

Code	Name	Credits	Edu. level
SF2943	Time Series Analysis	7.5 hp	Second cycle
SF2950	Applied Mathematical Statistics	7.5 hp	Second cycle
SF2955	Computer Intensive Methods in Mathematical Statistics	7.5 hp	Second cycle
SF2970	Martingales and Stochastic Integrals	6.0 hp	Second cycle
SF2980	Risk Management	7.5 hp	Second cycle

Supplementary information

At least 3 of the conditionally elective courses on the track has to be studied.

Year 2

Conditionally elective courses

Code	Name	Credits	Edu. level
SF2935	Modern Methods of Statistical Learning	7.5 hp	Second cycle
SF2980	Risk Management	7.5 hp	Second cycle

Supplementary information

At least 3 of the conditionally elective courses on the track has to be studied.

Track, Optimization and Systems Theory (OPSA)

Year 1

Conditionally elective courses

Code	Name	Credits	Edu. level
SF2812	Applied Linear Optimization	7.5 hp	Second cycle
SF2822	Applied Nonlinear Optimization	7.5 hp	Second cycle
SF2832	Mathematical Systems Theory	7.5 hp	Second cycle
SF2842	Geometric Control Theory	7.5 hp	Second cycle
SF2852	Optimal Control Theory	7.5 hp	Second cycle
SF2863	Systems Engineering	7.5 hp	Second cycle

Supplementary information

At least 3 of the conditionally elective courses on the track has to be studied.

Year 2

Conditionally elective courses

Code	Name	Credits	Edu. level
SF2832	Mathematical Systems Theory	7.5 hp	Second cycle
SF2863	Systems Engineering	7.5 hp	Second cycle
SF2866	Applied Systems Engineering	7.5 hp	Second cycle

Supplementary information

At least 3 of the conditionally elective courses on the track has to be studied.



Appendix 2: Specialisations

Master's Programme, Applied and
Computational Mathematics (TTMAM)

Track, Computational Mathematics (COMA)

No information entered.

Track, Financial Mathematics (FMIA)

No information entered.

Track, Mathematical Statistics (MASA)

No information entered.

Track, Optimization and Systems Theory
(OPSA)

No information entered.