Linnæus University

Jnr: HL/2009-0153

Programme syllabus

Faculty Board of Science and Engineering
School of Computer Science, Physics and Mathematics

Matematikerprogrammet, 180 högskolepoäng
Applied Mathematics Programme, 180 credits

Level
First Level

Establishment of Programme
Established by Organisational Committee 2009-03-26

Date of Ratification
Approved by Organisational Committee 2009-09-15
The programme syllabus is valid from autumn semester 2010

Prerequisites
Basic eligibility for first-level studies as well as special eligibility requirement in Mathematics D or the equivalent. For the Engineering and Technology specialism, Physics B or the equivalent is also required.

Description of Programme

The Applied Mathematics Programme is a candidate programme with Mathematics as main subject and three directions: (1) Computer Science, (2) Technology, (3) Economics and Stochastics. An overarching thought is that the students shall get solid knowledge in mathematics and introductory knowledge in another subject. With the other subject the attractivity is even more increased at the labour market.

With the direction Computer Science, future employment may be for example in IT, banks and the Defence for handling of cryptized information. *The direction towards Computer Science can be completely studied in English*. Parts of that direction can be studied at Swedish.

With the direction Technology, future employment may be for example in the manufacturing industry for solving classical engineering problems, optimization problems and risk evaluations.

With the direction Economics and Stochastics, future employment may be for example in insurance companies, investment companies and banks for statistical analyses and insurance premium analyses but also in the pharmaceutical industry and health care for medical statistical planning or statistical investigations. The word stochastics is an established term that includes statistics and probability.

Objectives

Knowledge and understanding

For a Degree of Bachelor students must

- demonstrate knowledge and understanding in their main field of study, including knowledge of the scientific basis of the field, knowledge of applicable methods in the field, in-depth knowledge of some part of the field and a general sense of current research issues.
Skills and abilities

For a Degree of Bachelor students must
- demonstrate an ability to seek, gather and critically interpret information that is relevant to a problem and to critically discuss phenomena, issues and situations;
- demonstrate an ability to independently identify, formulate and solve problems and to perform tasks within specified time limits;
- demonstrate an ability to present and discuss information, problems and solutions in dialogue with different groups, orally and in writing; and
- demonstrate the skills required to work independently in the field that the education concerns.

Judgement and approach

For a Degree of Bachelor students must
- demonstrate an ability to make assessments in their main field of study, taking into account relevant scientific, social and ethical aspects;
- demonstrate insight into the role of knowledge in society and into people's responsibility for how knowledge is used; and
- demonstrate an ability to identify their need of further knowledge and to upgrade their capabilities.

Programme specific goals
Knowledge and understanding
For the degree of Bachelor, the student should:
- show knowledge and understanding within the main field of Mathematics and Applied Mathematics
Skills and ability
For the degree of Bachelor the student should:
• show the ability to critically and systematically integrate knowledge in Mathematics and Applied Mathematics and analyse Mathematical models in Computer Science, Technology / Physics, and Economics
• show the ability to critically, independently and creatively, identify problem issues within Computer Science, Economics or Technology / Physics and be able to build mathematical models for them
Judgement and Approach
For the degree of Bachelor, the student should
• show the ability within Mathematics and Applied Mathematics to make evaluations with respect to relevant scientific, social, and ethical aspects.

Content
Organisation

The programme is administered by the School of Computer Science, Physics and Mathematics. The main subject area is Mathematics. A programme director is appointed with overall responsibility for the programme in consultation with the students.

Programme Overwiew

The degree programme consists of 180 higher education credits and includes a final Bachelor's degree project dissertation consisting of 15 higher education credits .

The programme consists of three specialisms:
1. Computer Science
2. Engineering and Technology

3. Economics and Stochastics
The programme consists to a large part of Mathematics courses. An applied subject is linked to each specialism. The applications for the different specialisms are in Computer Science, Physics/ Engineering /Technology and Economics, respectively. The Mathematics courses in the various specialisms are chosen (in particular from among the intermediate and the specialized courses) so that the applied subjects are related. In the Economics and Stochastics specialism Mathematics courses are emphasized which stress stochastics.

During the first year the major studies are the basic principles of Mathematics in the form of algebra, vector geometry, analysis and modelling. During the 2nd and 3rd year studies in mathematics are more specialised to tie in with the applied subject. Courses in the applied subject occur with one or two exceptions during all three years of the programme. Students also have the opportunity to choose from among a number of courses in consultation with the programme director. The most extensive range of optional courses is in the last year.

During the programme, the progression of the students is followed up both concerning the individual courses and the whole programme, and the progression is evaluated against the aims for the learning outcomes.

Programme courses

Specialism Computer Science:

Year 1 (Autumn term)
• Basic Mathematics, 7.5 higher education credits (G1N) *
• Mathematical modelling 1, 7.5 higher education credits (G1N) *
• Vector geometry, 7.5 higher education credits (G1F) *
• Programming, 7.5 higher education credits (G1N)

Year 1 (Spring term)
• Calculus 1, 7.5 higher education credits (G1N) *
• Calculus 2, 7.5 higher education credits (G1F) *
• Programming and data structures, 7.5 higher education credits (G1N)
• Discrete Mathematics, 7.5 higher education credits (G1F) *

Year 2 (Autumn term)
• Probability theory and statistics, 7.5 higher education credits (G1F) *
• Computer graphics, 7.5 higher education credits (G1F)
• Numerical methods, 7.5 higher education credits (G1F)
• Optional course in Computer Science or Mathematics, 7.5 higher education credits

Year 2 (Spring term)
• Analysis of several variables, 7.5 higher education credits (G1F) *
• Linear algebra, 7.5 higher education credits (G1F) *
• Cryptography and coding theory, 7.5 higher education credits (G1F) *
• Algorithms and advanced data structures, 7.5 higher education credits (G1F)

Year 3 (Autumn term)
• Algebraic structures 1, 7.5 higher education credits (G2F) *
• Elementary number theory, 7.5 higher education credits (G2F) *
• Optional courses in computer science or mathematics, 15 higher education credits
Year 3 (Spring term)
• Computer graphics, 7.5 higher education credits (G2F)
• Optional course in Computer Science or Mathematics, 7.5 higher education credits
• Bachelor's degree dissertation project, 15 higher education credits (G2E) *
Specialism Engineering and Technology:

Year 1 (Autumn term)
• Basic Mathematics 1, 7.5 higher education credits (G1N) *
• Mathematical modelling 1, 7.5 higher education credits (G1N) *
• Vector geometry, 7.5 higher education credits (G1F) *
• Optional course in Physics, Electrical Engineering, or Mathematics, 7.5 higher education credits

Year 1 (Spring term)
• Calculus 1, 7.5 higher education credits (G1N) *
• Calculus 2, 7.5 higher education credits (G1F) *
• Mechanics, 7.5 higher education credits (G1N)
• Linear algebra, 7.5 higher education credits (G1F) *

Year 2 (Autumn term)
• Probability theory and statistics, 7.5 higher education credits (G1F) *
• Strength of materials, 7.5 higher education credits (G2F)
• Numerical methods, 7.5 higher education credits (G1F)
• Programming, 7.5 higher education credits (G1F)

Year 2 (Spring term)
• Analysis of several variables, 7.5 higher education credits (G1F) *
• Vector analysis, 7.5 higher education credits (G1F) *
• Fourier analysis, 7.5 higher education credits (G1F) *
• Optional course in Physics, Electrical Engineering, or Mathematics, 7.5 higher education credits

Year 3 (Autumn term)
• Ordinary differential equations, 7.5 higher education credits (G2F) *
• Partial differential equations, 7.5 higher education credits (G2F) *
• Finite element methods, 7.5 higher education credits (G2F)
• Optional course in Physics, Electrical Engineering, or Mathematics, 7.5 higher education credits

Year 3 (Spring term)
• Optional course in physics, electrical engineering, or mathematics, 15 higher education credits
• Bachelor's degree dissertation, 15 higher education credits (G2E)
Specialism Economics and Stochastics:

Year 1 (Autumn term)
• Basic Mathematics 1, 7.5 higher education credits (G1N) *
• Mathematical modelling 1, 7.5 higher education credits (G1N) *
• Vector geometry, 7.5 higher education credits (G1F) *
• Programming, 7.5 higher education credits (G1N)

Year 1 (Spring term)
• Calculus 1, 7.5 higher education credits (G1N) *
• Calculus 2, 7.5 higher education credits (G1F) *
• Linear algebra, 7.5 higher education credits (G1F) *
• Discrete Mathematics, 7.5 higher education credits (G1F) *

Year 2 (Autumn term)
• Probability theory and statistics, 7.5 higher education credits (G1F) *
• Optimization methods, 7.5 higher education credits (G1F) *
• Numerical methods, 7.5 higher education credits (G1F)
• Stochastic processes, 7.5 higher education credits (G1F) *

Year 2 (Spring term)
• Analysis of several variables, 7.5 higher education credits (G1F) *

• Linear statistical models, 7.5 higher education credits (G1F) *
• Micro economics, 15 higher education credits (G1N)

Year 3 (Autumn term)
• Ordinary differential equations, 7.5 higher education credits (G2F) *
• Partial differential equations, 7.5 higher education credits (G2F) *
• Optional course in Economics, 7.5 higher education credits
• Optional course in Economics or Mathematics, 7.5 higher education credits

Year 3 (Spring term)
• Statistics, continuation, 7.5 higher education credits (G2F) *
• Optional course in Economics or Mathematics, 7.5 higher education credits
• Bachelor's degree dissertation project, 15 higher education credits (G2E) *

*=main field course.

Community contacts

All students have opportunities to develop contacts with local trade and industrial representatives. These contacts are in the form of educational visits, projects, seminars etc. The main contact is through the concluding Bachelor's degree dissertation project which for many students will be a bridge for a career in trade and industry.

Studies abroad

Following consultation with the programme director, part of the programme can be pursued at university abroad.

Scope of the programme

On the basis of examples, assignments and the degree dissertation project, students' awareness of sustainable development, gender, equality and diversity and internationalization will be raised. Mathematics is in particularly suitable subject for internationalization. Mathematics is an international language.

Quality Development

The students are involved both in programme evaluations and course evaluations. The programme director regularly meets students to discuss courses and assist in the choice of optional courses. Compilations of course evaluations and programme evaluations will be archived by the department.

Degree Certificate

After completing programme studies, corresponding to the requirements expressed in the Higher Education Ordinance (Degree Ordinance) as well as the Linnaeus University local Degree Ordinance, the student may apply for a degree. Students who have completed the Applied Mathematics Programme may, depending on the programme direction, obtain the following degree:

Filosofie kandidatexamen
Huvudområde: Matematik
Inriktning: Datavetenskap
Bachelor of Science
Main field of study: Mathematics
Specialization: Computer Science

Filosofie kandidatexamen
Huvudområde: Matematik
Inriktning: Teknik
Bachelor of Science
Main field of study: Mathematics
Specialization: Technology

Filosofie kandidatexamen
Huvudområde: Matematik
Inriktning: Ekonomi och stokastik
Bachelor of Science
Main field of study: Mathematics
Specialization: Economics and Stochastics

The degree certificate is bilingual (Swedish/English). The Degree Certificate is accompanied by a Diploma Supplement (English).

Other Information

The specialism in Computer Science can be completely studied in English. Parts of that specialism can be studied in Swedish.

For the optional courses in Physics and Electrical Engineering, Physics B or the equivalent is required.