



## FACULTY OF SCIENCE

Programme sheet

# Master Programme in Computational Science, Scientific Computing, 120 credits

*September 2024 – June 2026*

**Computations are becoming more and more important in research and industry. To make predictions, analysis or to replace experiments, we make use of numerical simulations and machine learning on large computers. We generate and store large amounts of data and use data science to search for patterns, connections, and trends.**

The Master Programme in Computational Science with specialisation in Scientific Computing will give you detailed knowledge about the underlying methods. You will learn how to study complex processes in natural sciences, and how Computational Science can contribute to knowledge evolution in society. A few of many examples are studies in, and research on, environment and climate change, design of new jet fuels and super novae. The programme will prepare you for a professional career in academia as well as in business and industry.

### Programme overview

This interdisciplinary education will give you leading edge knowledge in the field of computational science. The specialisation has students with a background in mathematics/physics and an interest in mathematics and programming, but also applications in natural sciences, as a target group. In addition to knowledge in theory for computational science, strong emphasis is placed on obtaining knowledge about the practical tools that are used by professionals in the field and you will amongst several things train your skills in programming. You will get generic knowledge and skills of importance for computationally intensive working tasks, such as problem

formulation, information search, data processing, scientific writing and presentation techniques.

The programme has three separate specialisations: Geoscience, Physics and Scientific Computing. You will study several courses together with students from another specialisation than your own and there will be opportunities to do common projects and thesis work. During your studies, an interdisciplinary perspective is emphasized and you will also study together with students from biology, geology, environmental sciences, physical geography and chemistry.

The education has a strong connection to research. You will meet and be taught by active and internationally well recognised researchers, and you will be in contact with several research groups. You will at the same time be prepared for a career in business and industry.

## Programme structure

Scientific Computing is a branch within computational science where analytical, numerical and statistical methods are used to analyse and draw conclusions from physical models, as well as huge datasets from physics experiments. The programme contains a mix of courses in physics, mathematics and computational science that will give you broad knowledge in numerical methods within data science, Monte-Carlo simulations and solutions to differential equations. You will also get insight into the interplay between computational methods and the underlying physical phenomena and models that are studied.

### Compulsory courses 30 credits

<a href="#"><u>BERN01</u></a>	Modelling in Computational Science 7.5 credits
<a href="#"><u>MASC14</u></a>	Stationary Stochastic Processes, 7.5 hp
<a href="#"><u>MASM11</u></a>	Monte Carlo Methods for Statistical Inference, 7.5 credits
<a href="#"><u>NUMN32</u></a>	Numerical Methods for Differential Equations, 7.5 credits

### Alternative-compulsory (elective) courses 37.5 credits

Alternative-compulsory (elective) courses 37.5 credits, of which 15 credits in computational science or numerical analysis (see list below), 7.5 credits in statistics (see list below) and 15 credits in natural science or computer science.

**At least two of the following courses:**

- [NUMN19](#) Approximation theory 7.5 credits  
[NUMN21](#) Advanced Course in Numerical Algorithms with Python/SciPy, 7.5 credits  
[NUMN26](#) Simulation Tools 7.5 credits  
[NUMN28](#) Numerical Simulations of Flow Problems, 7.5 credits  
[BERN04](#) Introduction to Artificial Neural Networks and Deep Learning, 7.5 credits

**At least one of the following courses:**

- [MASC13](#) Markov Processes, 7.5 credits  
[MASM15](#) Statistical modelling of extreme values, 7.5 credits  
[MASM17](#) Time Series Analysis 7.5 credits  
[MASM25](#) Spatial Statistics with Image Analysis 7.5 credits  
[MASM26](#) Stationary and non-stationary Spectral analysis 7.5 credits  
[MASM27](#) Nonparameteric Inferens 7.5 credits  
[MASM22](#) Linear and Logistic Regression, 7.5 credits  
[BERN02](#) Reproducible Data Science and Statistical Learning, 7.5 credits

**Optional courses 22.5 credits**

The optional courses are to be chosen from computational science, mathematics, numerical analysis and mathematical statistics.

**Degree project 30 credits**

- [BERM01](#) Degree project Master of Science in Computational Science, 30 credits

*Table 1 Course of study, example*

Year 1	Autumn 1	Autumn 2	Spring 1	Spring 2
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	<b>BERN01</b> Modelling in Computational Science, 7.5 credits	<b>NUMN32</b> Numerical Methods for Differential Equations, 7.5 credits	<b>MASM11</b> Monte Carlo Methods for Statistical Inference, 7.5 credits	NUMN28 Numerical Simulations of Flow Problems, 7.5 credits
	<b>MASC14</b> Stationary Stochastic Processes, 7.5 credits	BERN04 Introduction to Artificial Neural Networks and Deep Learning, 7.5 credits	NUMN26 Simulation Tools, 7.5 credits	MASM15 Statistical Modelling of Extreme Values, 7.5 credits
<b>Year 2</b>	<b>Autumn 1</b>	<b>Autumn 2</b>	<b>Spring 1</b>	<b>Spring 2</b>
	Course in other subject within Natural Science or in Computer Science, 7.5 credits	MATC51 Optimization, 7.5 credits	<b>Degree project Master of Science, 30 credits</b>	
	NUMN21 Advanced Course in Numerical Algorithms with Python/SciPy, 7.5 credits	Course in other subject within Natural Science or in Computer Science, 7.5 credits		

## Career opportunities

After graduation, there are several different career paths depending on which subject profile you have chosen. The Master's programme gives you a solid ground for postgraduate education in natural sciences. You can also choose a career path outside academia and then find attractive jobs in areas where there is a need to solve computational problems both in industry and in public administration and other organisations.

## Requirements and selection

### Entry requirements

Bachelor's degree in Physics of at least 180 credits.

Proficiency in English equivalent to English 6/B from Swedish upper-secondary school.

*or*

Bachelor's degree of at least 180 credits in Science or Engineering. The degree must contain at least 30 credits mathematics, of which 6 credits in programming and 7.5 credits in statistics, and an additional 60 credits in mathematics and/or physics. The degree must contain at least 15 credits in a natural science (not mathematics) or in computer science.

Proficiency in English equivalent to English 6/B from Swedish upper-secondary school.

### **Selection criteria**

Based on grades awarded for previous academic courses, with majors in science, technology and mathematics, as well as a statement of purpose for the application in which applicants state their goals with the programme (from the applicant's "Summary sheet").

## **Degree**

### **Master of Science**

Major: Computational Science with specialisation in Scientific Computing

### **Naturvetenskaplig masterexamen**

Huvudområde: Beräkningsvetenskap med fördjupning i beräkningsmatematik

## **Application**

Apply online using [Universityadmissions.se](https://universityadmissions.se)

Application period: 16 October 2023 - 15 January 2024

Language of instruction: English

## **Contact**

Master coordinator Robert Klöfkorn [compsci@math.lu.se](mailto:compsci@math.lu.se)