Studies Plan

Qualification Objectives

Education within the Master's Program of Mathematics is aimed at qualifying students for professional activity in economy (in particular at banks, insurance companies, and consulting companies), industry (in particular in the area of simulation or interpretation of simulation results and in the area of software production for various needs), as well as for a scientific career (doctorate) in mathematics, engineering and natural sciences or economics. Research-based education prepares graduates for life-long learning.

Scientific Core Competencies

Graduates possess extended and in-depth knowledge in mathematics and, if applicable, in a complementary subject (Ergänzungsfach) that can be chosen freely. They are able to analyze and explain current, complex issues in these areas. They know the main mathematical disciplines (areas), their methodological approaches, and their mutual relationships. Graduates are able to define, describe, and interpret the specifics, limits, and terminologies in the areas chosen, to present the state of the art, and to further develop certain aspects of it.

Transferable Skills

Graduates can analyze topics from various perspectives. They can select and combine appropriate action alternatives for research-relevant topics. They can transfer and apply these approaches to specific problems. They can study in a differentiated manner complex problems and information as well as current requirements. They can analyze, compare, and evaluate them using suitable methods and concepts. Doing this, they estimate the complexity and risks, identify improvement potentials, and choose sustainable solution and improvement methods. As a result, they are in a position to make responsible and scientifically substantiated decisions. Scientific knowledge is used across disciplines taking into account social, scientific, and ethical findings. Graduates develop innovative ideas and can implement them. They can pursue these approaches either independently or in international teams. They are able to explain and discuss their decisions. They can also exchange opinions on a scientific level with representatives of their subject. They are in a position to interpret, validate, and illustrate the findings obtained. In particular, they can easily handle electronic media. Graduates are in a position to implement strategies for life-long learning and have developed pronounced stamina.

Learning Results

Graduates can name, explain, and independently apply specialized mathematical methods. They have an in-depth understanding of mathematical methods from at least two of the four areas of Algebra und Geometrie (algebra and geometry), Analysis (analysis), Angewandte und Numerische Mathematik (applied and numerical mathematics), and Stochastik (stochastics).

Depending on the subject, graduates have vast knowledge of special mathematical models and methods. This enables them to analyze complex and innovative problems in the respective area and to assess the results.

Organization of Studies

The study program is divided into subjects, the subjects are divided into modules, and the modules are divided into courses, with most modules consisting of a lecture (with or without exercise) or a seminar. Every module is completed by a control of success. The average work expenditure is measured in credits. Generally, modules are graded. Exceptions are e.g. seminar modules that may only be passed or failed. The master's thesis is a module of its own with 30 credits. In total, 120 credits have to be acquired within the Master's Program. These credits are to be distributed about homogeneously over four semesters.

Subjects, Areas, and Modules

The modules offered in the subjects are assigned to one of these **four mathematical areas**:

+ *Algebra und Geometrie (algebra and geometry),*

+ *Analysis (analysis),*

+ *Angewandte und Numerische Mathematik (applied and numerical mathematics),*

+ *Stochastik (stochastics).*

As a rule, no requirement is made as regards individual modules for the master's examination. However, in subject 1 "Mathematische Methoden 1" (mathematical methods 1), 24 credits have to be acquired in one of the four mathematical areas and in subject 2 "Mathematische Methoden 2" (mathematical methods 2), 16 credits have to be acquired in a second of the four areas. At least one of the areas chosen in these subjects must be *Algebra und Geometrie (algebra and geometry)* or *Analysis (analysis)*. Only lecture modules and no seminars are permitted in both subjects.

In subject 3 "Ergänzungsfach" (complementary subject), modules in the total amount of 16 to 24 credits have to be passed. These modules have to be chosen either in one of the two mathematical areas not chosen in subject 1 and subject 2 or in one of the subjects of *Informatik (informatics),*

Physik (physics), Wirtschaftswissenschaften (economics), Maschinenbau (mechanical engineering)* or *Elektrotechnik (electrical engineering)*. Other subjects may be approved by the examination committee. If the modules are chosen from one of the mathematical areas, no seminars are permitted. The modules from informatics, physics, economics, mechanical engineering, or electrical engineering and information technology are offered by the respective Departments of Informatics, Physics, Economics, Mechanical Engineering or Electrical Engineering and Information Technology. It is possible to choose modules from the master's program and the advanced bachelor's program of the respective department. The modules permitted are listed in the module manual, others may be permitted by the examination committee. For some modules, registration for examination is possible only, if certain admission requirements specified in the module manual are met. It is strongly recommended to discuss the planned course of studies in the complementary subject with the subject's study advisor, if no mathematical area is chosen as a complementary subject.

In subject 4 "Mathematisches Seminar" (mathematical seminar), two seminars of 3 credits each are required to obtain the necessary 6 credits as ungraded coursework.

In subject 5 "Mathematische Vertiefung" (mathematical specialization), modules in the amount of 14 to 22 credits have to be passed. The modules permitted in the above four mathematical areas are listed in the module manual. At the maximum, one ungraded seminar (with 3 credits) may be credited.

The credits of the modules passed in the subjects of "Ergänzungsfach" (complementary subject) and "Mathematische Vertiefung" (mathematical specialization) must total 38 at least.

Subject 6 "Überfachliche Qualifikation" (transferable skills) covers the additive acquisition of transferable skills in the amount of 6 credits (see Section 2.6). The attended courses may be graded or not graded. In any case, the grade will not be considered when calculating the total grade of the master's examination.

+ Subject 1: Mathematische Methoden 1 (mathematical methods 1) (24 credits)

+ Subject 2: Mathematische Methoden 2 (mathematical methods 2) (16 credits)

+ Subject 3: Ergänzungsfach (complementary subject) (16 – 24 credits)

+ Subject 4: Mathematisches Seminar (mathematical seminar) (6 credits)

+ Subject 5: Mathematische Vertiefung (mathematical specialization) (14 – 22 credits)

+ Subject 6: Überfachliche Qualifikation (transferable skills) (6 credits)

+ Master's thesis (30 credits)