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Appendices for the Bachelor's degree programme(s) in Applied Mathematics

2025-2026

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Appendix I Learning outcomes of the Bachelor's degree programme (Article 3.1)

Objectives of BSc Applied Mathematics

As a consequence of the ongoing automation of society and the technological innovations that go along with this, the call of our society for mathematics is growing. Underneath virtually every form of automation lies a mathematical concept or model. In order to be able to respond to this development in society, it is important that mathematics is utilised in a proper and effective way. This requires that society has access to sufficiently many well qualified and highly trained (applied) mathematicians.

The Bachelor's degree programme in Applied Mathematics aims to impart knowledge, skills, understanding and an academic attitude in the field of applied mathematics by means of a broadly based curriculum such that Bachelor's graduates are able to pursue an independent career as independent professionals and are also qualified for further training to become academic researchers in the field.

The Bachelor's graduate must be able to progress to the follow-on Master's degree programme in Applied Mathematics. Graduates of the Bachelor's degree programme in Applied Mathematics should also be able to take the Master's degree programme in Mathematics or in Education and Communication.

Learning outcomes BSc Applied Mathematics

The above aim has been translated into a set of learning outcomes which consists of generic learning outcomes complemented with specific learning outcomes with respect to both Knowledge and Skills.

A. Generic learning outcomes – Knowledge

Bachelor's graduates in Applied Mathematics:

A1. have general knowledge of the foundations and principal branches of (applied) mathematics.

A2. have mastered the basic concepts of applied mathematics (see Appendix I for further specification) to a certain extent and are familiar with the interrelationships of these concepts within mathematics and applied mathematics as well as with other disciplines (e.g. in science and engineering).

A3. have in-depth knowledge of several current topics within applied mathematics.

A4. are familiar with the quantitative character of applied mathematics and have an understanding of the mathematical methods used in various areas of application, particularly including computer-aided methods.

A5. have sufficient knowledge and understanding of applied mathematics to successfully complete a follow-up Master's degree programme in Applied Mathematics.

A6. are aware of the societal, ethical and social aspects involved in the field of applied mathematics.

B. Generic learning outcomes – Skills

Bachelor's graduates in Applied Mathematics:

B1 (Research) are able to draw up a research question, design, plan and conduct research and report on it independently with a certain degree of supervision and to evaluate the value and limitations of their research and assess its applicability outside their own field. See Appendix II for further specification.

B2 (Designing and Modelling) are able to translate a problem, in particular a design problem, into a plan of approach and – taking into account requirements and/or technical preconditions – find a solution.

B3 (Gathering information) are able to gather relevant information using modern means of communication and to critically interpret this information.

B4 (Collaborating) are able to collaborate in teams on technical-scientific problems, are able to work on (interdisciplinary) projects, taking responsibility for their (mathematical) contributions.

B5 (Communicating) are able to communicate orally and in writing in academic and professional contexts, in English, and are able to interact with mathematicians as well as scientists and engineers. They are familiar with the relevant means of communication.

B6 (Reflecting) are able to assess their own actions and those of others in a natural sciences and engineering context, bearing in mind the social/societal and ethical aspects.

B7 (Learning skills) are able to apply learning skills that enable them to pursue a follow-up degree and acquire knowledge in new fields with a high level of autonomy.

Appendix I Specified basic knowledge related learning outcomes

Bachelor's graduates in Applied Mathematics:

1.1. have mastered the basic concepts and techniques of mathematics, in particular single and multivariable calculus, linear algebra, analysis, ordinary differential equations, probability theory, statistics and algebra.
1.2. have knowledge of more advanced subjects within the fields of applied analysis, numerical mathematics, dynamical systems and systems theory.
1.3. have knowledge of more advanced topics in the fields of Computational Mathematics, and Systems and Control.
1.4. have gained knowledge of and experience in the 'heart' of mathematics, i.e., the truth and value of exact mathematical proof.
1.5. have knowledge of basic sciences at a level necessary to apply mathematical methods, and are aware of the wider multidisciplinary context of science and engineering
1.6. are able to use mathematical software packages in an effective way or, if necessary, modify programs themselves.

Appendix II Specified skills related learning outcomes

Bachelor's graduates in Applied Mathematics:

Research

2.1 have an academic attitude, which means they are curious, critical, creative and dare to show initiative.

2.2 are able to formulate (relatively simple) problems in the mathematical language, pose relevant mathematical questions and address them in an exact way, and if necessary, adapt the problem to make it mathematically tractable.

2.3 are able to articulate assumptions, understand the importance of detailed definitions, and are able to think in an organised way, to apply exact logical arguments when solving problems, and to generalise and abstract.

2.4 are able to model, analyse and abstract simple problems that are outside the scope of their own study programme and to independently acquire new knowledge to this end.

Designing and modelling

2.5 are able, under supervision and from the perspective of their field of interest, to translate a problem into a relevant mathematical problem definition and to this end formulate and evaluate a solution based on source research.

2.6 are able to formulate concrete problems from application areas as mathematical problems, and are able to discuss the assumptions underlying their mathematical model.

2.7 are able to approach mathematical problems on the basis of a certain logical system and with determination to find the right method of approach and are aware of the limitations of the chosen method.

2.8 are aware of the importance of researching specific cases and examples and have the attitude and skills necessary to critically evaluate the solutions found, test them for correctness and interpret them.

2.9 are able, by abstracting and modelling, to delve into the root of a problem and determine whether existing methods can be applied or new methods must be developed.

2.10 are able to conduct searches of literature, to critically use scientific databases and other sources of information, or to consult specialists to carry out numerical simulations and mathematical analysis in order to study problems in science and engineering.

Appendix II Majors and Minors of the degree programme (Article 3.7 and 7.1.3)

The degree programme has the following Major:

- Applied Mathematics (165 ECTS)

The degree programme has the following choices in Minors (15 ECTS):

- The first half of the Minor Mathematics (see the TER of the degree programme Mathematics)
- Faculty-wide deepening minors
- University-wide broadening minors
- Personal minor, based on an individual choice of course units to be approved by the Board of Examiners; the minor must be coherent and of sufficient level.

In addition, the programme offers the option of a Minor Abroad (30 ECTS) or an Education Minor (30 ECTS). Students who take a Minor Abroad or an Education Minor follow 150 ECTS from the major programme instead of 165 ECTS; see Appendix IV for details.

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Appendix III Course units in the first year of the degree programme

- **List of course units (Article 4.1.1)**
- **Compulsory order of examinations (Article 9.3)**

First year degree programme Applied Mathematics
The first year of the Bachelor's degree programme in Applied Mathematics comprises a compulsory programme of 60 ECTS.

Course unit name	**Course code**	**ECTS**	**Entry requirements**
Calculus 1	WBMA003-05	5	
Linear Algebra 1	WBMA020-05	5	
Sets and Numbers	WBMA051-05	5	
Analysis	WBMA012-05	5	
Introduction to Graph Theory	WBMA052-05	5	
Calculus 2	WBMA029-05	5	
Scientific Programming	WBMA053-05	5	
Linear Algebra 2	WBMA035-05	5	
Mechanics and Relativity for Mathematicians	WBMA060-05	5	
Linear Systems	WBMA043-05	5	
Probability Theory	WBMA046-05	5	
One out of: - First-year Project Mathematics - First-year Project Applied Mathematics	 WBMA041-05 WBMA040-05	5	

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Appendix IV Course units in the second and third year

- **List of course units (Article 7.1.1)**
- **Compulsory order of examinations (Article 9.3)**

Second and third year Bachelor's programme in Applied Mathematics
The second and third year of the programme consist of a major (105 ECTS) and a minor (15 ECTS).

Compulsory major courses

Course unit name	Course code	ECTS	Entry requirements
Metric and Topological Spaces	WBMA036-05	5	
Statistics	WBMA009-05	5	
Introduction to Optimization	WBMA054-05	5	
Complex Analysis	WBMA018-05	5	
Multivariable Analysis	WBMA022-05	5	
Differential Equations in Science and Engineering	WBMA061-05	5	
Functional Analysis	WBMA033-05	5	
Numerical Analysis	WBMA062-05	5	
Partial Differential Equations	WBMA008-05	5	
Mathematical Modelling	WBMA007-05	5	
Computational Methods of Science	WBMA004-05	5	
Two out of: - Project Mathematical Modelling - Project Systems Theory - Project Statistical Reasoning (25/26)	 WBMA055-05 WBMA027-05 WBMA038-05	10	
Two out of: - Numerical Linear Algebra - Advanced Systems Theory - Statistical Modelling	 WBMA063-05 WBMA001-05 WBMA028-05	10	
Mathematics & Society: Ethical and Professional Aspects	WBMA049-05	5	
Elective (see optional course units below)		5	
Preparation Bachelor's Project	WBMA056-05	5	
Bachelor's Project Applied Mathematics	WBMA901-15	15	Passed 150 ECTS of the Degree programme in Applied Mathematics, including Preparation Bachelor's Project. Approval of the study programme by the BOE,

			approval of Career Portfolio and enrolment Bachelor's Project Applied Mathematics in Progress.

Minor space
The degree programme has the following choices in minors (15 ECTS):

- Courses from the Minor Mathematics (see the TER of the Bachelor's programme Mathematics), provided that these courses are not already part of the student's programme
- Faculty-wide deepening minors
- University-wide broadening minors
- Personal minor, based on an individual choice of course units to be approved by the Board of Examiners

In addition, the programme offers the option of a Minor Abroad (30 ECTS), the contents of which must be approved by the Board of Examiners, or an Education Minor (30 ECTS). Students who take a Minor Abroad or an Education Minor do not have to take the following courses from the degree programme Applied Mathematics (15 ECTS):

Course unit name
One elective (see optional course units below) Two out of: - Numerical Linear Algebra - Advanced Systems Theory - Statistical Modelling

Elective courses from Applied Mathematics
Elective course units can be chosen from the second and third year courses of the Bachelor's programme in Applied Mathematics as long as they are not otherwise part of the student's programme.

Course unit name	**Course code**	**ECTS**	**Entry requirements**
Numerical Linear Algebra	WBMA063-05	5	
Advanced System Theory	WBMA001-05	5	
Statistical Modelling	WBMA028-05	5	

Elective courses from Mathematics
Elective course units can be chosen from the second and third year courses of the Bachelor's programme in Mathematics as long as they are not already part of the student's programme.

Course unit name	Course code	ECTS	Entry requirements
Geometry	WBMA034-05	5	
Group Theory	WBMA005-05	5	
Introduction to Coding Theory (25/26)	WBMA065-05	5	
Dynamical Systems	WBMA031-05	5	
Project Chaos Theory (26/27)	WBMA025-05	5	
Algebraic Structures	WBMA039-05	5	
Analysis on Manifolds	WBMA013-05	5	
Advanced Algebraic Structures	WBMA011-05	5	
Discrete Mathematics	WBMA019-05	5	
Probability and Measure	WBMA024-05	5	
Stochastic Processes	WBMA048-05	5	
Project Statistical Reasoning (25/26)	WBMA038-05	5	
Project Number Theory	WBMA064-05	5	
Percolation Theory	WBMA059-05	5	
Algebraic Topology	WBMA058-05	5	

Elective courses from other degree programmes

Course unit name	Course code	ECTS	Entry requirements
One out of: - Functional Programming - C++ fundamentals	 WBCS002-05 WBCS033-05	 5 5	
One out of: - Object-Oriented Programming (for CS) - Object-Oriented Programming (for AI)	 WBCS028-05 WBAI045-05	 5 5	
Programming in C++	WBCS034-05	5	
Mechatronics	WBIE011-05	5	
Fundamentals of Electronics	WBPH070-05	5	
Astrophysical Hydrodynamics	WBAS011-05	5	
Physics of Fluids	WBPH042-05	5	
One out of: - Oriëntatie op Onderwijs in de Bètawetenschappen (in Dutch) - Introduction to Science Communication	 WBEC002-05 WBEC001-05	5	

Appendix V Contact hours (Article 3.6)

Degree programme year 1	
Structure contact hours	**Contact hours per year**
Lectures	352
Tutorials	320
Practicals	24
Computer practicals	32
Study support/mentor groups	70
Supervision during an internship	
Examinations	50
Misc. contact hours (seminars and symposia)	20

Degree programme year 2 and 3	
Structure contact hours	**Contact hours per year**
Lectures	384
Tutorials	384
Practicals	48
Computer practicals	64
Study support/mentor groups	
Supervision during an internship	
Examinations	40
Misc. contact hours (seminars and symposia)	20

Note: contact hours in year 2 and 3 might deviate from the table above due to choices of the Minor and elective courses.

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Appendix VI Additional Requirements Open Degree Programmes (Art. 7.3)

Students wishing to pursue an open degree programme may file a request with the Board of Examiners. An Open Degree Programme must always be approved in advance by the Board of Examiners. The Board of Examiners will evaluate whether the proposed curriculum meets the learning outcomes of the degree programme and can determine further conditions in their rules and regulations.

The Open Degree Programme in Applied Mathematics must include all the compulsory course units of year 1 (see appendix III) and the-following course units from year 2 and 3:

Course unit name	**Course code**	**ECTS**	**Entry requirements**
Two out of: - Project Mathematical Modelling - Project Systems Theory - Project Statistical Reasoning (25/26)	 WBMA055-05 WBMA027-05 WBMA038-05	10	
Differential Equations in Science and Engineering	WBMA061-05	5	
Functional Analysis	WBMA033-05	5	
Numerical Analysis	WBMA062-05	5	
Partial Differential Equations	WBMA008-05	5	
Mathematical Modelling	WBMA007-05	5	
Mathematics & Society: Ethical and Professional Aspects	WBMA049-05	5	
Introduction to Optimization	WBMA054-05	5	
Two out of: - Computational Methods of Science - Numerical Linear Algebra - Advanced Systems Theory - Statistical Modelling	 WBMA004-05 WBMA063-05 WBMA001-05 WBMA028-05	10	
Preparation Bachelor's Project	WBMA056-05	5	
Bachelor's Project Applied Mathematics	WBMA901-15	15	Passed 150 ECTS of the Open Degree programme in Applied Mathematics, including Preparation Bachelor's Project. Approval of the study programme by the BOE, approval of Career Portfolio and enrolment

			Bachelor's Project Applied Mathematics in Progress.

Appendix VII Transitional provisions (article 12.1)

Since the TER for this academic year is applicable to all students registered in the Bachelor's degree programme in Applied Mathematics, regardless of the starting date of students, transitional provisions are in place. Students who have already completed a discontinued course are excluded from taking the respective replacement course.

Discontinued elective courses
The course Philosophy of Science (FI180WET) is no longer offered by the Faculty of Philosophy from academic year 2024-2025 onwards. Students who passed this course before 1 September 2024 may still include this course as an elective in their programme. The course has been replaced by Philosophy of Mathematics (FI213BK).

For cohort 2023-2024 and earlier
In 2024-2025, the courses Mechanics and Relativity for Mathematicians and Calculus 2 will be scheduled in different blocks. As a result of this change, there is no longer the possibility to choose the course Introduction to Logic as an elective. Students from the cohort 2023-2024 and earlier may replace a discontinued course according to the table below, provided the discontinued course was passed before September 1, 2024.

In 2025-2026 the courses Numerical Mathematics 1 and 2 will be changed into the new courses Numerical Analysis and Numerical Linear Algebra, respectively. In 2025-2026 the course Project Security and Coding will be replaced by Introduction to Coding Theory. In 2025-2026 the course Elementary Number Theory will be replaced by Project Number Theory. Students from the cohort 2023-2024 and earlier may replace a discontinued course according to the table below, provided the discontinued course was passed before September 1, 2025.

Old course	New course
Introduction to Logic	Mechanics and Relativity for Mathematicians
Numerical Mathematics 1	Numerical Analysis
Numerical Mathematics 2	Numerical Linear Algebra
Project Security and Coding	Introduction to Coding Theory
Elementary Number Theory	Project Number Theory
Philosophy of Science	Philosophy of Mathematics

In 2024-2025, the compulsory deepening minor of 30 ECTS has been replaced by a more flexible minor space of 15 ECTS. In addition, the courses Dynamical Systems and Group Theory are no longer mandatory in the Bachelor's programme Applied Mathematics, but they still can be taken as elective courses. Students from the cohort 2022-2023 and earlier who already passed these courses before 1 September 2024, can add these courses to a personal minor together with one extra elective that is not already a part of the student's programme.

For cohort 2021-2022 and earlier
In 2022-2023, three new compulsory course units were introduced in the first year: Sets and Numbers, Scientific Programming and Introduction to Graph Theory. In addition, the elective course Mechanics and Relativity for Mathematicians was introduced. Four courses (Kaleidoscope Mathematics, Mechanics and Relativity 1, Mechanics and Relativity 2 and Computer-Aided Problem Solving) were discontinued. Students from the cohort 2021-2022 and earlier may replace a discontinued course according to the table below, provided the discontinued course was passed before September 1, 2022.

Old Course	New Course
Kaleidoscope Mathematics	Sets and Numbers
Mechanics and Relativity 1	Introduction to Graph Theory
Mechanics and Relativity 2	Mechanics and Relativity for Mathematicians
Computer-Aided Problem Solving	Scientific Programming

In the second and third year, the following substitutions are allowed, provided the discontinued course is passed before September 1, 2022.

Old Course	New Course
Fluid Dynamics	Differential Equations in Science and Engineering
Bachelor's Workgroup Mathematics	Preparation Bachelor's Project
Calculus of Variation and Optimal Control	Introduction to Optimization
Project Modelling	Project Mathematical Modelling
Imperative Programming	Functional Programming or C++ Fundamentals

See also the transitional provisions in the appendices TER of previous years. For information on transitional provisions for courses offered by other degree programmes, see also the Teaching and Examination Regulations of the corresponding programme.