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UNIVERSITÄT KLAGENFURT

Curriculum

for the Master's degree programme in Mathematics

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Curriculum for the Master's degree programme in *Mathematics*

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Section 1 General

(1) The Master's degree programme in Mathematics is equivalent to 120 ECTS credits. This equates to an anticipated study duration of four semesters. The Master's degree programme in Mathematics is assigned to the group of engineering science programmes of study pursuant to Section 54 (1) of the Universities Act 2002 (UG).

(2) The workload for the individual course units is indicated in ECTS credits; the workload for one year should amount to 1,500 hours, for which 60 ECTS credits are awarded (Section 54 (2) UG). The workload comprises independent study as well as the semester hours/contact hours, including participation in assessment procedures.

(3) The Master's degree programme in Mathematics is taught in English.

Section 2 Competency profile

The competency profile describes the academic and professional qualifications that students gain by completing the degree programme.

The Master's degree programme in Mathematics builds on the Bachelor's degree programme in Technical Mathematics or a comparable Bachelor's degree programme and deepens students' knowledge and understanding of (applied) mathematics and statistics.

The research-informed degree programme provides students with the skills they need to pursue careers in technology, management and business, for which it is increasingly necessary to master a wide range of mathematical methods. The Master's degree programme also equips students to work in the areas of science and research.

A key learning objective of the Master's degree programme is for students to develop wide and sound knowledge of mathematical methods and tools. Graduates are able to comprehend the formal and mathematical structures of problems in practice and to use mathematical modelling to devise problem-solving strategies. They are also capable of applying and developing the problem-solving strategies and algorithms learnt during the Master's degree programme.

The Master's degree programme gives students the choice to specialise in the following three fields:

Applied Analysis

Applied Statistics

Discrete Mathematics

Before specialising, all students cover the fundamental aspects of all three fields.

A key element of the application-oriented course content is a work placement lasting several weeks in an Austrian or international business, a public administrative office, a

non-profit organisation or a non-university or university research institution, giving students the chance to try out and apply the skills they have gained.

The opportunity to study the extension elective Informatics and Information and Communications Engineering gives mathematicians educated at the University of Klagenfurt an additional application-oriented qualification. This provides graduates with an introduction to interdisciplinary collaboration in the technical subjects offered at the University of Klagenfurt. The actual opportunities for interdisciplinary cooperation open to graduates on completion of the Master's degree programme in Mathematics is much wider and ranges from technology to natural and biological sciences and the economic and financial sector.

This course gives graduates the sound skills needed to pursue a career in the finance and insurance industry, technology companies, consulting, the medical and pharmaceutical industry and in research and post-secondary educational institutions. The strong practical component of the Master's degree programme, which builds on its broad and in-depth scientific foundations, further improves graduates' career prospects. The Master's degree programme in Mathematics also prepares students for a Doctoral programme in Mathematics or Statistics as well as technical and scientific subjects in general.

After completing the degree programme, students are able to abstract problems that occur in practice, formulate mathematical models for these problems, examine them using the techniques they have learnt and discuss the solutions they develop in an interdisciplinary context. They can perform analyses, simulations and evaluations and implement results using modern symbolic and numerical tools. In terms of the academic sector, the degree programme familiarises students with modern mathematical methods so that they can tackle current topics of research.

Section 3 Admission requirements

(1) Students are eligible to study a Master's degree programme if they have successfully completed a relevant Bachelor's degree programme, a relevant university of applied sciences Bachelor's degree programme or another equivalent programme at a recognised Austrian or international post-secondary educational institution (Section 64 (3) UG).

Examples of relevant courses include the Bachelor's degree programme in (Technical) Mathematics at the University of Klagenfurt, the universities of Graz, Innsbruck, Linz, Salzburg and Vienna and the technical universities of Graz and Vienna.

(2) Since the Master's degree programme is taught in English, proof must be provided of English language ability at level B2 of the Common European Framework of Reference for Languages. Evidence of having studied English and having passed the subject in the last year of a higher education school (provided in the form of an Austrian certificate ("Jahresabschlusszeugnis") of the final school year at a higher education school) is always sufficient proof of proficiency. Proof can also be provided in the form of one of the following internationally recognised certificates: TOEFL iBT (at least 87 points), IELTS (overall band score of at least 6.5), English

First Certificate (FCE), Cambridge Advanced English CAE (level B2 certificate). Applicants whose native language is English or who can prove their English skills as a result of having studied a degree programme in English may be exempt from providing this proof of proficiency.

Section 4 Degree

Graduates of this Master's degree programme will be awarded the academic title "Diplom-Ingenieurin/Diplom-Ingenieur" (shortened to "Dipl.-Ing." or "DI"). If this title is used, it must be placed before the graduate's name.

Section 5 Structure and organisation of the degree programme

Table 1: Subjects, intended learning outcomes and ECTS credits

Subject	Subject reference	Intended learning outcomes	ECTS credits
Required subjects	1 Analysis	Ability to define and present key concepts and theorems in the area of functional analysis (Riesz theory, Fredholm theory, spectral theory), to provide and explain proofs for these theorems, to select and adapt them for different areas of application and to combine them with different branches within and outside of mathematics.	10
	2 Discrete Mathematics	Ability to define and present key concepts and theorems in the area of algebra (group actions, structure of finitely generated abelian groups, Sylow theorems, solvable groups, field extensions, Galois theory) and integer programming (Polyeder theory, unimodularity, relaxations, branch and bound, cutting planes, column generation, matroids), to provide and explain proofs for these theorems, to select and adapt them for different areas of application and to combine them with different branches within and outside of mathematics.	10
	3 Statistics	Ability to define and present key concepts and theorems in the areas of decision theory (loss functions, different kinds of risks, frequentist decision principle, Bayes decision principle, minimax decision principle, Savage's axiom, von Neumann-Morgenstern expected utility theory) and stochastic processes (classification of stochastic processes, Kolmogorov existence theorem, discrete Markov chains [transition probabilities, class properties, limit theorem], continuous Markov chains [Poisson process, probability transition function, infinitesimal matrix, Kolmogorov differential equation], continuous Markov processes, Brownian motion), to provide and explain proofs for these theorems, to select and adapt them for different areas of application and to combine them with different branches within and outside of mathematics.	10

Electives	*One of the following specialist electives:* 4 Applied Analysis 5 Applied Statistics 6 Discrete Mathematics	*Applied Analysis:* Ability to define and present key concepts and theorems in the chosen sub-areas (Dynamical Systems 1: notion and examples of dynamical systems, attractors and limit sets, linear dynamical systems, linearization, Poincaré-Bendixson theory (if time permits); Dynamical Systems 2: continuation of Dynamical Systems 1; inverse problems: examples of inverse problems, regularization methods, convergence analysis; Mathematical Methods in Continuum Mechanics: deformations, displacements, conservation laws, equation of motion; Nonlinear Analysis: local (differentiability notions in normed spaces, implicit and inverse function theorems) and global (topological and monotonicity tools) theory, applications to differential and integral equations; Numerics of Partial Differential Equations: finite element approximation of elliptic problems, numerical time integration; Partial Differential Equations 1: existence, uniqueness and properties of solutions, classical and weak theory; Partial Differential Equations 2: time dependent problems, Hamilton-Jacobi equations, semigroup theory), to provide and explain proofs for these theorems, to select and adapt them for different areas of application and to combine them with different branches within and outside of mathematics. Ability to acquire knowledge of a chosen mathematical topic independently, to conduct literary research independently, to work independently with mathematical texts and to formulate mathematical thought processes independently.	24

		Applied Statistics: Ability to define and present key concepts and theorems in the chosen sub-areas (Bayesian Statistics: prior and posterior distribution, types of priors [conjugate, non-informative, maximum entropy], Bayesian decision theory, Bayesian computation [Gibbs sampling, Metropolis Hastings algorithm, MCMC, importance sampling], hierarchical Bayes, empirical Bayes, Bayesian model averaging; Design of Experiments: randomization, replication, blocking, design of experiments for regression models, sequential designs, factorial design, design of computer experiments; Financial Data Analysis: time series, AR, MA, ARMA and GARCH models, stochastic differential equations [e.g. Cox-Ingersoll-Ross model, Vasicek model], Generalized Linear Models: link functions, deviance, logistic regression, Poisson regression, generalized additive models; Statistical Learning: loss functions, supervised and unsupervised learning, regression and classification, principal component analysis, discriminant analysis; Stochastic Differential Equations: Ito integral, linear and non-linear stochastic differential equations, Euler and Milstein scheme, parameter identification via ML and estimating functions, linear and non-linear filtering, stochastic partial differential equations), to provide and explain proofs for these theorems, to select and adapt them for different areas of application and to combine them with different branches within and outside of mathematics. Ability to acquire knowledge of a chosen mathematical topic independently, to conduct literary research independently, to work independently with mathematical texts and to formulate mathematical thought processes independently. *Discrete Mathematics:* Ability to define and present key concepts and theorems in the chosen sub-areas of Discrete Mathematics (algebraic curves: Riemann-Roch theorem, elliptic curves; Algorithms and Complexity: complexity classes, approximation algorithms, probabilistic algorithms; Combinatorial Optimization: tree and matching enumeration, linear assignment problems, interval graphs, approximation, rounding; Combinatorics: Polya theory, sieve methods, Möbius inversion, random graphs, Ramsey theory; Mathematical Analysis of algorithms: generating functions, Mellin transform methods, singularity analysis, saddle point method), to provide and explain proofs for these theorems, to select and adapt them for different areas of application and to combine them with different branches within and outside of mathematics. Ability to acquire knowledge of a chosen mathematical topic independently, to conduct literary research independently, to work independently with mathematical texts and to formulate mathematical thought processes independently.	

	One of the following extension electives: 7 Feminist Science/Gender Studies 8 Informatics 9 Information and Communications Engineering 10 Applied Mathematics	*Feminist Science/Gender Studies:* Ability to understand fundamental theories, methods and concepts of interdisciplinary gender studies, in particular intersectional and critical approaches to diversity, and to apply these in a multi-disciplinary manner to both professional and everyday life. *Informatics:* Ability to explain and apply fundamental methods from selected areas of informatics (cryptography, computer security, database technologies, verification and validation, machine learning). *Information and Communications Engineering:* Ability to explain and apply fundamental methods from selected areas of information technology (information theory, mobile communications, signal processing, image processing, data mining, robust design, CAE of mechatronic systems). *Applied Mathematics* Ability to define and present key concepts and theorems in the chosen sub-areas, to provide and explain proofs for these theorems, to select and adapt them for different areas of application and to combine them with different branches within and outside of mathematics.	12
Options	11 Optional subjects		9
	12 Work placement		15
	13 Master's thesis	Ability to research, present, summarise and apply the latest scientific and technological knowledge in a sub-area of mathematics and in the areas in which this domain is applied, to compare and question various approaches and to devise, implement and validate solutions.	24
	14 Research seminar		3
	15 Comprehensive examination held before an examination board		3
		Total (ECTS credits)	**120**

Section 6 Semester abroad/mobility

It is recommended that one semester is spent at an international university. In particular, students are advised of the possibility to complete a work placement abroad. The Programme Director will decide whether any examinations passed abroad will be recognised (see also Section78 (6) UG) by issuing a pre-recognition notice.

Section 7 Types of courses

(1) Lectures (LE) are courses in which knowledge is transferred by means of talks given by lecturers. The examination takes place as a one-off (written and/or oral) examination.

(2) Courses with ongoing assessment are courses in which the assessment does not take place as a one-off examination, but on the basis of written and/or oral contributions by the participants. If, in the framework of a course with ongoing assessment, a seminar paper or a paper requiring a comparable degree of effort is to be written, papers for courses taking place in the winter semester can be handed in up until the following 30 June; papers for courses taking place in the summer semester can be handed in up until 31 January of the following year. For written papers (seminar papers, introductory seminar papers or papers requiring a comparable degree of effort), oral or written feedback is to be offered to students.

Courses with ongoing assessment comprise:

(a) Exercise classes (EC)
Students are required to solve specific tasks during exercise classes.

(b) Projects (PR)
During projects, students are required to work on specific practical problems, sometimes in work groups. The development of teamwork skills is taken into account during this element of the degree programme. The project concludes with a paper on the practical work and a presentation about this paper.

(c) Seminars (SE)
Seminars are used for academic discussion. Students are expected to make their own contributions. The seminar concludes with a seminar paper and a presentation about this paper.

(d) Research Seminars (RS)
The purpose of the research seminar is to provide ongoing supervision and quality assurance to students as they write their Master's thesis.

In terms of courses from other curricula, the definitions found in the respective other curricula apply.

Section 8 Required subjects

Required subjects are subjects significant to the degree programme and for which examinations must be taken.

Table 2: Required subjects (30 ECTS credits)

	Course code	Course type	S.h.	ECTS credits	Recommended semester
Analysis	1.1 Functional Analysis	LE+EC	4+2	6+4	1
Discrete Mathematics	2.1 Algebra	LE+EC	2+1	3+2	1
	2.2 Integer Optimization	LE+EC	2+1	3+2	2
Statistics	3.1 Statistical Decision Theory	LE+EC	2+1	3+2	1
	3.2 Stochastic Processes	LE+EC	2+1	3+2	2
		Total (ECTS credits)		**30**	

Section 9 Electives

(1) Electives are subjects that students are able to select according to the regulations of the curriculum. A total of 36 ECTS credits must be obtained from electives.

The electives can be divided into

- a specialist elective (24 ECTS credits) and
- an extension elective (12 ECTS credits).

(2) Students are required to choose one of the following specialist elective:

- Applied Analysis
- Applied Statistics
- Discrete Mathematics

Students are required to complete courses worth 24 ECTS credits in their chosen specialist elective from the list found in Table 3. As part of this, students have the opportunity to select courses worth up to a total of 6 ECTS credits from other specialist electives. One seminar must always be chosen.

(3) Students are required to choose one of the following extension electives:

a) Feminist Science/Gender Studies

b) Informatics

c) Information and Communications Engineering

d) Applied Mathematics

Students who select extension electives a), b) or c) are required to complete courses worth 12 ECTS credits in their chosen extension elective from the list found in Table 4. As part of this, students have the opportunity to select courses worth up to a total of 6 ECTS credits from other extension electives or the specialist electives. Students who select extension elective d) are required to complete courses worth 12 ECTS credits from the list found in Table 3. As part of this, students have the opportunity to select courses worth up to a total of 6 ECTS credits from the list found in Table 4.

Table 3: Specialist electives (24 ECTS credits)

	Course code	Course type	S.h.	ECTS credits
Applied Analysis	4.1 Dynamical Systems 1	LE+EC	2+1	4+2
	4.2 Dynamical Systems 2	LE+EC	2+1	4+2
	4.3 Inverse Problems	LE+EC	2+1	4+2
	4.4 Mathematical Methods in Continuum Mechanics	LE+EC	2+1	4+2
	4.5 Nonlinear Analysis	LE+EC	2+1	4+2
	4.6 Numerics of Partial Differential Equations	LE+EC	2+1	4+2
	4.7 Partial Differential Equations 1	LE+EC	2+1	4+2
	4.8 Partial Differential Equations 2	LE+EC	2+1	4+2
	4.9 Selected Topics in Analysis	LE+EC	2+1	3+2
	4.10 Selected Topics in Numerics	LE+EC	2+1	3+2
	4.11 Numerics Lab	PR	1	3
	4.12 Seminar in Analysis	SE	2	4
Applied Statistics	5.1 Bayesian Statistics	LE+EC	2+1	4+2
	5.2 Design of Experiments	LE+EC	2+1	4+2
	5.3 Financial Data Analysis	LE+EC	2+1	4+2
	5.4 Generalized Linear Models	LE+EC	2+1	4+2
	5.5 Statistical Learning	LE+EC	2+1	4+2
	5.6 Stochastic Differential Equations	LE+EC	2+1	4+2
	5.7 Selected Topics in Statistics	LE+EC	2+1	3+2
	5.8 Selected Topics in Stochastic Processes	LE+EC	2+1	3+2
	5.9 Statistics Lab	PR	1	3
	5.10 Seminar in Statistics	SE	2	4

Discrete Mathematics	6.1 Algebraic Curves	LE+EC	3+1	6+2
	6.2 Algorithms and Complexity	LE+EC	2+2	2+4
	6.3 Combinatorial Optimization	LE+EC	2+1	4+2
	6.4 Combinatorics	LE+EC	2+1	4+2
	6.5 Mathematical Analysis of Algorithms	LE+EC	2+1	4+2
	6.6 Selected Topics in Algebra and Number Theory	LE+EC	2+1	3+2
	6.7 Selected Topics in Discrete Mathematics	LE+EC	2+1	3+2
	6.8 Selected Topics in Optimization	LE+EC	2+1	3+2
	6.9 Symbolic Computation Lab	PR	1	3
	6.10 Seminar in Discrete Mathematics	SE	2	4

Table 4: Extension electives (12 ECTS credits)

	Course code	Course type	S.h.	ECTS credits
Feminist Science/Gender Studies	*7.1 Courses from the elective subject Feminist Studies/Gender Studies*			
Informatics	8.1 Applied Cryptology	LC	2	4
	8.2 Selected Areas of Systems Security	LC	2	4
	8.3 Basic Mechanisms of Cryptology	LC	2	4
	8.4 Uncertain Knowledge: Reasoning and Learning	LC	2	4
	8.5 Heuristic Search	LC	2	2
	8.6 Specification and Verification	LE+EC	2+2	2+4
	8.7 Databases	LE+EC	2+2	2+4
	8.8 Database Technologies	LE+EC	2+2	2+4
	8.9 Systems Security	LE+EC	2+2	2+4
Information and Communications Engineering	9.1 Information Theory	LC	2	4
	9.2 Mobile Communications	LC+CS	2+2	4+3
	9.3 Signal Processing for Communications	LC+CS	2+2	4+3
	9.4 Fundamentals of Image Processing	LC	2	4

	9.5 Data Mining and Neurocomputing	LC	2	4
	9.6 Measurement Signal Processing	LC+CS	2+2	4+3
	9.7 Robust Design & Reliability	LC+CS	2+2	4+3
	9.8 CAE of Mechatronic Systems I	LC+CS	2+2	4+3
	9.9 Nonlinear Dynamics — Modelling, Simulation and Neurocomputing	LC	2	4

Section 10 Options

Options are courses that can be freely chosen from a range of different course offerings at recognised Austrian or international universities. Courses that the student completed in order to be entitled to study or to gain general or special eligibility for university admission are excluded from this. A total of 9 ECTS credits must be obtained from optional subjects.

In the case of courses that have been completed at other recognised Austrian or international post-secondary educational institutions, the responsible university body will decide whether recognition as options makes sense academically or with regard to professional activities for the chosen programme of study.

Section 11 Courses with a limited number of participants

(1) The maximum number of participants permitted on each of the following courses is as follows:

Exercise classes: 25

Projects: 15

Seminars: 15

For courses from other curricula, the maximum numbers found in the respective curricula apply.

(2) If the number of applications for these courses exceeds the number of places available, students will be accepted in accordance with the following procedure:

1. If the maximum number of participants is exceeded, students will be accepted on to the course in the following order:

   (a) Students enrolled on programmes of study for which the course is a required subject according to the course curriculum.

   (b) Students enrolled on programmes of study for which the course is an elective according to the course curriculum.

2. Depending on the financial resources available, parallel courses may be offered for the course in question.

3. If the number of applications for courses nevertheless exceeds the number of places available, places will be awarded on the basis of the number of ECTS credits obtained from courses on the programme of study used to rank the students according to Para. 2, clause 1. Courses completed from other programmes of study are not taken into account during this process. If the number of ECTS credits is the same, students will be drawn at random.

4. Up to 10% of the places available will be allocated on a priority basis to students completing a portion of their programme of study at Alpen-Adria-Universität Klagenfurt as part of a mobility programme.

Section 12 Courses with special registration requirements

To register for a seminar, the student must have completed at least one lecture and the associated exercise class from the list of required subjects.

Section 13 Master's thesis

(1) The Master's thesis is the academic paper that demonstrates the student's ability to achieve adequate standards of content and methodology when independently addressing scholarly topics. The assignment for the Master's thesis will be so chosen that it is reasonable to expect a student to complete it within six months. A number of students may jointly address a topic, provided that the performance of individual students can be assessed.

(2) The topic to be covered in the Master's thesis must be chosen from one of the following subjects:

- Analysis
- Discrete Mathematics
- Statistics

(3) The Master's thesis is worth 24 ECTS credits and the associated research seminar 3 ECTS credits.

(4) Before beginning work on their thesis, students are required to submit an application to the Rector of Studies to have their topic and supervisor approved. A decision about the application must be made within two months after receiving it. The student is permitted to change supervisor until the Master's thesis is submitted.

(5) The completed Master's thesis must be submitted to the Rector of Studies in electronic format. More specific regulations regarding this are to be established by the Rector of Studies under consideration of technical developments. On the request of the supervisor, the author must provide them with a bound copy of the thesis. The supervisor will have two months from the date of submission to assess the Master's thesis.

Section 14 Regulations regarding work placement

(1) Students are required to complete a work placement in an Austrian or international business, a public administrative office, a non-profit organisation or a non-university research institution in order to try out and apply in practice the skills they have gained. The work placement may also be completed in a university research institute. The work placement must amount to 300 hours. Students are also required to submit a work placement report and give a work placement presentation. The work placement, including the work placement report and presentation, is worth 15 ECTS credits.

(2) Students must inform their supervising university teacher of their choice of work placement in advance, who must then approve it. The Programme Director must agree with the supervising university teacher's decision to approve the work placement. Students are recommended to complete the work placement during the second or third semester of study.

(3) After the work placement and no later than during the following semester, students are required to write a work placement report and to give a presentation about the work placement. This is necessary in order for the work placement to be deemed to have been successfully completed.

Section 15 Use of languages other than English

The courses and oral and written examinations for the Master's degree programme in Mathematics will be held and taken in English; the Master's thesis must be written in English.

At the student's request and with the course lecturer's consent, examinations may be taken in a language other than English.

Section 16 Examination regulations

(1) To graduate from the Master's degree programme in Mathematics, students are required to successfully complete the following course components:

a) the courses for the required subjects, electives and options (Sections 8–10),

b) the Master's thesis and the associated research seminar according to Section 13,

c) the work placement according to Section 14 and

d) the comprehensive examination held before an examination board according to Para. 4.

(2) The prerequisite for applying for the comprehensive examination held before an examination board is the completion of the parts listed under Para. 1, points a–c.

(3) The required subjects, electives and options are deemed to be complete following successful completion of the courses to the required extent. The research seminar according to Section 13 and the work placement according to Section 14 are assessed as being either “successfully completed” or “unsuccessfully completed”.

(4) The comprehensive examination held before an examination board takes the form of an oral examination that generally lasts for one hour and is taken in front of an examination committee comprising three people. The comprehensive examination held before an examination board is worth 3 ECTS credits and includes the following:

a) a presentation and defence of the Master's thesis (1 ECTS credit);

b) an examination on a branch of the subject from which the topic of the Master’s thesis was taken, see Section 13, Para. 2 (1 ECTS credit);

c) an examination on a further branch, which can be chosen from the subjects of Analysis, Discrete Mathematics, Statistics, Informatics or Information and Communications Engineering (1 ECTS credit).

(5) On completion of the Master’s degree programme, an overall assessment will be provided in addition to the assessments of the individual subjects and the Master’s thesis. The overall assessment has been “passed”, if every subject and the Master’s thesis has been passed. The overall assessment will be deemed to be “passed with distinction” if none of the mentioned deliverables has received a worse assessment than “good” and at least half of the deliverables has received the assessment “excellent”. The assessments of the individual subjects of the overall assessment should also be taken into account when determining the overall assessment.

(6) Examinations that have already been used for the completion of studies regarded as admission requirements cannot be used again to complete the programme of studies in the Master’s degree programme.

Section 17 Effective validity

This curriculum will enter into force after announcement in the Alpen-Adria-Universität Klagenfurt university bulletin as of 1 October 2018 and will apply to all students who commence their Master’s degree programme from the 2018/19 winter semester onwards.

Section 18 Transitional provisions

(1) Students who began their Master’s degree programme before the 2018/19 winter semester are able to complete their programme of study in line with the previously applicable regulations within a period corresponding to the intended duration of study plus one semester, i.e. by no later than 30 April 2021. If the programme of study is not completed within the appointed period of notice, the student will be

subject to the new curriculum for the further programme of study. Furthermore, students can voluntarily agree to study under the new curriculum at any time.

(2) Specific regulations relating to the equivalence of examinations from the previously applicable and new curriculum can be found in Appendix 1 (equivalence tables).

(3) Students who, after expiry of the transition period according to Para.1, are subject to the new curriculum are entitled to complete the Master's thesis in German.

APPENDIX 1 Equivalence tables

Required subjects, see Section 8:

Master's degree programme in Mathematics (2018)			Master's degree programme in Technical Mathematics (2013)		
Course	S.h., course type	ECTS credits	Course	S.h., course type	ECTS credits
1.1 Functional Analysis	4LE+2CE	6+4	Dynamische Systeme 1 ("Dynamical Systems 1") Funktionalanalysis ("Functional Analysis") Partielle Differentialgleichungen 1 ("Partial Differential Equations")	2LP 2LP 2LP	3 3 3
or					
4.1 Dynamical Systems 1	2LE	4	Dynamische Systeme 1	2LP	3
1.1 Functional Analysis	2EC	4	Funktionalanalysis	2LP	3
4.7 Partial Differential Equations 1	2LE	4	Partielle Differentialgleichungen 1	2LP	3
2.1 Algebra	2LE+1EC	3+2	Algebra	2LE+1EC	3+2
2.2 Integer Optimization	2LE+1EC	3+2	Ganzzahlige Optimierung ("Integer Optimization")	3LP	5
3.1 Statistical Decision Theory	2LE+1EC	3+2	Finanzstatistik ("Financial Data Analysis")	3LP	5
or					
5.3 Financial Data Analysis	2LE+1EC	4+2			
3.2 Stochastic Processes	2LE+1EC	3+2	Stochastische Prozesse 1 ("Stochastic Processes 1")	3LP	5
4.12 Seminar in Analysis	2SE	4	Seminar aus Analysis ("Seminar in Analysis")	2SE	4
5.10 Seminar in Statistics	2SE	4	Seminar aus Statistik ("Seminar in Statistics")	2SE	4
6.10 Seminar in Discrete Mathematics	2SE	4	Seminar aus Diskreter Mathematik ("Seminar	2SE	4

			in Discrete Mathematics")		
4.11 Numerics Lab *or* Statistics Lab *or* Symbolic Computation Lab	1PR	3	Praktikum Angewandte Mathematik ("Practical Work in Applied Mathematics")	2PR	4

Electives, see Section 9:

Courses passed in the elective “Feministische Wissenschaft/Gender Studies” (“Feminist Studies/Gender Studies”) according to Section 9 of the Master’s degree programme in Technical Mathematics (2013) will be fully recognised for the elective “Feminist Science/Gender Studies” taken as part of the Master’s degree programme in Mathematics (2018).

Courses passed in the elective “Informatik” (“Informatics”) according to Section 9 of the Master’s degree programme in Technical Mathematics (2013) will be fully recognised for the elective “Informatics” taken as part of the Master’s degree programme in Mathematics (2018).

Courses passed in the elective “Informationstechnik” (“Information Technology”) according to Section 9 of the Master’s degree programme in Technical Mathematics (2013) will be fully recognised for the elective “Information and Communications Engineering” taken as part of the Master’s degree programme in Mathematics (2018).

The following equivalence table also applies:

Master’s degree programme in Mathematics (2018)			Master’s degree programme in Technical Mathematics (2013)		
Course	S.h., course type	ECTS credits	Course	S.h., course type	ECTS credits
4.2 Dynamical Systems 2	2LE+1EC	4+2	Dynamische Systeme 2 ("Dynamical Systems 2")	3LP	6
4.3 Inverse Problems	2LE+1EC	4+2	Inverse Probleme ("Inverse Problems")	3LP	6
4.6 Numerics of Partial Differential Equations	2LE+1EC	4+2	Numerik partieller Differentialgleichungen ("Numerics of Partial Differential Equations")	3LP	6
4.8 Partial Differential Equations 2	2LE+1EC	4+2	Partielle Differentialgleichungen 2 ("Partial Differential Equations 2")	3LP	6
4.9 Selected Topics in Analysis	2LE+1EC	3+2	AK der Analysis ("Selected Topics in Analysis")	3LP	5
4.10 Selected Topics in Numerics	2LE+1EC	3+2	AK der Numerik ("Selected Topics in Numerics")	3LP	5

5.1 Bayesian Statistics	2LE+1EC	4+2	Bayessche Statistik ("Bayesian Statistics")	3LP	6
5.4 Generalized Linear Models	2LE+1EC	4+2	Generalisierte Lineare Modelle ("Generalized Linear Models")	3LP	6
3.1 Statistical Decision Theory	2LE+1EC	3+2	Statistische Entscheidungstheorie ("Statistical Decision Theory")	3LP	6
Or					
5.5 Statistical Learning	2LE+1EC	4+2			
5.2 Design of Experiments	2LE+1EC	4+2	Statistische Versuchsplanung ("Design of experiments")	3LP	6
5.6 Stochastic Differential Equations	2LE+1EC	4+2	Stochastische Prozesse 2 ("Stochastic Processes 2")	3LP	6
5.7 Selected Topics in Statistics	2LE+1EC	3+2	AK der Statistik ("Selected Topics in Statistics")	3LP	5
5.8 Selected Topics in Stochastic Processes	2LE+1EC	3+2	AK der Stochastischen Prozesse ("Selected Topics in Stochastic Processes")	3LP	5
6.1 Algebraic Curves	3LE+1EC	6+2	Algebraische Kurven ("Algebraic Curves")	3LE+1EC	6+2
6.2 Algorithms and Complexity	2LE+2CE	2+4	Algorithmen und Komplexitätstheorie ("Algorithms and Complexity")	2LE+2PR	2+4
6.4 Combinatorics	2LE+1EC	4+2	Kombinatorik ("Combinatorics")	2LE+1EC	4+2
6.3 Combinatorial Optimization	2LE+1EC	4+2	Kombinatorische Optimierung ("Combinatorial Optimization")	2LE+1EC	4+2
6.5 Mathematical Analysis of Algorithms	2LE+1EC	4+2	Mathematische Analyse von Algorithmen ("Mathematical Analysis of Algorithms")	2LE+1EC	4+2
6.6 Selected Topics in Algebra and Number Theory	2LE+1EC	3+2	AK der Algebra und Zahlentheorie ("Selected Topics in Algebra and Number Theory")	3LP	5
6.7 Selected Topics in Discrete Mathematics	2LE+1EC	3+2	AK der Diskreten Mathematik ("Selected Topics in Discrete Mathematics")	3LP	5

6.8 Selected Topics in Optimization	2LE+1EC	3+2	AK der Optimierung ("Selected Topics in Optimization")	3LP	5

APPENDIX 2 Non-binding recommended route for orientation and planning purposes

The following table suggests how the ECTS credits could be distributed across the semesters. It is recommended that the specialist elective seminar is taken in the third semester.

	1st semester	2nd semester	3rd semester	4th semester
1.1 Functional Analysis	10 ECTS credits			
2.1 Algebra	5 ECTS credits			
2.2 Integer Optimization		5 ECTS credits		
3.1 Statistical Decision Theory	5 ECTS credits			
3.2 Stochastic Processes		5 ECTS credits		
4–6 Specialist elective	12 ECTS credits	8 ECTS credits	4 ECTS credits	
7–10 Extension elective		6 ECTS credits	6 ECTS credits	
11 Options		6 ECTS credits	3 ECTS credits	
12 Work placement			15 ECTS credits	
13 Master's thesis				24 ECTS credits
14 Research seminar				3 ECTS credits
15 Comprehensive examination held before an examination board				3 ECTS credits
Totals:	**32 ECTS credits**	**30 ECTS credits**	**28 ECTS credits**	**30 ECTS credits**