Faculty of Mathematics and Computer Science:

Following the resolution of the Faculty Council of the Faculty of Mathematics and Computer Science dated 31.05.2023, the Presidential Board of the Georg-August-Universität Göttingen approved the sixteenth amendment of the Examination and Study Regulations for the consecutive Master's degree programme "Mathematics" of the University of Göttingen on 26.06.2023, in the version published on 28.03.2013 (Official Announcements I No. 14/2013 p. 313), last amended by decision of the Presidential Board on 08.02.2022 (Official Announcements I no. 6/2023 p. 143) (§ 44 section 1 sentence 2 NHG in the version published on 26.02.2007 (Nds. GVBl. p. 69), last amended by Article 7 of the Act dated 23.03.2022 (Nds. GVBl. p. 218); §§ 37 section 1 sentence 3 No. 5 b), 44 section 1 sentence 3 NHG).

Examination and Study Regulations for the consecutive Master's degree programme "Mathematics" of the University of Göttingen

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Appendix I: Module overview

Appendix II: Exemplary curricula

§ 1 Scope

(1) The "General examination regulations for baster and master programmes as well as other courses and degrees offered at the University of Göttingen" (APO) apply in their respectively valid forms to the Master's degree programme in "Mathematics" at the Georg-August-Universität Göttingen.

(2) These regulations stipulate the additional provisions for the Master's degree programme in "Mathematics".

§ 2 Objectives of the academic programme, purpose of the examinations

(1) [1]Besides a solid and extensive acquisition of mathematical knowledge, students in the Master's degree programme "Mathematics" should apply a suitable focus within their studies to obtain specialised knowledge in a research area of mathematics that they select, in order to

a) acquire excellent general and specific abilities to progress in their chosen professions,
b) create a foundation upon which to complete a further degree in the form of doctoral studies.

[2]The following study objectives should be mentioned in particular:

a) knowledge of the main disciplines within mathematics, their methodologies and their mutual interrelationships,
b) course of studies in current mathematical research literature, and
c) acquire the ability to process and present mathematical problems in a master's thesis.

(2) In order to achieve the designated goals, well-founded theories are merged with relevant questions of mathematical application and developments in practice, hence meaning that students are given skills in a vocational field of action just as much as an academic qualification.

(3) [1]Moreover, the academic programme provides the opportunity to acquire specialisation in preferred areas of the subject to suit personal inclinations and professional objectives. [2]It is also a means of obtaining professional skills and fundamental, key competencies.

(4) [1]The examinations included within the Master's degree programme are intended to ascertain whether the candidate has acquired fundamental knowledge of the core mathematical disciplines, their methodologies and their mutual interrelations, has studied current mathematical research literature and has demonstrated in a master's thesis the ability to process and present scientific issues. [2]The master examination is a degree that serves as a qualification for a professional career and for research.

§ 3 Academic degree

Once the master degree examination is passed, the Georg-August-Universität Göttingen awards the academic title "Master of Science" (abbreviated: M.Sc.).

§ 4 Structure of the academic programme; standard course length; periods of studies; profiles

(1) The academic programme commences in the winter or the summer semester.

(2) The standard course length is four semesters.

(3) The consecutive Master's degree programme "Mathematics" can be attended part-time.

(4) [1]The academic programme comprises 120 credits (ECTS credits; abbreviated as: C), which are usually distributed as follows:

a) for the subject specific studies in mathematics 60 C,
b) for the area of professionalisation 30 C, comprising 18 C for the minor subject and 12 C for key competencies and
c) 30 C for the master's thesis.

[2]The allocation of the 120 C to the areas of specialist course, minor subject and key competencies may be defined differently for individual study focuses in appendix I (Module overview) than in the terms set forth in sentence 1. [3]The selectable minor subjects are astrophysics, business administration, chemistry, computer sciences, philosophy, physics and economics. [4]The examination board can approve other subjects or curricula regulations for minor subjects other than those specified in appendix 1 for minor subjects upon reasoned application. [5]The exporting faculty must enclose with the application a recommendation concerning the study and examination components that must be completed (in a scope of 18 C); the application must also contain a confirmation from the Dean of Studies in the exporting faculty that the applicant can be enabled to attend the modules in question. [6]An application as described in sentence 4 does not constitute a legal entitlement.

(5) [1]These compulsory modules, optional required modules and optional modules are specified in the module overview (appendix 1). [2]It is at the discretion of the student to decide the times and order in which the modules are attended, provided the qualifications for entry to the individual modules and courses are adhered to. [3]A recommendation on the appropriate academic programme structure is contained in the sample curricula enclosed in appendix II. [4]The module index is published separately; it is an integral part of these Examination and Study Regulations, insofar as the modules are itemised in the module overview (appendix I).

(6) [1]Following the four research focuses in the teaching units within mathematics at the Faculty of Mathematics and Computer Science, there are also four focuses in the teaching:

- SP 1: Analysis, geometry, topology
- SP 2: Algebra, geometry, number theory
- SP 3: Numerical and applied mathematics
- SP 4: Mathematical stochastics.

[2]The Master's degree programme "Mathematics" can be completed with one of the study focuses according to sentence 1 or without a study focus.

(7) [1]One of the following research-oriented study profiles must be completed successfully:

- Study profile F "Research-oriented – general"
- Study profile Phy "Physics"
- Study profile MDS “Mathematical Data Science”

[2]Appendix I "Module overview" defines the terms in greater detail.

§ 5 Certification of study profiles and study focuses

(1) [1]Study profiles are certified in the transcript of records. [2]They specify the ancillary requirements described in appendix I 'Module overview', which may restrict the free combinations of modules based on the qualifications for entry defined in the catalogue of modules.

(2) [1]A study focus is successfully completed if modules amounting to at least 27 C from modules of this study focus have been acquired and the master's thesis with a topic related to the selected study focus has been successfully completed. [2]If the conditions according to sentence 1 are fulfilled, the specialization is certified according to § 8 section 1 APO. [3]The grade awarded for the study focus is the arithmetic average of the master’s thesis and the modules attributable to the study focus, weighted according to credits; in the event that modules from the study focus rated above 27 C are completed, only the modules with the best grades will count towards the grade, but in all cases at least 27 C. [4]Module examinations that are to be assigned to the chosen specialisation and are to be disregarded in the formation of the overall grade of the Master's examination according to § 14 section 4 shall also be disregarded in the formation of the grade for the specialisation.

§ 6 Study Abroad

[1]It is possible to complete part of the academic programme abroad. [2]There are agreements on student exchange programmes with a number of different universities abroad. [3]Results awarded abroad are credited under the provisions of APO. [4]For this purpose, a 'learning agreement' is concluded before the start of the planned period abroad. [5]This should only include courses and degrees offered at the university abroad

a) that are essentially equivalent with the standards and requirements of this Master’s degree programme;
b) that correspond to the qualification objectives of master programme in "Mathematics"; and
c) whose contents were not and will not be included in a module examination that has already been completed successfully, or will be completed, before the start of the period abroad.

[6]Courses that satisfy the conditions described in a) and c), but not those in b), can only be credited as voluntary additional examinations (additional modules) and stated as such in the transcript of records. [7]The examination board rules on the learning agreement. [8]Students are strongly advised to attend a study advice appointment in the study advisory office with the teaching staff at the Faculty of Mathematics and Computer Science before commencing a period studying abroad and to prepare for the learning agreement. [9]The study advisory office should be informed as soon as possible, especially if the period abroad is planned for the first or the last semester.

§ 7 Module examinations: Registration and withdrawal

(1) [1]The registration for written module examinations is completed electronically according to the form and within the deadline specified by the examination board. [2]Withdrawal without stating reasons (deregistration) is possible up to 24 hours before the examination date, provided the time period between the deadline for registration and the examination date is more than a day. [3]Withdrawal is otherwise excluded.

(2) [1]The registration for oral module examinations is completed electronically according to the form and within the deadline specified by the examination board. [2]Withdrawal without stating reasons (deregistration) is possible up to seven days before the examination date, as far as the time period between the deadline for registration and the examination date is more than seven days. [3]Withdrawal is otherwise excluded.

(3) [1]The registration for practical course examinations during the teaching period is completed electronically according to the form and within the deadline specified by the examination board. [2]Withdrawal without stating reasons (deregistration) is possible up to two weeks before the examination date – which is usually the start of the internship – provided the time period between the deadline for registration and the start of the examination period is more than two weeks. [3]Withdrawal is otherwise excluded.

(4) [1]Registration for other examinations during the teaching period must be completed at the course start. [2]Withdrawal from papers is possible up to announcement of the paper's topic and withdrawal from presentations and co-presentations up to fourteen days before the date of presentation, provided the time period between the deadline for registration and the examination date is more than two weeks. [3]Withdrawal is otherwise excluded.

§ 8 Qualifications for entry to modules and courses

(1) The entry to certain courses or modules (in the following: courses) can be restricted by resolution passed by the Faculty Council, if the inherent nature of the content of said courses or their proper implementation necessitates such a measure.

(2) [1]The requirements for entry to the courses restricted according to section 1 will be decided by the Faculty Council and announced in advance. [2]The assignment of places among those qualified for entry will be managed by the course lecturer based on the following eligibility ranking:

a) Students in the respective subject semester for whom the course is provided as a compulsory course in accordance with the Examination and Study Regulations, and who have not yet attended and successfully completed this course. As ranked equally shall be considered registrations by students who satisfied the preconditions as laid down in sentence 1 in the previous semester and, despite orderly registration, were unable to receive a place or, due to allocation of a compulsory course taking place simultaneously in a subject studied concurrently, were unable to accept the allocation. Sentences 1 and 2 apply accordingly to courses relating to sections within a degree programme.

b) Registrations by students in subject semesters, who deviate from the preconditions laid down in letter a) by one semester or were unable to successfully complete the course in the previous semester or were unable to regularly attend or successfully complete the course in the previous semester due to illness - without having a leave of absence. A doctor's certificate must be submitted as proof of illness.

c) Registrations by students from subject semesters who deviate by two or more semesters from the requirements defined in letter a).

d) Students in the respective study semester or section of their degree programme for whom the course is provided as an optional required course according to the Examination and Study Regulations, and who satisfy the requirements defined in letter a).

e) Registrations by students from subject semesters who deviate by one or more semesters from the requirements defined in letter d).

f) Registrations by students who wish to attend the course as an optional subject within their degree programme.

g) Other students.

[3]In the event of any conflict, the Dean of Studies will make a ruling.

(3) The Faculty Council is entitled to install a central procedure for access to certain courses under its auspices that deviates from the procedure laid down in section 2.

§ 9 Admission to the master's thesis

(1) [1]A written application for admission to the master thesis must be submitted to the responsible examination board. [2]In this, following documents must be enclosed:

a) The proposal of topic for the master's thesis,
b) a proposal for the first academic advisor or the second academic advisor,
c) a written confirmation of the first academic advisor and the second academic advisor,
d) a declaration specifying that the master examination has not been failed definitively or registered as definitively failed in the same or comparable master degree programme at a domestic or foreign university.

[3]The proposals under letters a) and b) as well as the proof as specified under letter c) are unnecessary if the student provides assurance that he or she has been unable to find an academic advisor. [4]In the event that the student is unable to find an academic advisor, the examination board will, upon application, assign an academic advisor and a topic, provided the student has already acquired at least 50 C in the mathematics modules. [5]The candidate's view must be considered in choosing the topic. [6]The right to propose the topic does not constitute any legal right.

(2) [1]The examination board decides on the admission. [2]This should be rejected if the qualifications for entry are not fulfilled or the master examination in the same or similar Master's degree programme at a domestic or foreign university has been definitively failed or regarded as definitive failing.

§ 10 Master's thesis

(1) The master's thesis is intended to demonstrate that the examination candidate is able to independently process and represent a problem within a defined period through the application of scientific methods.

(2) [1]In general, the master's thesis should be written in the fourth subject semester of the Master's degree programme. [2]The examination office issues the topic of the master's thesis under the auspices of the chairperson of the examination board. [3]The time of issue must be recorded.

(3) [1]The processing time for the master's thesis is six months. [2]Upon application of the candidate, the competent examination board can extend the deadline for submitting the thesis by a maximum of eight weeks in the event of an important reason that cannot be attributed to the candidate. [3]Good cause normally exists in case of illness that is to be notified immediately and established by producing a medical certificate. [4]In this case the period will be extended by the duration of the illness, but by no longer than eight weeks.

(4) The master's thesis can be written in German or English.

(5) [1]The topic can be returned only once and only within the first 8 weeks following issue of the topic. [2]A new topic should be promptly agreed, at the latest within 2 weeks. [3]In the event that the master's thesis is repeated, the topic may be returned only in accordance with sentence 1 if the examinee has not resorted to this option in the first submission of the master's thesis.

(6) [1]The master's thesis must be submitted to the responsible examination office in due time and exclusively in PDF/A format according to ISO 19005-1:2005; data supplementing the master's thesis (e.g. programme code, measured values) must be submitted compressed as one file in ZIP format. [2]Students who can credibly show that this is not reasonable for them will be supported by the university. [3]The time of submission must be placed on file. [4]Upon submission, the candidate should declare that he or she has independently compiled the work and has not used any sources and tools other than those specified.

(7) [1]The examination office forwards the master's thesis to the first advisor and the second advisor as evaluators. [2]Each evaluator awards a grade.

(8) The duration of the application procedure should not exceed six weeks.

§ 11 Examination language

[1]The examination language can be German or English. [2]Examinations in the optional required and optional modules can always be taken in German if this is the only way to complete the academic programme properly within the standard course length. [3]The candidate can apply to the examination board that an examination should be help, unlike in the respective module description, in German or in English; the application does not constitute a legal entitlement. [4]The language skills of the examiner must be given due consideration in the decision.

§ 12 Reassessment guidelines for grade improvement

Repeating examinations once successfully completed for the purpose of improving the grade is not possible; this is without prejudice to the provision of § 16 a section 3 sentence 2 APO.

§ 13 Examination board

(1) [1]The examination board has five members, namely the Dean of Studies, two members of the professoral group, one faculty employee and one member of the student body. [2]They are appointed by the respective group representatives in the Faculty Council in the Faculty of Mathematics and Computer Science. [3]At the same time, a deputy is nominated for each member. [4]If a member or a representative steps down prematurely, a substitute will be nominated for the remaining tenure.

(2) The implementation and organisation of the examination procedure is delegated to examination management at the Faculty of Mathematics and Computer Science, without prejudice to the competencies of the dean of studies.

(3) The examination board elects a chairperson and deputy chairperson from the professoral group; as a rule, the Dean of Studies will chair the board.

(4) Contrary to § 10 section 3 sentence 3 APO, the examination board will define the nature and scope of the examination prerequisites and announced in a suitable form at the start of the semester insofar as the module descriptions define alternatives forms and scopes of examination.

§ 14 Grade point average

(1) The master examination is passed, if at least 120 credits were acquired and all of the required module examinations as well as the master's thesis have been passed.

(2) The final result "with distinction" is awarded if the master's thesis is graded 1.0 and the current average grade of the master examination is at least 1.3 in accordance with § 16 section 8 APO.

(3) [1]An examination result can only be credited on one occasion, even if it is achieved in several modules. [2]The definition of the module in which the examination result is to be achieved takes place upon registration for the examination.

(4) [1]Module examinations at an aggregate value of no more than 12 credits will be discounted upon application by the student in the calculation of the current average grade; in these cases the equivalent modules will be listed in the master certificate as "passed", but without grade. [2]An application as described under sentence 1 must be placed before preparation of the certificate.

(5) [1]The candidate is entitled to earn acquire a performance record in more modules (additional) modules than the required number. [2]They will then be listed in the certificate and in the transcript of records. [3]Additional modules will not be included in the calculation of the final grade for the master examination, unless otherwise specified hereafter.

(6) [1]Modules as described in section 5 can be completed in addition to the modules listed in the module overview (appendix I), provided the module contributes to the objectives of the course of study, there is no restriction on admission in the respective area, and there are sufficient teaching capacities available. [2]A suitable application must be placed with the Dean of Studies for mathematics before a registration for this kind of module is made. [3]The application can be rejected without stating any reasons; a legal right of the applicant to object the decision does not exist.

(7) [1]Upon application by the student, grades from the voluntary additional examinations (additional modules) in mathematical modules from the selection of "Mathematical optional modules in the Master's degree programme" listed in appendix I will be considered up to a scope of no more than 30 C in the calculation of the grade point average of the master

examination. [2]An application as described under sentence 1 must be placed before preparation of the certificate.

§ 15 Study and examination advice

(1) The Central Student Advisory Office at the University of Göttingen is responsible for the general study advice, especially in inter-faculty questions.

(2) [1]The study advisory service for the subject is provided by the study and examination advisers appointed at the participating faculties, also by study representatives in the study advisory offices under the auspices of the Dean of Studies in the faculties. [2]The module managers and the lecturers in the individual courses will also provide advice on specific questions pertaining to the individual modules and courses. [3]The study and examination advice supports the students in designing their academic programme and is intended in particular to provide assistance in the event of failed examinations.

(3) The students should seek study advice, especially in the following cases:

- After failing examinations twice,
- In case of any deviations from the standard course length,
- when changing the degree programme or university,
- when attending a minor subject different to the minor subject selected during the Bachelor's degree programme,
- before spending a period of study abroad,
- upon first failure of the master examination.

§ 16 Entry into force; interim regulations

(1) This regulation enters into force following its promulgation in the Official Bulletin I of Georg-August-Universität Göttingen as per 01.04.2013.

(2) [1]Students who commenced their academic programme before an amendment to these examination and study regulations came into force and who have remained enrolled therein without interruption, shall be examined, upon application, on the basis of the examination and study regulations in place before the amendments came into force. The application must be placed within 6 months of the amendment coming into force. [2]In the event that upon application according to sentence 1, the examination and study regulations shall apply in the version in place before these regulations came into force, this shall not apply to module overviews and the Module Handbook for examinations that remain to be taken, unless preventing a breach of trust with a student would necessitate a different decision by the examination board. [3]A different decision is possible especially in the cases in which a module examination can be retaken or a compulsory module or an optional required module was changed substantially or

removed. [4]The examination board may introduce general regulations for these cases. [5]Examinations on the basis of a version of examination and study regulations in place before any amendments thereto came into force, shall be held for the last time in the fourth semester following said amendment coming into force.

(3) [1]Departing from section 2, students who commenced their studies before the winter semester of 2022/2023 and who were continuously enrolled in this degree programme without interruption and are aiming at the study profile "Business Mathematics", will be examined according to the examination and study regulations for the consecutive Master's degree programme "Mathematics" of the Georg-August-Universität Göttingen in the version of the announcement of 28.03.2013 (Official Announcements I no. 14/2013 p. 313), last amended by resolution of the Presidential Board dated 26.05.2021 (Official Announcements I No. 26/2021 p. 499). [2]In the case of examinations still to be taken, this shall not apply to the module overview, module catalogue and module handbook, unless the protection of a student's confidence requires a deviating decision by the examination board. [3]A deviating decision is possible in particular in cases in which a module examination can be repeated or a compulsory or required elective compulsory module has been substantially changed or cancelled. [4]The examination board may make general regulations in this regard. [5]An examination in the study profile "Business Mathematics" according to the the examination and study regulations for the consecutive Master's degree programme "Mathematics" of the Georg-August-Universität Göttingen in the version of the announcement of 28.03.2013. (Official Announcements I No. 14/2013 p. 313), last amended by resolution of the Presidential Board dated May 26, 2021 (Official Announcements I No. 26/2021 p. 499), will be carried out for the last time in the winter semester 2024/25. [6]Upon application, students within the meaning of sentence 1 shall be examined as a whole in accordance with the provisions of the examination and study regulations in force as of the winter semester 2022/2023; the application shall be submitted within six months.

Appendix I: Module overview

120 C must be acquired in accordance with the provisions contained hereinafter. Modules already completed in the prior bachelor degree cannot be repeated.

1) Study tracks in the Master's degree programme in Mathematics (M.Sc.)

In the Master's degree programme in Mathematics, one of the following study tracks has to be chosen, whereas modules with a total of at least 90 C have to be completed successfully in accordance with the following regulations. The regulations for the modules that can be chosen within the scope of a study focus can be found in no. 2) "Elective courses in Mathematics (graduate studies)".

a) Study track F "Research-oriented - general"

In the study track F "Research-oriented - general" modules have to be completed successfully according to the regulations below.

aa) Elective compulsory modules in Mathematics (60 C)

In the study track F, elective compulsory modules in the subject mathematics with a total of at least 60 C have to be completed successfully according to the following regulations:

i) In the study foci SP 1 or SP 2, modules with a total of at least 12 C have to be completed successfully, thereof at least a seminar module or an advanced seminar module with at least 3C (M.Mat.481*, M.Mat.482*, M.Mat.491*, M.Mat.492*). If the Master's thesis is in one out of these two study foci, a total of at least 6 C of the modules out of the other study focus have to be completed successfully.

ii) In the study foci SP 3 or SP 4, modules with a total of at least 12 C have to be completed successfully, thereof at least a seminar module or an advanced seminar module with at least 3C (M.Mat.483*, M.Mat.484*, M.Mat.493*, M.Mat.494*). If the Master's thesis is in one out of these two study foci, a total of at least 6 C of the modules out of the other study focus have to be completed successfully.

iii) Further modules can be chosen freely out of the modules offered in all four mathematical study foci.

bb) Elective compulsory modules in the minor subject (18 C)

In the study track F, modules with at total of at least 18 C have to be completed successfully in one out of the following minor subjects: Astrophysics, Business Administration, Chemistry, Computer Science, Philosophy, Physics, Economics. The regulations for the modules to choose from in each case can be found in no. 3) "Minor subjects in the graduate programme in Mathematics".

cc) Elective modules in the key competencies area (12 C)

Modules with a total of at least 12 C have to be completed successfully, among them one out of the key competencies modules offered by the Unit Mathematics, according to the regulations in no. 4) "Key competencies in the graduate programme in Mathematics". The remaining modules can be chosen freely from the key competencies modules offered by the Unit Mathematics, according to the regulations in No. 4) "Key competencies in the graduate programme in Mathematics", or from the cross-faculty key competencies offer. The choice of other modules (alternative modules) is only possible with the approval of the Dean of Studies of the faculty that offers the module. The choice of an alternative module has to be reported to the Study Office Mathematics in advance.

b) Study track Phy "Physics"

In the research-oriented study track Phy "Physics", modules below have to be completed successfully according to the regulations.

aa) E lective compulsory modules in Mathematics (60 C)

In the study track Phy, elective compulsory modules covering a total of at least 60 C have to be completed successfully according to the following regulations:

i) In the study foci SP 3 or SP 4, ective compulsory modules with a total of at least 12 C have to be completed successfully, thereof at least a seminar module or an advanced seminar module with at least 3 C (M.Mat.483*, M.Mat.484*, M.Mat.493*, M.Mat.494*).

ii) In the cycles "Mathematical Methods in Physics", "Analysis of Partial Differential Equations", "Differential Geometry", "Algebraic Topology", "Non-commutative Geometry" and "Groups, Geometry and Dynamical Systems", modules with a total of at least 12 C have to be completed successfully, thereof at least a seminar module or an advanced seminar module with at least 3 C.

iii) Further modules can be chosen freely out the modules offered in all four mathematical study foci SP1-4. Additionally, modules in the section no. 3) f "Physics" can be chosen freely, however this option is restricted to modules with a total of at most 12 C.

bb) Elective compulsory modules in the minor subject (18 C)

In the study track Phy, in the minor subject "Physics", modules with a total of at least 18 C have to be completed successfully. The regulations for the modules that can be chosen can be found in no. 3) "Minor subjects in the graduate programme in Mathematics".

cc) Elective modules of the key competencies area (12 C)

At least one key competencies module out of the offer of the Faculty of Physics or out of the offer of the Unit Mathematics has to be completed successfully. Furthermore, modules can be chosen freely from the key competencies modules offered by the Unit Mathematics, according to the regulations in no. 4) "Key competencies in the graduate programme in Mathematics", or

from the cross-faculty key competencies offer. The choice of other modules (alternative modules) is only possible with the approval of the Dean of Studies of the faculty that offers the module. The choice of an alternative module has to be reported to the Study Office Mathematics in advance.

c) Study track MDS "Mathematical Data Science"

In the study track MDS "Mathematical Data Science" modules have to be completed successfully according to the regulations below. In the study track "Mathematical Data Science" the study foci SP 3 or SP 4 are permitted as study focus of the master's thesis, only.

aa) Elective compulsory modules in Mathematics (60 C)

In the study track MDS, elective compulsory modules in the subject mathematics with a total of at least 60 C have to be completed successfully according to the following regulations:

i) Elective compulsory modules in SP 3

In the cycles listed below, modules with a total of at least 12 C have to be completed successfully, thereof at least a seminar module or an advanced seminar module with at least 3 C.

- Inverse problems
- Optimisation
- Variational analysis
- Image and Geometry processing
- Scientific computing/applied mathematics

ii) Elective compulsory modules in SP 4

In the cycles listed below, modules with a total of at least 12 C have to be completed successfully, thereof at least a seminar module or an advanced seminar module with at least 3 C.

- Applied and mathematical stochastics
- Statistical modelling and inference
- Multivariate statistics
- Statistical foundations of data science

iii) Practical course

One out of the following practical course modules with 10 C has to be completed successfully:

M.Mat.0731: Advanced practical course in scientific computing (10 C, 4 WLH)

M.Mat.0741: Advanced practical course in stochastics (10 C, 6 WLH)

iv) Computer Science

In the area "Computer science", one out of the following modules has to be completed successfully.

B.Inf.1236: Machine Learning (6 C, 4 WLH)
B.Inf.1237: Deep Learning (6 C, 4 WLH)
B.Inf.1240 Visualization (5 C, 3 WLH)
B.Inf.1241 Computational Optimal Transport (6 C, 4 WLH)
M.Inf.1112: Efficient Algorithms (5 C, 3 WLH)
M.Inf.1151: Data Science and Big Data Analytics (5 C, 3 WLH)
M.Inf.1171: Service-Oriented Infrastructures (5 C, 3 WLH)
M.Inf.1172: Using Research Infrastructures (5 C, 3 WLH)
M.Inf.1185: Sensor Data Fusion (5 C, 3 WLH)
M.Inf.1186: Seminar Hot Topics in Data Fusion and Analytics (5 C, 2 WLH)
M.Inf.1188: Mobile Robotics (5 C, 4 WLH)
M.Inf.1210: Seminar on Algorithmic Methods and Theoretical Concepts in Computer Science (5 C, 2 WLH)
M.Inf.1141: Semistructured Data and XML (6 C, 4 WLH)
M.Inf.1211: Probabilistic Data Models and Applications (6 C, 4 WLH)
M.Inf.1213: Algorithmic Learning and Pattern Recognition (6 C, 4 WLH)
M.Inf.1216: Data Compression and Information Theory (6 C, 4 WLH)
M.Inf.1231: Specialisation in Distributed Systems (6 C, 4 WLH)
M.Inf.1232: Parallel Computing (6 C, 4 WLH)
M.Inf.1244: Seminar on optimal transport (5 C, 2 WLH)
M.Inf.1268: Information Theory (6 C, 4 WLH)
M.Inf.1802: Practical Course on XML (6 C, 4 WLH)
M.Inf.1806: Seminar and Project Databases (6 C, 2 WLH)
M.Inf.1808: Practical Course on Parallel Computing (6 C, 4 WLH)
M.Inf.2102 Advanced Statistical Learning for Data Science (6 C, 4 WLH)
M.Inf.2201 Probabilistic Machine Learning (6 C, 4 WLH)
M.Inf.2241 Current Topics in Machine Learning (5 C, 2 WLH)

v) Elective modules

In order to achieve 60 C, modules out of the four study foci in Mathematics can be added. In addition, modules with a total of at most 12 C can be chosen in the subject "Computer science" as listed in no. 3) d "Computer Science". However, those listed in section iv) "Computer Science" are recommended.

bb) Elective compulsory modules in the minor subject (18 C)

In the study track MDS, in the minor subject "Computer science" modules with a total of at least 18 C have to be completed successfully. The regulations can be found in no. 3) d "Computer science". However, those listed in section iv) "Computer Science" are recommended.

cc) Elective modules in the key competencies area (12 C)

One out of the elective modules listed in no. 4) " Key competencies in the graduate programme in Mathematics" offered by the teaching unit Mathematics or from the modules listed in section iv) "Computer Science" has to be completed successfully. Furthermore, modules can be chosen freely from the elective modules offered by the Unit Mathematics, according to the regulations in no. 4) "Key competencies in the graduate programme in Mathematics", or from the cross-faculty key competencies offer. The choice of other modules (alternative modules) is only possible with the approval of the Dean of Studies of the faculty that offers the module. The choice of an alternative module has to be reported to the Study Office Mathematics in advance.

2) Elective courses in Mathematics (graduate studies)

a) Elective compulsory modules in study focus SP 1 "Analysis, geometry, topology"

M.Mat.3110: Higher analysis	(9 C, 6 WLH)
B.Mat.3111: Introduction to analytic number theory	(9 C, 6 WLH)
B.Mat.3112: Introduction to analysis of partial differential equations	(9 C, 6 WLH)
B.Mat.3113: Introduction to differential geometry	(9 C, 6 WLH)
B.Mat.3114: Introduction to algebraic topology	(9 C, 6 WLH)
B.Mat.3115: Introduction to mathematical methods in physics	(9 C, 6 WLH)
B.Mat.3311: Advances in analytic number theory	(9 C, 6 WLH)
B.Mat.3312: Advances in analysis of partial differential equations	(9 C, 6 WLH)
B.Mat.3313: Advances in differential geometry	(9 C, 6 WLH)
B.Mat.3314: Advances in algebraic topology	(9 C, 6 WLH)
B.Mat.3315: Advances in mathematical methods in physics	(9 C, 6 WLH)
M.Mat.4511: Specialisation in analytic number theory	(9 C, 6 WLH)
M.Mat.4512: Specialisation in analysis of partial differential equations	(9 C, 6 WLH)
M.Mat.4513: Specialisation in differential geometry	(9 C, 6 WLH)
M.Mat.4514: Specialisation in algebraic topology	(9 C, 6 WLH)
M.Mat.4515: Specialisation in mathematical methods in physics	(9 C, 6 WLH)
M.Mat.4611: Aspects of analytic number theory	(6 C, 4 WLH)
M.Mat.4612: Aspects of analysis of partial differential equations	(6 C, 4 WLH)
M.Mat.4613: Aspects of differential geometry	(6 C, 4 WLH)
M.Mat.4614: Aspects of algebraic topology	(6 C, 4 WLH)
M.Mat.4615: Aspects of mathematical methods in physics	(6 C, 4 WLH)
M.Mat.4711: Special course in analytic number theory	(3 C, 2 WLH)
M.Mat.4712: Special course in analysis of partial differential equations	(3 C, 2 WLH)
M.Mat.4713: Special course in differential geometry	(3 C, 2 WLH)
M.Mat.4714: Special course in algebraic topology	(3 C, 2 WLH)

M.Mat.4715: Special course in mathematical methods in physics (3 C, 2 WLH)
M.Mat.4811: Seminar on analytic number theory (3 C, 2 WLH)
M.Mat.4812: Seminar on analysis of partial differential equations (3 C, 2 WLH)
M.Mat.4813: Seminar on differential geometry (3 C, 2 WLH)
M.Mat.4814: Seminar on algebraic topology (3 C, 2 WLH)
M.Mat.4815: Seminar on mathematical methods in physics (3 C, 2 WLH)
M.Mat.4911: Advanced seminar on analytic number theory (3 C, 2 WLH)
M.Mat.4912: Advanced seminar on analysis of partial differential equations (3 C, 2 WLH)
M.Mat.4913: Advanced seminar on differential geometry (3 C, 2 WLH)
M.Mat.4914: Advanced seminar on algebraic topology (3 C, 2 WLH)
M.Mat.4915: Advanced seminar on mathematical methods in physics (3 C, 2 WLH)

b) Elective compulsory modules in study focus SP 2 "Algebra, geometry, number theory"

B.Mat.3121: Introduction to algebraic geometry (9 C, 6 WLH)
B.Mat.3122: Introduction to algebraic number theory (9 C, 6 WLH)
B.Mat.3123: Introduction to algebraic structures (9 C, 6 WLH)
B.Mat.3124: Introduction to groups, geometry and dynamical systems (9 C, 6 WLH)
B.Mat.3125: Introduction to non-commutative geometry (9 C, 6 WLH)
B.Mat.3321: Advances in algebraic geometry (9 C, 6 WLH)
B.Mat.3322: Advances in algebraic number theory (9 C, 6 WLH)
B.Mat.3323: Advances in algebraic structures (9 C, 6 WLH)
B.Mat.3324: Advances in groups, geometry and dynamical systems (9 C, 6 WLH)
B.Mat.3325: Advances in non-commutative geometry (9 C, 6 WLH)
M.Mat.4521: Specialisation in algebraic geometry (9 C, 6 WLH)
M.Mat.4522: Specialisation in algebraic number theory (9 C, 6 WLH)
M.Mat.4523: Specialisation in algebraic structures (9 C, 6 WLH)
M.Mat.4524: Specialisation in groups, geometry and dynamical systems (9 C, 6 WLH
M.Mat.4525: Specialisation in non-commutative geometry (9 C, 6 WLH)
M.Mat.4621: Aspects of algebraic geometry (6 C, 4 WLH)
M.Mat.4622: Aspects of algebraic number theory (6 C, 4 WLH)
M.Mat.4623: Aspects of algebraic structures (6 C, 4 WLH)
M.Mat.4624: Aspects of groups, geometry and dynamical systems (6 C, 4 WLH)
M.Mat.4625: Aspects of non-commutative geometry (6 C, 4 WLH)
M.Mat.4721: Special course in algebraic geometry (3 C, 2 WLH)
M.Mat.4722: Special course in algebraic number theory (3 C, 2 WLH)
M.Mat.4723: Special course in algebraic structures (3 C, 2 WLH)
M.Mat.4724: Special course in groups, geometry and dynamical systems (3 C, 2 WLH)
M.Mat.4725: Special course in non-commutative geometry (3 C, 2 WLH)

M.Mat.4821: Seminar on algebraic geometry (3 C, 2 WLH)
M.Mat.4822: Seminar on algebraic number theory (3 C, 2 WLH)
M.Mat.4823: Seminar on algebraic structures (3 C, 2 WLH)
M.Mat.4824: Seminar on groups, geometry and dynamical systems (3 C, 2 WLH)
M.Mat.4825: Seminar on non-commutative geometry (3 C, 2 WLH)
M.Mat.4921: Advanced seminar on algebraic geometry (3 C, 2 WLH)
M.Mat.4922: Advanced seminar on algebraic number theory (3 C, 2 WLH)
M.Mat.4923: Advanced seminar on algebraic structures (3 C, 2 WLH)
M.Mat.4924: Advanced seminar on groups, geometry and dynamical systems (3 C, 2 WLH)
M.Mat.4925: Advanced seminar on non-commutative geometry (3 C, 2 WLH)

c) Elective compulsory modules in study focus SP 3 "Numerical and applied mathematics"

M.Mat.0731: Advanced practical course in scientific computing (10 C, 4 WLH)
M.Mat.3110: Higher analysis (9 C, 6 WLH)
M.Mat.3130: Operations research (9 C, 6 WLH)
B.Mat.3131: Introduction to inverse problems (9 C, 6 WLH)
B.Mat.3132: Introduction to approximation methods (9 C, 6 WLH)
B.Mat.3133: Introduction to numerics of partial differential equations (9 C, 6 WLH)
B.Mat.3134: Introduction to optimisation (9 C, 6 WLH)
B.Mat.3137: Introduction to variational analysis (9 C, 6 WLH)
B.Mat.3138: Introduction to image and geometry processing (9 C, 6 WLH)
B.Mat.3139: Introduction to scientific computing / applied mathematics (9 C, 6 WLH)
B.Mat.3331: Advances in inverse problems (9 C, 6 WLH)
B.Mat.3332: Advances in approximation methods (9 C, 6 WLH)
B.Mat.3333: Advances in numerics of partial differential equations (9 C, 6 WLH)
B.Mat.3334: Advances in optimisation (9 C, 6 WLH)
B.Mat.3337: Advances in variational analysis (9 C, 6 WLH)
B.Mat.3338: Advances in image and geometry processing (9 C, 6 WLH)
B.Mat.3339: Advances in scientific computing / applied mathematics (9 C, 6 WLH)
M.Mat.4531: Specialisation in inverse problems (9 C, 6 WLH)
M.Mat.4532: Specialisation in approximation methods (9 C, 6 WLH)
M.Mat.4533: Specialisation in numerical methods of partial differential equations (9 C, 6 WLH)
M.Mat.4534: Specialisation in optimisation (9 C, 6 WLH)
M.Mat.4537: Specialisation in variational analysis (9 C, 6 WLH)
M.Mat.4538: Specialisation in image and geometry processing (9 C, 6 WLH)
M.Mat.4539: Specialisation in scientific computing / applied mathematics (9 C, 6 WLH)
M.Mat.4631: Aspects of inverse problems (6 C, 4 WLH)

M.Mat.4632: Aspects of approximation methods (6 C, 4 WLH)
M.Mat.4633: Aspects of numerical methods of partial differential Equations (6 C, 4 WLH)
M.Mat.4634: Aspects of optimisation (6 C, 4 WLH)
M.Mat.4637: Aspects of variational analysis (6 C, 4 WLH)
M.Mat.4638: Aspects of image and geometry processing (6 C, 4 WLH)
M.Mat.4639: Aspects of scientific computing / applied mathematics (6 C, 4 WLH)
M.Mat.4731: Special course in inverse problems (3 C, 2 WLH)
M.Mat.4732: Special course in approximation methods (3 C, 2 WLH)
M.Mat.4733: Special course in numerical methods of partial differential equations (3 C, 2 WLH)
M.Mat.4734: Special course in optimisation (3 C, 2 WLH)
M.Mat.4737: Special course in variational analysis (3 C, 2 WLH)
M.Mat.4738: Special course in image and geometry processing (3 C, 2 WLH)
M.Mat.4739: Special course in scientific computing / applied Mathematics (3 C, 2 WLH)
M.Mat.4831: Seminar on inverse problems (3 C, 2 WLH)
M.Mat.4832: Seminar on approximation methods (3 C, 2 WLH)
M.Mat.4833: Seminar on numerical methods of partial differential Equations (3 C, 2 WLH)
M.Mat.4834: Seminar on optimisation (3 C, 2 WLH)
M.Mat.4837: Seminar on variational analysis (3 C, 2 WLH)
M.Mat.4838: Seminar on image and geometry processing (3 C, 2 WLH)
M.Mat.4839: Seminar on scientific computing / applied mathematics (3 C, 2 WLH)
M.Mat.4931: Advanced seminar on inverse problems (3 C, 2 WLH)
M.Mat.4932: Advanced seminar on approximation methods (3 C, 2 WLH)
M.Mat.4933: Advanced seminar on numerical methods of partial differential equations (3 C, 2 WLH)
M.Mat.4934: Advanced seminar on optimisation (3 C, 2 WLH)
M.Mat.4937: Advanced seminar on variational analysis (3 C, 2 WLH)
M.Mat.4938: Advanced seminar on image and geometry processing (3 C, 2 WLH)
M.Mat.4939: Advanced seminar on scientific computing / applied mathematics (3 C, 2 WLH)

d) Elective compulsory modules in study focus SP 4 "Mathematical stochastics"

M.Mat.0741: Advanced practical course in stochastics (10 C, 6 WLH)
B.Mat.3041: Overview on non-life insurance mathematics (3 C, 2 WLH)
B.Mat.3042: Overview on life insurance mathematics (3 C, 2 WLH)
B.Mat.3043: Non-life insurance mathematics (6 C, 4 WLH)
B.Mat.3044: Life insurance mathematics (6 C, 4 WLH)

M.Mat.3140: Mathematical statistics (9 C, 6 WLH)
B.Mat.3141: Introduction to applied and mathematical stochastics (9 C, 6 WLH)
B.Mat.3142: Introduction to stochastic processes (9 C, 6 WLH)
B.Mat.3143: Introduction to stochastic methods of economathematics (9 C, 6 WLH)
B.Mat.3144: Introduction to mathematical statistics (9 C, 6 WLH)
B.Mat.3145: Introduction to statistical modelling and inference (9 C, 6 WLH)
B.Mat.3146: Introduction to multivariate statistics (9 C, 6 WLH)
B.Mat.3147: Introduction to statistical foundations of data science (9 C, 6 WLH)
B.Mat.3341: Advances in applied and mathematical stochastics (9 C, 6 WLH)
B.Mat.3342: Advances in stochastic processes (9 C, 6 WLH)
B.Mat.3343: Advances in stochastic methods of economathematics (9 C, 6 WLH)
B.Mat.3344: Advances in mathematical statistics (9 C, 6 WLH)
B.Mat.3345: Advances in statistical modelling and inference (9 C, 6 WLH)
B.Mat.3346: Advances in multivariate statistics (9 C, 6 WLH)
B.Mat.3347: Advances in statistical foundations of data science (9 C, 6 WLH)
M.Mat.4541: Specialisation in applied and mathematical stochastics (9 C, 6 WLH)
M.Mat.4542: Specialisation in stochastic processes (9 C, 6 WLH)
M.Mat.4543: Specialisation in stochastic methods in economathematics (9 C, 6 WLH)
M.Mat.4544: Specialisation in mathematical statistics (9 C, 6 WLH)
M.Mat.4545: Specialisation in statistical modelling and inference (9 C, 6 WLH)
M.Mat.4546: Specialisation in multivariate statistics (9 C, 6 WLH)
M.Mat.4547: Specialisation in statistical foundations of data science (9 C, 6 WLH)
M.Mat.4641: Aspects of applied and mathematical stochastics (6 C, 4 WLH)
M.Mat.4642: Aspects of stochastic processes (6 C, 4 WLH)
M.Mat.4643: Aspects of stochastics methods of economathematics (6 C, 4 WLH)
M.Mat.4644: Aspects of mathematical statistics (6 C, 4 WLH)
M.Mat.4645: Aspects of statistical modelling and inference (6 C, 4 WLH)
M.Mat.4646: Aspects of multivariate statistics (6 C, 4 WLH)
M.Mat.4647: Aspects of statistical foundations of data science (6 C, 4 WLH)
M.Mat.4741: Special course in applied and mathematical stochastics (3 C, 2 WLH)
M.Mat.4742: Special course in stochastic processes (3 C, 2 WLH)
M.Mat.4743: Special course in stochastic methods of economathematics (3 C, 2 WLH)
M.Mat.4744: Special course in mathematical statistics (3 C, 2 WLH)
M.Mat.4745: Special course in statistical modelling and inference (3 C, 2 WLH)
M.Mat.4746: Special course in multivariate statistics (3 C, 2 WLH)
M.Mat.4747: Special course in statistical foundations of data science (3 C, 2 WLH)
M.Mat.4841: Seminar on applied and mathematical stochastics (3 C, 2 WLH)
M.Mat.4842: Seminar on stochastic processes (3 C, 2 WLH)
M.Mat.4843: Seminar on stochastic methods of economathematics (3 C, 2 WLH)

M.Mat.4844: Seminar on mathematical statistics (3 C, 2 WLH)
M.Mat.4845: Seminar on statistical modelling and inference (3 C, 2 WLH)
M.Mat.4846: Seminar on multivariate statistics (3 C, 2 WLH)
M.Mat.4847: Seminar in statistical foundations of data science (3 C, 2 WLH)
M.Mat.4941: Advanced seminar on applied and mathematical Stochastics (3 C, 2 WLH)
M.Mat.4942: Advanced seminar on stochastic processes (3 C, 2 WLH)
M.Mat.4943: Advanced seminar on stochastic methods in Economathematics (3 C, 2 WLH)
M.Mat.4944: Advanced seminar on mathematical statistics (3 C, 2 WLH)
M.Mat.4945: Advanced seminar on statistical modelling and inference (3 C, 2 WLH)
M.Mat.4946: Advanced seminar on multivariate statistics (3 C, 2 WLH)
M.Mat.4947: Advanced seminar in statistical foundations of data science (3 C, 2 WLH)

3) Minor subjects in the graduate programme in Mathematics

a) Astrophysics

In "Astrophysics" as a minor subject the following module with 8 C has to be completed successfully. Furthermore, all modules with module number B.Phy.55** and M.Phy.55** may be chosen.

B.Phy.1551: Introduction to Astrophysics (8 C / 6 WLH)

b) Business Administration

In "Business Administration" as a minor subject the following modules may be chosen.

B.WIWI-WIN.0001: Management of Business Information Systems (6 C, 2 WLH)
B.WIWI-WIN.0002: Fundamentals of Information Management (6 C, 6 WLH)
B.WIWI-BWL.0014: Financial Accounting (6 C, 4 WLH)
B.WIWI-BWL.0023: Actuarial Techniques (6 C, 2 WLH)
B.WIWI-BWL.0038: Supply Chain Management (6 C, 2 WLH)
B.WIWI-BWL.0087: International Marketing (6 C, 2 WLH)
M.WIWI-BWL.0001: Corporate Finance (6 C, 4 WLH)
M.WIWI-BWL.0002: IFRS Financial Reporting (6 C, 4 WLH)
M.WIWI-BWL.0003: Company Taxation (6 C, 4 WLH)
M.WIWI-BWL.0004: Financial Risk Management (6 C, 4 WLH)
M.WIWI-BWL.0006: Seminar in Finance (6 C, 2 WLH)
M.WIWI-BWL.0008: Derivate (6 C, 4 WLH)
M.WIWI-BWL.0023: Management Accounting (6 C, 3 WLH)
M.WIWI-BWL.0034: Logistics and Supply Chain Management (6 C, 3 WLH)
M.WIWI-BWL.0133: Banking Supervision (6 C, 2 WLH)
M.WIWI-BWL.0134: Panel Data Analysis in Marketing (6 C, 2 WLH)

M.WIWI-QMW.0001: Generalized Regression (6 C, 4 WLH)
M.WIWI-QMW.0002: Advanced Statistical Inference (Likelihood & Bayes) (6 C, 4 WLH)
M.WIWI-QMW.0009: Introduction to Time Series Analysis (6 C, 4 WLH)
M.WIWI-QMW.0011: Advanced Statistical Programming with R (6 C, 2 WLH)
M.WIWI-QMW.0012: Multivariate Time Series Analysis (6 C, 4 WLH)

c) Chemistry

In "Chemistry" as a minor subject the following module may be chosen. Furthermore all modules in Chemistry out of the graduate programm in Chemistry (module number M.Che.****) can be chosen. Selection of modules out of the undergraduate programme in Chemistry may be selected provided approval through the Dean of Studies of the Faculty of Chemistry. In this case the Study Office Mathematics must be informed beforehand.

M.Che.1311: Vibrational Spectroscopy and Intermolecular Dynamics (6 C, 4 WLH)
M.Che.1313: Electronic Spectroscopy and Reaction Dynamics (6 C, 4 WLH)
M.Che.1314: Biophysical Chemistry (6 C, 4 WLH)
M.Che.1315: Chemical Dynamics at Surfaces (6 C, 4 WLH)

d) Computer Science

i) In "Computer Science" as a minor subject all the modules with module number B.Inf.**** or M.Inf.**** can be chosen with the exception of the following modules:
B.Inf.1101: Introduction to Computer Science and Programming
B.Inf.1102: Introduction to Computer Systems
B.Inf.1801: Programming

ii) Furthermore, the following modules can be brought in:

B.Phy.5601: Theoretical and Computational Neuroscience I (3 C, 2 WLH)
B.Phy.5602: Theoretical and Computational Neuroscience II (3 C, 2 WLH)
B.Phy.5651: Advanced Computational Neuroscience (3 C, 2 WLH)
B.Phy.5652: Advanced Computational Neuroscience II (3 C, 2 WLH)
B.Phy.5676: Computer Vision and Robotics (9 C, 6 WLH)
M.Phy.5601: Seminar Computational Neuroscience/Neuroinformatik (4 C, 2 WLH)

e) Philosophy

In "Philosophy" as a minor subject the following modules can be chosen; for at least one of the selected modules a term paper has to be prepared. Advanced studies modules may be chosen after the respective basic studies module has successfully been completed, only.

B.Phi.01: Basic Studies in Theoretical Philosophy (9 C, 4 WLH)
B.Phi.02: Basic Studies in Practical Philosophy (9 C, 4 WLH)
B.Phi.03: Basic Studies in History of Philosophy (9 C, 4 WLH)
B.Phi.05: Advanced Studies in Theoretical Philosophy (10 C, 4 WLH)
B.Phi.06: Advanced Studies in Practical Philosophy (10 C, 4 WLH)

B.Phi.07: Advanced Studies in History of Philosophy (10 C, 4 WLH)
B.Phi.18a: Detailed Philosophical Studies (6 C, 2 WLH)
B.Phi.19a: Special Philosophical Topics (3 C, 2 WLH)
M.Phi.101: Selected Topics in Theoretical Philosophy (9 C, 4 WLH)
M.Phi.102: Selected Topics in Practical Philosophy (9 C, 4 WLH)
M.Phi.103: Selected Topics in History of Philosophy (9 C, 4 WLH)

f) Physics

In "Physics" as a minor subject all modules with module number B.Phy.**** or M.Phy.*** can be chosen, with the exception of the following module:

B.Phy.1301: Mathematical Methods in Physics (6 C, 6 WLH)

g) Economics

In "Economics" as a minor subject the following modules can be chosen:

B.WIWI-BWL.0023: Actuarial Techniques (6 C, 2 WLH)
B.WIWI-VWL.0001: Microeconomics II (6 C, 4 WLH)
B.WIWI-VWL.0002: Macroeconomics II (6 C, 4 WLH)
B.WIWI-VWL.0005: Introduction to International Economicsi (6 C, 4 WLH)
B.WIWI-VWL.0006: Economic Growth and Development (6 C, 4 WLH)
B.WIWI-VWL.0007: Introduction to Econometrics (6 C, 6 WLH)
B.WIWI-VWL.0008: Money and International Finance (6 C, 4 WLH)
B.WIWI-VWL.0010: Foundations of Institutional Economics (6 C, 2 WLH)
B.WIWI-VWL.0059: International Financial Markets (6 C, 2 WLH)
M.WIWI-BWL.0134: Panel Data Analysis in Marketing (6 C, 2 WLH)
M.WIWI-QMW.0001: Generalized Regression (6 C, 4 WLH)
M.WIWI-QMW.0002: Advanced Statistical Inference (Likelihood & Bayes) (6 C, 4 WLH)
M.WIWI-QMW.0004: Econometrics I (6 C, 4 WLH)
M.WIWI-QMW.0005: Econometrics II (6 C, 4 WLH)
M.WIWI-QMW.0009: Introduction to Time Series Analysis (6 C, 4 WLH)
M.WIWI-QMW.0011: Advanced Statistical Programming with R (6 C, 2 WLH)
M.WIWI-QMW.0012: Multivariate Time Series Analysis (6 C, 4 WLH)
M.WIWI-VWL.0001: Advanced Microeconomics (6 C, 4 WLH)
M.WIWI-VWL.0041: Panel Data Econometrics (6 C, 4 WLH)
M.WIWI-VWL.0092: International Trade (6 C, 4 WLH)
M.WIWI-VWL.0099: Poverty and Inequality (6 C, 3 WLH)
M.WIWI-VWL.0128: Deep Determinants of Growth and Development (6 C, 4 WLH)

4) Key competencies in the Master's degree programme in Mathematics

Within the Master's degree programme "Mathematics", the Unit Mathematics offers the following key competence modules.

B.Mat.0720: Mathematical application software (3 C, 2 WLH)

B.Mat.0721: Mathematics related programming (5 C, 3 WLH)
B.Mat.0730: Practical course in scientific computing (9 C, 4 WLH)
M.Mat.0731: Advanced practical course in scientific computing (10 C, 4 WLH)
B.Mat.0740: Practical course in stochastics (9 C, 6 WLH)
M.Mat.0741: Advanced practical course in stochastics (10 C, 6 WLH)
B.Mat.0910: Effective use of Linux (3 C, 2 WLH)
B.Mat.0921: Introduction to TeX/LaTeX with applications (3 C, 2 WLH)
B.Mat.0922: Mathematics information services and electronic publishing (3 C, 2 WLH)
B.Mat.0923: Scientific Writing (3 C, 2 WLH)
B.Mat.0931: Coaching of teaching assistants (4 C, 2 WLH)
B.Mat.0932: Communicating mathematical topics to a professional audience (3 C, 2 WLH)
B.Mat.0935: Historical, museum-related, and technical aspects of the building-up, the maintenance and the use of scientific collections (4 C, 2 WLH)
B.Mat.0936: Media education for mathematical objects and problems (4 C, 2 WLH)
B.Mat.0940: The mathematical nature of the world we are living in (3 C, 2 WLH)
B.Mat.0950: Membership in the student or academic self-government (3 C, 1 WLH)
B.Mat.0951: Civic engagement in a mathematical environment (3 C, 1 WLH)
B.Mat.0952: Event management in mathematics (3 C, 2 WLH)
B.Mat.0970: Internship (8 C)
M.Mat.0971: Internship (10 C)

5) Master’s thesis

By successfully completing a master's thesis students earn 30 C.

Appendix II: Exemplary curricula

1) Full-time studies: Profile F with focus 2, minor subject “Economics”

<table>
<tr><th>Sem
Σ C*</th><th colspan="3">Mathematics (60 C)</th><th>Minor subject “Economics”
(18 C)</th><th>Key competencies
(12 C)</th><th>Master’s thesis
(30 C)</th></tr>
<tr><td>1
Σ 30 C</td><td>B.Mat.3114
Introduction to algebraic topology
9 C</td><td>B.Mat.3125
Introduction to non-commutative geometry
9 C</td><td>M.Mat.4834
Seminar on optimisation
3 C</td><td>B.WIWI-VWL.0006
Growth and development
6 C</td><td>B.Mat.0922
Mathematics information services and electronic
publishing
3 C</td><td></td></tr>
<tr><td>2.
Σ 30 C</td><td colspan="2">B.Mat.3314
Advances in algebraic topology
9 C</td><td>B.Mat.3325
Advances in non-commutative geometry
9 C</td><td>B.WIWI-VWL.0008
Money and International Finance
6 C</td><td>B.Inf.908
General programming practical course
6 C</td><td></td></tr>
<tr><td>3.
Σ 30 C</td><td>M.Mat.4825
Seminar on non-commutative geometry
3 C</td><td>M.Mat.3140
Mathematical statistics
9 C</td><td>M.Mat.4525
Specialisation in non-commutative geometry
9 C</td><td>B.WIWI-VWL.0007
Introduction to Econometrics
6 C</td><td>B.Mat.0932
Communicating mathematical topics to a professional audience
3 C</td><td></td></tr>
<tr><td>4.
Σ 30 C</td><td colspan="3"></td><td></td><td></td><td>Master’s thesis in SP 2
30 C</td></tr>
<tr><td>Σ120 C</td><td colspan="3">60 C</td><td>18 C</td><td>12 C</td><td>30 C</td></tr>
</table>

2) Full-time studies: Profile Phy with focus 1, minor subject “Physics”

Sem **Σ C***	**Mathematics (60 C)**			**Minor subject “Physics” (18 C)**	**Key competencies (12 C)**	**Master’s thesis (30 C)**
1 **Σ 30 C**	B.Mat.3114 Introduction to algebraic topology 9 C	B.Mat.3125 Introduction to non-commutative geometry 9 C	M.Mat.4834 Seminar on optimisation 3 C	B.Phy.5506 Introduction to fluid dynamics 6 C	B.Mat.0922 Mathematics information services and electronic Publishing 3 C	
2. **Σ 30 C**	B.Mat.3314 Advances in algebraic topology" 9 C	B.Mat.3325 Advances in non-commutative geometry 9 C		B.Phy.5523 General Relativity 6 C	B.Phy.606 Electronic Lab Course for Natural Scientists 6 C	
3. **Σ 30 C**	M.Mat.4914: Advanced seminar on algebraic topology 3 C	M.Mat.3140 Mathematical statistics 9 C	M.Mat.4514 Specialisation in algebraic topology 9 C	B.Phy.5501 Aerodynamics 6 C	B.Mat.0932 Communicating mathematical topics to a professional audience 3 C	
4. **Σ 30 C**						Master’s thesis in SP 1 30 C
Σ120 C	**60 C**			**18 C**	**12 C**	**30 C**

3) Full time studies: Profile MDS with focus 4, minor subject “Computer Science”

Sem Σ C*	**Subject specific degree programme (60 C)**				**Minor subject “Computer Science” (18 C)**	**Key competencies (12 C)**	**Master’s thesis (30 C)**
1. Σ 30 C	M.Mat.3130 Operations research 9 C		B.Mat.3147 Introduction to statistical foundations of data science 9 C		M.Inf.1232 Parallel Computing 6 C	SK.FS.EN-FW-C1-1 Business English I – C1.1 6 C	
2. Σ 30 C	B.Mat.3334 Advances in optimisation 9 C		M.Mat.4847 Seminar on statistical foundations of data science 3 C	B.Mat.3337 Advances in statistical foundations of data science 9 C	M.Inf.1808 Practical Course on Parallel Computing 6 C	B.Mat.0922 Mathematics Information Services and electronic publishing 3 C	
3. Σ 30 C	M.Mat. 4834 Seminar on optimisation 3 C	M.Inf.1151 Vertiefung Software-technik: Data Science und Big Data Analytics 5 C	M.Mat.4947 Advanced seminar on statistical foundations of data science 3 C	M.Mat.0741 Advanced practical course in stochastics 10 C	M.Inf.1281 NOSQL Databases 6 C	B.Mat.0940 The mathematical nature of the world we are living in 3 C	
4. Σ 30 C							Master’s thesis in SP 4 30 C
Σ120 C	**60 C**				**18 C**	**12 C**	**30 C**

4) Part-time studies: Profile F with focus 2, minor subject “Economics”

Sem **Σ C***	**Mathematics (60 C)**		**Minor subject “Economics” (18 C)**	**Key competencies (12 C)**	**Master’s thesis (30 C)**
1 **Σ 15 C**	B.Mat.3114 Introduction to algebraic topology 9 C	M.Mat.4834 Seminar on optimisation 3 C		B.Mat.0922 Mathematics information services and electronic Publishing 3 C	
2. **Σ 15 C**	B.Mat.3314 Advances in algebraic topology 9 C		B.WIWI-VWL.0001 Microeconomics II 6 C		
3. **Σ 15 C**	B.Mat.3125 Introduction to non-commutative geometry 9 C	M.Mat.4914: Advanced seminar on algebraic topology 3 C		B.Mat.0932 Communicating mathematical topics to a professional audience 3 C	
4. **Σ 15 C**	B.Mat.3325 Advances in non-commutative geometry 9 C		B.WIWI-VWL.0002 Macroeconomics II 6 C		
5. **Σ 15 C**	M.Mat.4525 Specialisation in algebraic topology 9 C			B.Inf.908 General programming practical course 6 C	
6. **Σ 15 C**	M.Mat.3140 Mathematical statistics 9 C		B.WIWI-VWL.0008 Money and International Finance 6 C		
7. **Σ 30 C**					Master’s thesis in SP 2 30 C
Σ120 C	**60 C**		**18 C**	**12 C**	**30 C**

5) Part-time studies: Profile Phy with focus 2, minor subject “Physics”

Sem **Σ C***	**Mathematics (60 C)**		**Minor subject “Physics” (18 C)**	**Key competencies (12 C)**	**Master’s thesis (30 C)**
1 **Σ 15 C**	B.Mat.3114 Introduction to algebraic topology 9 C	M.Mat.4834 Seminar on optimisation 3 C		B.Mat.0922 Mathematics information services and electronic Publishing 3 C	
2. **Σ 15 C**	B.Mat.3314 Advances in algebraic topology 9 C		B.Phy.5504 Computational Physics 6 C		
3. **Σ 15 C**	B.Mat.3125 Introduction to non-commutative geometry 9 C	M.Mat.4914: Advanced seminar on algebraic topology 3 C		B.Mat.0932 Communicating mathematical topics to a professional audience 3 C	
4. **Σ 15 C**	B.Mat.3325 Advances in non-commutative geometry 9 C		B.Phy.5506 Introduction to fluid dynamics 6 C		
5. **Σ 15 C**	M.Mat.4525 Specialisation in non-commutative geometry 9 C			B.Phy.606 Electronic Lab Course for Natural Scientists 6 C	
6. **Σ 15 C**	M.Mat.3140 Mathematical statistics 9 C		B.Phy.5513 Numerical fluid dynamics 6 C		
7. **Σ 30 C**					Master’s thesis in SP 2 30 C
Σ120 C	**60 C**		**18 C**	**12 C**	**30 C**

Appendix III: Module packages "Mathematics" in a scope of 36 or 18 C
(can be completed only as part of another suitable Master Programme)

The Unit Mathematics offers the following module packages for students in non-mathematics M.A. graduate programmes.

1) Qualifications for entry

The following common qualifications for entry apply to the modules packages "Mathematics" in a scope of 36 C or 18 C.

Proof of academic achievements in basic mathematics in a scope of at least 33 C, including basics of analysis in a scope of at least 18 C (e.g. the modules B.Mat.0011 and B.Mat.0021), also analytic geometry and linear algebra in a scope of at least 15 C (e.g. the modules B.Mat.0012 and B.Mat.0026). In addition, proof of additional achievements in pure or applied mathematics in a scope of at least 21 C.

2) Module package "Mathematics" in a scope of 36 C

a) Study objectives

The underlying objective is to convey the necessary specialised knowledge and skills required for transition into professional practice, in particular insight into mathematical theories and methods, and the ability to apply fundamental scientific methods and insight.

Besides the knowledge of specialist foundations, the students should acquire complementary knowledge and skills through advanced learning in a suitable topic to thus obtain an extremely good general and specialised professional qualification.

In addition to understanding pure specialist knowledge, the graduates should be equipped to independently prepare problem solutions and arguments in their research area for application in a professional setting. Moreover, they should be enabled to work in a team comprising specialists from different scientific disciplines, to formulate specialist points of view and problem solutions, and to defend these positions by means of reason.

b) Module overview

Modules from the following selection must be completed successfully with a total rating of 36 C:

aa) The following modules are recommended:

B.Mat.1400	Foundations of measure and probability theory	(9 C, 6 WLH)
B.Mat.2100	Partial differential equations	(9 C, 6 WLH)
B.Mat.2110	Functional analysis	(9 C, 6 WLH)
B.Mat.2120	Complex analysis	(9 C, 6 WLH)
B.Mat.2200	Modern geometry	(9 C, 6 WLH)
B.Mat.2210	Numbers and number theory	(9 C, 6 WLH)
B.Mat.2300	Numerical analysis	(9 C, 6 WLH)
B.Mat.2310	Optimisation	(9 C, 6 WLH)

bb) Furthermore, students can attend advanced mathematical modules from the Bachelor's degree programme "Mathematics" at the Georg-August-Universität Göttingen (module numbers B.Mat.3XXX) or mathematical optional required modules from the module catalogue of the Master's degree programme "Mathematics" at the Georg-August-Universität Göttingen (module numbers M.Mat.4XXX).

c) Exemplary curricula

Sem. **Σ C**	**Module package "Mathematics" (36 C)**	
	Module	Module
1. **Σ 18 C**	B.Mat.2200 Modern geometry 9 C	B.Mat.2120 Complex analysis 9 C
2. **Σ 18 C**	M.Mat.3130 Operations research 9 C	B.Mat.2110 Functional analysis 9 C
Σ 36 C		

Sem. Σ C	Module package "Mathematics" (36 C) Module
1. 9 C	B.Mat.2200 Modern geometry 9 C
2. 9 C	B.Mat.2110 Functional analysis 9 C
3. 9 C	B.Mat.2120 Complex analysis 9 C
4. 9 C	M.Mat.3130 Operations research 9 C
Σ 36 C	

3) Module package "Mathematics" in a scope of 18 C

a) Study objectives

The underlying objective is to convey the necessary specialised knowledge and skills required for transition into professional practice, in particular insight into mathematical theories and methods, and the ability to apply fundamental scientific methods and insight.

In addition to understanding pure specialist knowledge, the graduates should be equipped to independently prepare problem solutions and arguments in their research area for application in a professional setting. Moreover, they should be enabled to work in a team comprising specialists from different scientific disciplines, to formulate specialist points of view and problem solutions, and to defend these positions by means of reason.

b) Module overview

Modules from the following selection must be completed successfully with a total rating of 18 C:

aa) The following modules are recommended:

B.Mat.1400	Foundations of measure and probability theory	(9 C, 6 WLH)
B.Mat.2100	Partial differential equations	(9 C, 6 WLH)
B.Mat.2110	Functional analysis	(9 C, 6 WLH)
B.Mat.2120	Complex analysis	(9 C, 6 WLH)
B.Mat.2200	Modern geometry	(9 C, 6 WLH)
B.Mat.2210	Numbers and number theory	(9 C, 6 WLH)
B.Mat.2300	Numerical analysis	(9 C, 6 WLH)
B.Mat.2310	Optimisation	(9 C, 6 WLH)

bb) Furthermore, students can attend advanced mathematical modules from the Bachelor's degree programme "Mathematics" at the Georg-August-Universität Göttingen (module numbers B.Mat.3XXX) or mathematical optional required modules from the module catalogue of the Master's degree programme "Mathematics" at the Georg-August-Universität Göttingen (module numbers M.Mat.4XXX).

c) Exemplary curricula

Sem. **Σ C**	**Module package "Mathematics" (18 C)**
	Module
1. **9 C**	B.Mat.2200 Modern geometry 9 C
2. **9 C**	B.Mat.2110 Functional analysis 9 C
Σ 18 C	

Sem. Σ C	Module package "Mathematics" (18 C)
	Module
1. 9 C	B.Mat.2200 Modern geometry 9 C
3. 9 C	B.Mat.2120 Complex analysis 9 C
Σ 18 C	