Translation

Examination Regulations
for the Consecutive Master's Degree Program

"Mathematics"

at the Faculty of Mathematics and Natural Sciences of the University of Bonn

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Please note that only the original German version is legally binding.

**Examination Regulations
for the Consecutive Master's Degree Program**

"Mathematics"

**of the Faculty of Mathematics and Natural Sciences
of the University of Bonn**

dated March 11, 2020

By virtue of § 2, para. 4 and § 64, para. 1 of the NRW Higher Education Act (Gesetz über die Hochschulen des Landes Nordrhein-Westfalen, Hochschulgesetz) of September 16, 2014 (Legal and Regulatory Gazette of North Rhine-Westphalia, p. 547) as last amended by Article 1 of the Act for Amending the Higher Education Act (Gesetz zur Änderung des Hochschulgesetzes) of July 12, 2019 (Legal and Regulatory Gazette of North Rhine-Westphalia, p. 425), the Faculty of Mathematics and Natural Sciences of the University of Bonn issued the following Regulations:

Content

Part 1
Scope

§ 1
Scope

(1)   Students who commence their studies within the consecutive master's degree program "Mathematics" at the University of Bonn after entry into force of these Examination Regulations are subject to these Examination Regulations.

(2)   The Examination Regulations for the consecutive master's degree program "Mathematics" of the Faculty of Mathematics and Natural Sciences of the University of Bonn dated August 27, 2012 (Official Announcements of the University of Bonn, 42nd year, no. 34, dated August 28, 2012) as last amended by the Amendment to the Examination Regulations for the Consecutive Master's Degree Program "Mathematics" dated July 17, 2014 (Official Announcements of the University of Bonn, 44th year, no. 14, dated July 18, 2014), hereinafter referred to as MPO Math 2012, will be repealed as of September 30, 2023. Examinations in accordance with MPO Math 2012 will be admissible until September 30, 2022. The examination board may extend this period by six months upon valid request.

(3)   Students who, having commenced their studies prior to the coming into force of these Examination Regulations, are subject to MPO Math 2012 and have not yet completed all necessary examinations, may
a.   continue their studies under MPO Math 2012 until the deadline stated in para. 2 or
b.   irrevocably adopt these Examination Regulations by written request.
Students who continue their studies under MPO Math 2012 and do not graduate by September 30, 2022 shall adopt these Examination Regulations ex officio on October 1, 2022. Credit for prior academic achievements shall be granted. Para. 2 sentence 3 shall remain unaffected; these Examination Regulations shall then be adopted ex officio on April 1, 2023.

Part 2
Program Objective, Degree and Standard Period of Study

§ 2
Objective of the degree program and purpose of the examination

(1)   The consecutive master's degree program "Mathematics" offered by the Faculty of Mathematics and Natural Sciences of the University of Bonn is research-oriented.

(2)   Students in this master's degree program are to acquire the necessary scientific knowledge, skills and methods as well as relevant key qualifications for an occupation in the field, enabling them to conduct sound research, to critically assess and practically apply research findings and methods as well as to act responsibly. This includes giving due regard to changes and requirements in the working world and, if applicable, in cross-disciplinary references. The program objectives mainly focus on
-     building expert knowledge regarding current research by expanding the students' basic knowledge;
-     building methodical and analytical competences, enabling students to expand their research findings on their own authority, with a strong emphasis on research methods and strategies.

(3)   Students are to learn how to approach complex problems and work on their solution beyond the existing scope of knowledge, using research methods.

(4)   The master's examination shall lead to conferral of a master's degree in "Mathematics," which qualifies the holder for positions demanding extensive skills in this field.

§ 3
Academic degree

Candidates who successfully complete the master's examination for the "Mathematics" degree program shall be awarded a Master of Science (MSc) degree by the Faculty of Mathematics and Natural Sciences of the University of Bonn.

§ 4
Standard period of study, credit point system, range of courses, program structure and language of instruction/examinations

(1)   The standard period of study, including the master's thesis, is four semesters (120 CP) when pursuing the degree program full-time.

(2)   The contents of the degree program are selected and limited in a manner that the master's examination can be completed within the standard period of study. They are organized in modules that, as a rule, consist of courses with a thematic, methodical or systematic connection.

(3)   As a rule, each module is completed by passing a module examination, awarding credit points (CP) in accordance with the European Credit Transfer and Accumulation System (ECTS). One credit point is equivalent to a calculated student workload in contact hours and self-learning of 30 hours.

(4)   The degree program includes 36 CP for compulsory modules (including the master's thesis) and 84 CP for elective modules. This must include at least 60 CP for subject-specific electives. The remaining up to 24 CP can be acquired in any subject-specific or non-subject-specific elective modules in accordance with paragraph 5. Of these, up to 6 CP may, upon request, be acquired in modules from other master's degree programs at the University of Bonn, provided their content is significantly different from the content of the modules in Annex 1. Decisions on the permissibility of modules shall be made by the examination board. Further information on the choice of modules, detailed information about the modules, admission requirements and the number of credit points for each module is provided in the module structure (Annex 1).

(5)   Students can select up to a maximum of 24 CP in non-subject-specific elective modules. They must choose a subject area; physics, computer science and economics are permissible subject areas. All modules in the corresponding master's degree programs are permissible modules in this case, provided their content is significantly different from the content of the modules in Annex 1 and the examination board does not determine otherwise. The examination board can, upon request by the student, approve other master's degree programs offered by the University of Bonn as elective subject areas; the modules that can be taken are also specified. The subject area is chosen by registration for the first module examination or, in the case of sentence 4, the approval decision. The subject area cannot be changed. The choice of a subject area for non-subject-specific electives does not, however, obligate the student to obtain a certain number of credit points in the chosen subject area. Module examinations in the subject area are subject to the examination regulations for the associated master's degree program as amended at the time of registration for the module examination.

(6)   Students receive a curriculum as recommendation on how to structure their course of studies. Students may receive an individual study schedule upon request.

(7)   The language of instruction and examinations is English. The examination board may make exceptions for individual elective modules and shall announce them before the beginning of the semester, pursuant to § 8, para. 7.

(8)   The degree program starts in the summer and winter semesters of each year. Beginning in the winter semester is recommended.

Part 3
Admission requirements and recognition of academic achievements

§ 5
Degree program admission requirements

(1)   The consecutive master's degree program "Mathematics" is open to applications from graduates from a university undergraduate degree program in mathematics or a related field. The applicants must also provide proof that a minimum of 120 CP were acquired for modules in the field of mathematics to acquire the previous academic degree.

(2)   The university degree in paragraph 1 must have been completed with a grade of at least 2.5.

(3)   English skills at level B2 or higher according to the Common European Framework of Reference for Languages (CEFR) are a prerequisite for admission to the degree program and are to be proved by submitting a recognized language certificate (e.g. TOEFL, IELTS) or equivalent proof.

(4)   Foreign students who are not given equivalent status to Germans by or based on international treaties and do not have German university entrance qualifications can only be admitted to the master's degree program "Mathematics" if they have passed the procedure for the aptitude test for university studies in accordance with Annex 2.

(5)   This does not affect admission restrictions due to capacity limits (numerus clausus).

(6)   Students who do not meet the admission requirements stated in paras. 1 and 2, but have already taken all examinations necessary for graduating from an undergraduate degree program, may already enroll for a master's degree program if there is sufficient proof of their aptitude for that degree program, which is determined with special regard to the average grade for all examinations taken to that point. Enrollment is revoked with effect for the future if necessary proof of meeting the admission requirements is not submitted to the admission office within six months after the date of enrollment.

§ 6
Recognition of and granting credit for academic achievements

(1)   Academic achievements in degree programs at other public or officially recognized universities and public or officially recognized vocational academies, or in degree programs at foreign public or officially recognized universities, or in another degree program at the University of Bonn will be recognized if the acquired skills are deemed equivalent to those that would have been acquired at the University of Bonn; an equivalency assessment is not performed. The examination board assigns credit points for these achievements to the corresponding modules defined in the curriculum. Enrollment may be denied to applicants who failed the final attempt at an examination that cannot be compensated for in a degree program with substantial similarities in content with the consecutive master's degree program "Mathematics."

(2)   The question of recognition shall be reviewed with special regard to the significance of differences. In order to determine whether significant differences do or do not exist, the topic, scope and requirements of the academic achievement to be recognized is compared to the same aspects of the academic achievement that the former is to replace. This shall not be done by schematic comparison but rather in the form of an overall review and evaluation. A difference in the amount of awarded credit points alone does not constitute significant difference. The aforementioned regulations apply analogously to academic achievements in degree programs designed for continued education. Academic achievements are recognized to their full extent if significant difference cannot be determined. If the reviewers, in accordance with the principles described above, find that a certain academic achievement can only be recognized in

part, credit points shall partially be assigned to the respective module. The respective module shall only be considered passed when all missing course work and/or examinations are completed; only then shall credit points be awarded to the extent stipulated in these Regulations. Scope and nature of course work and/or examinations to be completed are at the discretion of the examination board. Equivalence agreements approved by the Standing Conference of the Ministers of Education and Cultural Affairs of the Länder of the Federal Republic of Germany and the German Rectors' Conference as well as agreements under university partnerships shall be observed when determining equivalence.

(3)　　In accordance with § 8, para. 4, sentence 2, the examination board has authority over the processes that underlie recognition of or granting credit for academic achievements. The examination board decides which degree programs are related to or show substantial similarities in content with the master's degree program "Mathematics." Representatives of the relevant departments shall be consulted when reviewing the significance of differences. In case of doubts regarding whether academic achievements completed abroad should be recognized, the Central Office for Foreign Education may be consulted. Students shall be notified within 10 weeks of whether an academic achievement is recognized, including information on legal remedies available. In case an achievement is not or only partially recognized, the examination board shall provide the reasons for its decision, thus bearing the burden of proof. If the examination board denies recognition, students may apply for an internal audit to be conducted by the Rectorate.

(4)　　If examinations are recognized, the same grades–provided grading systems are comparable–shall be added to the student's transcript of records and, weighted with the credit points of the module to which credit points are assigned, considered when calculating the overall grade. If course work is recognized, the entry "pass" shall be made in the student's transcript, not assigning a grade. Should the grading systems not be comparable, the entry "pass" shall also be made in the student's transcript. Recognized academic achievements shall be identified as such in the student's certificate. Academic achievements in degree programs not using the credit point system shall be translated by the examination board into credit points, provided that the respective examination is equivalent to the module examinations defined in these Examination Regulations. Such translation must adhere to the scale approved by the Standing Conference of the Ministers of Education and Cultural Affairs of the Länder of the Federal Republic of Germany for comparisons to the ECTS system.

(5)　　If the requirements defined in para. 1 are met, students are legally entitled to have their academic achievements recognized. The student must provide all information on the academic achievement in question deemed necessary for recognition. Each semester, the examination board defines a deadline in that semester by which applications for recognition must be submitted. Applications submitted after that deadline cannot be processed until the subsequent semester.

(6)　　Applicants who, due to their performance in a placement test as per § 49, para. 12 of the NRW Higher Education Act, have earned the right to enter the degree program in a higher program-related semester will be granted credit for the knowledge and skills demonstrated in the placement test, with credit points being assigned to examinations that form part of the master's examination. The examination board is bound to the results of the placement test stated in the certificate.

(7)　　Upon request, up to 50% of the credit points to be earned pursuant to § 4, para. 1 can be granted towards this degree program for knowledge and qualifications acquired in a manner other than academic studies if the knowledge and qualifications are equivalent in terms of content and level to the academic achievements they are to replace.

§ 7
Admission to individual courses

(1)　　If admission to a course, due to its nature, purpose or to other reasons, needs to be limited and the number of applications exceeds the defined capacity, the lecturer may file a request with the examination board of the degree program to which the respective module is assigned to manage admissions to that

course, giving due regard to § 59 of the NRW Higher Education Act . Criteria for admissions in these cases are stipulated in Annex 3 of these Examination Regulations.

(2)   The examination board shall define the maximum number of participants in courses with limited capacity. The examination board shall announce capacities before the beginning of a semester.

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Part 4
Examination board and examiners

§ 8
Examination board and exam office

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(1)   The faculty council of the Faculty of Mathematics and Natural Sciences shall appoint a joint examination board for the bachelor's and master's degree programs in the Department of Mathematics that is to organize examinations and perform the tasks assigned in these Examination Regulations. The dean shall assure that the examination board is able to duly fulfill its tasks and does reliably do so. The dean shall give appropriate instructions and provide necessary administrative support.

(2)   The examination board shall have a chairperson, a deputy chairperson and an additional seven regular members. The chairperson, the deputy chairperson and four additional members are appointed by the faculty council from the group of university professors (Hochschullehrerinnen und Hochschullehrer) in the faculty. The faculty council appoints another member from among the faculty's academic staff (akademische Mitarbeiter*innen) and one student member from each of the degree programs covered by the examination board, separated by group. All university professors teaching in one of the degree programs in the Department of Mathematics are eligible to become members of the examination board. From the group of academic staff, those who are teaching or previously taught in these degree programs, or are involved in their management, are eligible to become members. From the group of students, those enrolled in these degree programs are eligible to become members. For each of the nine members in sentence 1, a deputy shall be appointed to represent the member in his or her absence; the deputies appointed for the chairperson and deputy chairperson of the examination board may not assume the position of chairperson of the examination board. The term of office of members from the group of professors and from the group of academic staff is three years. The term of office of the student members is one year. Members may be re-elected.

(3)   The examination board is an administrative body as defined by German administrative procedure law and the German law governing procedure in contentious administrative matters. The faculty shall create an office for administrative support of the examination board.

(4)   The examination board shall ensure compliance with the provisions of the Examination Regulations and make certain that the examination procedure is conducted in accordance with regulations. The examination board shall appoint examiners as well as assistant examiners and is responsible in particular for recognizing academic achievements as well as handling objections against decisions made within examination procedures. It shall report to the faculty council on a regular, at least annual basis on the development of examination and study periods, including the time taken to complete master's theses and the distribution of overall grades. Once a semester, the examination board shall inform the Student Registry on which students, according to final ruling by the examination board, have failed their final attempt at passing the master's examination in accordance with § 24, para. 6 or do not meet the requirements to be admitted to the master's examination as per § 11, para. 1. The examination board shall provide input for amendments to the Examination Regulations and curriculum. It may delegate clearly defined tasks to the chairperson. It shall not delegate

- decisions on objections as per sentence 2,
- reviews of decisions on deception and disruption of examinations as per § 22, para. 1, sentences 1 and 2,
- assessments of whether a student repeatedly or otherwise seriously attempted to cheat as per § 22, para. 3,

- decisions on the invalidity of the master's examination and revocation of the master's degree as per § 29 and
- reporting duties to the faculty council as per sentence 3.

(5) Examination board meetings are not open to the public. All members of the examination board as well as their deputies shall be bound to confidentiality. Members who are not civil servants shall be bound to confidentiality by the chairperson of the examination board. Summary minutes shall be taken as record of the examination board's discussions and decisions.

(6) The examination board shall have a quorum when, in addition to the chairperson or their deputy, at least four more members or their deputies, including at least two professors, are present. Resolutions shall be passed by simple majority. In the event of a tie vote, the chairperson's vote or, in case of his/her absence, the deputy chairperson's vote shall be the deciding vote. Members of the examination board have a right to attend examinations upon resolution of the examination board.

(7) Directives, dates set and other communication of the examination board with public relevance shall, giving due consideration to data protection requirements, be made available by public display or in electronic form with legally binding effect. Additional publications of other nature are admissible but not legally binding.

(8) The examination board may include examination office staff involved in the examination procedure for consultation on a regular basis or for individual meetings or agenda items. These staff shall have a right to speak but no right to vote.

§ 9
Examiners and assistant examiners

(1) The professors and assistant professors of the Department of Mathematics of the Faculty of Mathematics and Natural Sciences are examiners without express appointment by the examination board. This also applies to members with postdoctoral qualification (Habilitation) in the department, contract lecturers, honorary professors, academic staff and lecturers with special responsibilities, provided the person concerned has teaching responsibilities in the master's degree program "Mathematics" during the respective semester. All those holding a position named in sentences 1 and 2 can also act as assistant examiner. The examination board has the right to appoint additional examiners and assistant examiners in accordance with § 65 of the NRW Higher Education Act. Examiners and assistant examiners must have at least passed the master's examination or an equivalent examination.

(2) Module examinations are usually held by the responsible teaching staff for that module. If a teacher, due to illness or other important cause, is not able to hold module examinations in due time, the examination board shall be responsible for the appointment of another examiner for these module examinations.

(3) Examiners shall be independent of instructions in their conduct of examinations.

(4) Candidates may propose examiners for their master's thesis. A candidate's proposal should be followed whenever possible; however, it does not substantiate a claim.

(5) The examination board assures that the candidate is informed of the name of the examiners in due time, as a rule within two weeks before the date of the respective examination.

Part 5
Scope, conduct, modalities and types of examinations

§ 10
Scope of the master's examination

(1)   The master's examination is intended as proof of qualification for positions demanding extensive skills in the respective field as well as in-depth and research-oriented scientific qualification.

(2)   The master's examination consists of
1.   module examinations completed during the course of studies and reflecting the contents and qualification targets of the modules specified in the module structure (Annex 1);
2.   the master's thesis.
All examinations are to be completed within the standard period of study stipulated in § 4, para. 1.

(3)   Examinations are completed during the course of studies. As a rule, one module examination is assigned to each module, even when a module consists of more than one course. The grade of the module examination will be indicated on the degree certificate. Students must successfully complete a module in order to be awarded the assigned credit points. A module is considered successfully completed once the assigned module examination, or all examination components associated with the module, have been graded "Sufficient" or higher.

(4)   If a module consists of more than one course, with associated module examination components, the credit points will be awarded after the last module examination component has been passed.

(5)   Examinations are generally held in the language of instruction. Upon request by the student and after consultation with the examiner(s), examinations or parts of examinations can also be taken in German. However, no right to take parts of the examination in this language exists.

§ 11
Admission to the master's examination and to module examinations

(1)   The student must apply for admission to the master's examination. This application shall be submitted to the examination board in writing and prior to registration for the first module examination. The application shall include the following documents as proof of meeting the admission requirements:
1.   Proof of meeting the general admission requirements stipulated in § 5;
2.   A certificate of enrollment as proof of enrollment as student in this degree program at the University of Bonn;
3.   A statement whether the student has failed a final attempt at an examination or the final attempt at the master's examination in this degree program or, at the time of registration for a module examination, is involved in another examination that, if failed, would give cause for denial of enrollment. The same applies to examination procedures of degree programs with substantial similarities in content.

(2)   The examination board may only admit students to module examinations who
1.   can provide proof of meeting the admission requirements as per para. 1; an enrollment certificate of another degree program at the University of Bonn can serve as proof as per para. 1 sentence 3 if this degree program imports the respective module in accordance with its own examination regulations; proof of current admission as a cross-registered student in accordance with § 52, para. 1 of the NRW Higher Education Act can serve as proof as per para. 1, sentence 3;
2.   meet all requirements that may be stipulated in the module structure (Annex 1) for the respective module and module examination.

(3)   Should the candidate not be able to submit documented proof as per para. 1 sentence 3 in the required form, the examination board may allow the candidate to provide documented proof in another form.

(4)   Admission to the master's examination procedure or, respectively, module examinations is at the discretion of the examination board.

(5)   The examination board may only deny admission to the master's examination procedure where
a.   documents submitted are incomplete as per para. 1 and/or not submitted as requested by a certain deadline;
b.   the requirements specified in para. 1 are not met;
c.   the student has failed a final attempt at an examination that cannot be compensated for or failed the final attempt at the master's examination in this degree program or in a degree program with substantial similarities in content; or
d.   the student is registered for an examination procedure at another university in the chosen degree program or a degree program with substantial similarities in content as per § 6, para. 1, if failing the examination procedure would mean failing the final attempt at the master's examination.

(6)   The examination board may only deny admission to a module examination where the criteria defined by para. 2 are not met.

§ 12
Examination modalities and compulsory attendance

(1)   Module examinations cover the contents and qualification targets of the modules specified in the module structure (Annex 1).

(2)   Candidates in module examinations must be students enrolled in this degree program at the University of Bonn or, respectively, in a degree program at the University of Bonn that imports modules from this degree program in accordance with its own examination regulations, or admitted as cross-registered students as defined by § 52 of the NRW Higher Education Act.

(3)   In the module examinations, students are to demonstrate the knowledge and competences acquired in the respective module as well as their ability to understand cross-disciplinary correlations. Module examinations can be completed by passing graded examination components. Module examinations and module examination components can be
-    written examinations;
-    oral examinations;
-    project reports;
-    presentations;
-    seminar talks and
-    portfolios.

The type of examination and, if applicable, division into module examination components is stipulated in the module structure. Deviating from the specifications stipulated in the module plan is possible in accordance with § 15, para. 4 and § 16, para. 4; the examination board shall, in conjunction with the examiners, determine the type of examination and, in accordance with § 8, para. 7, announce its decision in due time at the beginning of the semester.

(4)   The module structure may stipulate that students must have completed certain assessments (course work) prior to taking a module examination. Where required course work has not been completed, students shall not be admitted to the module examination. Upon request filed by the lecturer, the examination board shall, in accordance with § 8, para. 7, announce the specific requirements regarding such course work before the beginning of the semester.

(5)   Two examination dates shall be set for all written and oral module examinations during the semester in which the module is concluded. As a rule, the first examination date is shortly before or shortly after the end of the lecture period for the semester concerned. The second examination date is, as a rule, at the end of the semester concerned. Registration for the module examination initially always applies to the first examination date. If the examination on the first examination date is failed, the student is automatically registered for the second examination date. Deregistration is not possible then. If the performance needed to pass is not achieved on any of the dates, the module examination is considered failed (one failed attempt). The examination board shall announce the examination dates at the beginning of the semester pursuant to § 8, para. 7.

(6)   For courses in which achieving the qualification target requires active participation by students, the module structure may stipulate mandatory regular participation (compulsory attendance) as prerequisite to being admitted to the examination. Before the beginning of the semester, the examination board shall give reasons for its decision on which courses require compulsory attendance. In such cases, the examination board shall also define when participation can be considered regular. Depending on the qualification target, absences of up to 30% are permissible, including absences excused by means of a medical certificate. The examination board shall announce the decisions in sentences 2 to 4 before the beginning of the semester pursuant to § 8, para. 7.

(7)   The following applies when grading examinations:
1.   Examinations submitted in writing shall be graded by a minimum of one examiner. Candidates shall be informed of the result of such examinations within four weeks. In accordance with the applicable data protection regulations, results shall be made available by public display or in electronic form via the examination management system; as a rule, results are to be made available before the standard period of study ends.
2.   Oral examinations shall always be graded by a minimum of two examiners or a single examiner in the presence of a competent assistant examiner. A record shall be kept of the essential topics and results of each examination. If the examination is conducted by a single examiner in the presence of an assistant examiner, the examiner shall hear the assistant examiner in private prior to setting a grade. Candidates shall be informed of their grade immediately following the oral examination.
If the examination is conducted by two examiners, the grade shall be calculated using the average of the two individual grades. If only one of the grades for a written examination is "Insufficient", the examination board shall appoint a third examiner. In this case, the two best grades shall be averaged together for the final grade. An examination may, however, only be awarded the grade "Sufficient" or higher when at least two of the individual grades were "Sufficient" or higher. Grades shall be averaged in accordance with § 24, para. 2. Examinations to be completed in the course of studies that cannot be compensated for once the final attempt has been failed shall always be graded by a minimum of two examiners. Rules for grading the master's thesis are set forth in § 20, para. 4.

§ 13
Module examinations – registration and withdrawal

(1)   For each module examination, students shall electronically register with the examination board by the prescribed deadline. Where justified, registrations may be submitted in writing.

(2)   The examination board shall make the examination dates as well as registration periods available by public display or in electronic form; registration periods are cutoff periods.

(3)   Candidates may withdraw from a module examination in writing or electronically without indicating reasons until one week before the first examination date. The date of receipt by the examination board determines whether the deadline has been met. In cases of examinations that spread over a whole semester and are assigned to a specific course (seminars and practical training courses), candidates may not withdraw once topics or places have been assigned. This does not affect § 21, para. 3.

(4)　　Rules for registration for the master's thesis are defined separately in § 19, para. 2.

§ 14
Resitting examinations

(1)　　Examinations and examination components that have been failed or deemed failed may only be repeated once. Rules for repetition of the master's thesis are defined in § 20, para. 7. A module examination that concludes with a written or oral examination is not passed if the performance needed to pass is not achieved on either of the two examination dates in a semester. If a student fails to pass the examinations on these two examination dates, this is counted as one failed attempt.

(2)　　Students who fail the same compulsory module twice lose their right to examination and are deregistered from the degree program by the Student Registry once the examination board's decision that the final attempt at the master's examination has been failed has come into force.

(3)　　Module examinations graded "Sufficient" or higher cannot be repeated.

(4)　　In modules in which examinations spread over a whole semester or are assigned to a specific course (seminars and practical training courses), examinations cannot be repeated in that same semester. The module examination in such modules can only be repeated by retaking the entire module or course.

§ 15
Written examinations

(1)　　In written examinations, students are to demonstrate that, within a specific period of time and with limited auxiliary means, they are capable of understanding a problem from the module's subject area and solving this problem using methods commonly used in that field. The examiners shall announce in a timely manner which auxiliary means may be used during a written examination.

(2)　　Written examinations may be handwritten or computer-aided examinations, both conducted under supervision. Computer-aided written examinations are in particular free text or clozes that are completed using a computer.

(3)　　Written examinations shall last a minimum of 30 minutes and a maximum of 180 minutes. § 12, para. 7 applies accordingly. The examination board shall announce the specific date at the beginning of the semester, in accordance with § 8, para. 7.

(4)　　The examination board may, in conjunction with the examiner, decide that instead of a specified written examination, an oral examination shall be held that covers the module's subject area; in accordance with § 8, para. 7 this shall be announced in due time before the beginning of the semester.

§ 16
Oral examinations

(1)　　In oral examinations, candidates are to demonstrate sound knowledge in the subject of examination, identify correlations and analyze specific questions arising from these as well as provide possible solutions.

(2)　　Oral examinations shall be conducted by either a panel of several examiners (Kollegialprüfung) or a single examiner in the presence of a competent assistant examiner, with candidates being examined either individually or in a group. If the examination is conducted by a panel of several examiners, the candidate shall be examined by one examiner per subject of examination. This shall not affect the provisions set forth in § 12, para. 7. Each oral module examination shall last a minimum of 15 minutes and a maximum of 45

minutes per candidate. When candidates are examined in a group, each candidate within that group shall be examined for the same amount of time.

(3)   Students who wish to take the same oral examination at a later date may be admitted to sit in on the examination, provided that spatial circumstances allow for it and no candidate objects to their presence. The decision shall be made by the examiner, and in the case of examinations conducted by a panel of several examiners (Kollegialprüfung), by the examiners. Students sitting in on an examination shall attend neither the discussion nor the announcement of results. They shall also be prohibited from taking notes during the examination.

(4)   The examination board may, in conjunction with the examiner, decide that, instead of a specified oral examination, a written examination shall be held that covers the module's subject area. This shall be announced in due time before the beginning of the semester pursuant to § 8, para. 7.

§ 17
Project reports, presentations, seminar talks and portfolios

(1)   As a rule, project reports are used to show an ability to work in a team and, in particular, the ability to develop, implement and present concepts. Candidates are to demonstrate that they can define objectives and develop interdisciplinary problem-solving approaches and concepts for a large assignment. In the case of group project reports, it must be possible to clearly identify and grade the contribution of each individual candidate, and the contribution must satisfy the requirements in sentence 1. The presentation should be a minimum of 10 and a maximum of 60 minutes long for each candidate. Project reports are to be completed by the end of the semester in which the respective course is offered (by March 31 for courses in the winter semester and by September 30 for courses in the summer semester).

(2)   Presentations are oral presentations that last a minimum of 10 minutes and a maximum of 60 minutes. Candidates demonstrate their ability to comprehensibly present and discuss their own documented research results obtained using scientific methods. Presentations are to be held by the end of the semester in which the respective course is offered (by March 31 for courses in the winter semester and by September 30 for courses in the summer semester).

(3)   Seminar talks are oral presentations that last a minimum of 30 minutes and a maximum of 90 minutes, including a discussion. These talks are based on original scientific texts and individual research by the candidates. In seminar talks, candidates demonstrate their ability to comprehensibly present research results and explain them in a discussion. Seminar talks must be held in the semester in which the respective course is offered.

(4)   Portfolios are collections of material with comments by the candidate and/or documentation related to practical training courses, subject-related practical projects, tutoring and mentoring activities. The examiner shall specify the structure of the portfolio. As a rule, in addition to a collection of documents, the portfolio also includes an introduction and reflection. The scope of a portfolio can vary; all of the elements specified in the structure must be included. Portfolios must, as a rule, be submitted by the end of the semester in which the respective course is offered (by March 31 for courses in the winter semester and by September 30 for courses in the summer semester).

 (5)   Otherwise, the provisions for grading oral and written examinations stipulated in § 12, para. 7 apply accordingly.

§ 18
Compensation for disadvantages

Students who are unable to take an examination in the designated manner due to a disability or chronic illness, or due to maternity law provisions, can submit a request for compensation for disadvantages to the

examination board together with suitable proof; the same shall apply to the completion of course work as specified in § 12, para. 4. Compensation for disadvantages shall be granted on a case-by-case basis. It can, in particular, provide for differences with respect to how the examination is taken, the length of the examination and the use of auxiliary means or support persons. For students with disabilities or chronic illnesses, the entitlement to compensation for disadvantages shall extend to all of the examinations to be taken during the degree program, provided no change is expected in the illness or disability; sentence 2 remains unaffected. In the case of compulsory attendance courses, compulsory practical training courses and compulsory study periods abroad that cannot be completed due to the impairment, even with the support of the university, alternative forms of assessment that can provide equivalent competence and qualifications shall be permitted.

Part 6
Master's thesis

§ 19
Registration, topic and scope of the master's thesis

(1)   The master's thesis is an examination in the form of a written assignment in which candidates are to demonstrate their ability to conduct research on, develop a solution for and appropriately present a problem from the field of the master's degree program "Mathematics" within a specified period of time, on their own authority and using scientific methods.

(2)   Students must register their master's thesis with the examination board. The examination board shall announce the deadline by which a master's thesis must be registered for the candidate to complete the master's degree program within the standard period of study.

(3)   When registering their master's thesis, students must indicate their choice of examiners for the master's thesis.

(4)   The topic for the master's thesis may be assigned by any examiner specified in § 9, para. 1, sentence 1; if the topic is to be set by another examiner specified in § 9, para. 1, the consent of the examination board shall be required. As a rule, the examiner who assigned the topic also acts as supervisor of the master's thesis.

(5)   The topic for the master's thesis shall only be issued when the student has acquired a minimum of 30 CP. The examination board shall issue the topic for the master's thesis. A record shall be kept of the topic and the date of issue. Prior to registration of the master's thesis, students shall be given the opportunity to submit proposals for the research area from which the topic of their master's thesis shall be taken; the examination board is not bound to such proposals. Upon request by the student, the examination board shall assure that the student receives a topic for his/her master's thesis in due time as per para. 9.

(6)   Candidates may reject a master's thesis topic only once and only within the first two months after its issue. Rejecting a topic does not count as a failed attempt.

(7)   The master's thesis can also be approved in the form of a group thesis. In this case, it must be possible to clearly distinguish and evaluate the contribution of the individual candidate based on a specification of sections, page numbers or other objective criteria that allow the candidate's portion to be unambiguously identified. The requirements in paragraph 1 must also be satisfied.

(8)   The master's thesis must contain a minimum of 10 and a maximum of 100 DIN-A4 pages of text. In the case of a group thesis, the text portion of each candidate must contain a minimum of 10 and a maximum of 100 DIN-A4 pages.

(9)   Passing the master's thesis awards 30 CP, corresponding to 900 hours in student workload. It shall be completed within a maximum period of 12 months. The examination board shall determine the deadline by which the master's thesis must be submitted and notify the student of that deadline. Topic, task and scope of the master's thesis shall be limited in a way that candidates may complete it under reasonable requirements within the specified period. Upon valid request and in conjunction with the supervisor, the examination board may grant an extension by a maximum of six weeks. As a rule, the topic of the master's thesis is issued at the end of the second semester.

§ 20
Submission, evaluation and repetition of the master's thesis

(1)   Candidates shall submit their master's thesis in triplicate to the examination board by the specified deadline. A record shall be made of the time and date on which the particular master's thesis was submitted. Candidates may not withdraw an already submitted master's thesis. Master's theses that are not submitted by the stated deadline shall be graded "Insufficient."

(2)   Candidates shall declare in writing when submitting their master's thesis that the thesis – in the case of a group thesis, their appropriately labeled portion of the thesis – is their own work, that they used only those sources and resources cited in the thesis and that they have marked citations as such. The examination board can require that the candidate provide an affidavit to this effect and a digital version of the submitted master's thesis suitable for electronic evaluation.

(3)   Master's theses shall be evaluated and graded by two examiners. One of the examiners shall be the person who assigned the topic of the master's thesis; the second examiner shall be appointed by the examination board from among the group of examiners as defined by § 9, para. 1. Among these two examiners, at least one examiner must be a member of the group of university professors (Hochschullehrerinnen und Hochschullehrer) at the University of Bonn. The candidate shall be entitled to propose examiners but shall not have a right to be assigned a specific examiner.

(4)   The examiners shall each provide a grade separately and provide the reasons for the grade they assigned in writing in accordance with § 24, para. 1. When the difference between the two grades is less than 2.0, they shall be averaged together for the final grade for the master's thesis. When the difference is 2.0 or more or only one of the grades is "Insufficient", the examination board shall appoint a third examiner for review of the master's thesis. In this case, the two best grades shall be averaged together for the final grade. Grades shall be averaged in accordance with § 24, para. 2. A master's thesis may, however, only be awarded the grade "Sufficient" or higher when at least two of the individual grades were "Sufficient" or higher. If the master's thesis was prepared by multiple students as a group thesis, the portion of the complete thesis that was independently prepared by each individual student must be graded.

(5)   Examiners shall submit their reviews of the master's thesis within eight weeks after the submission deadline.

(6)   Candidates who receive the grade "Sufficient" or higher for their master's thesis are awarded 30 CP.

(7)   Master's theses graded "Insufficient" or deemed failed may be repeated once. The topic of the second master's thesis does not have to be chosen from the same area as the topic of the first master's thesis. The candidate may reject the proposed topic for their master's thesis within the period specified in § 19, para. 6 only if they did not make use of this option with their first master's thesis. Should the second thesis also be graded "Insufficient," the candidate shall have failed their final attempt at the master's examination, losing their right to examination and being deregistered from the degree program by the Student Registry once the examination board's decision has come into force.

Part 7
Procedural irregularities and protective regulations

§ 21
Cancellation, failure to appear, withdrawal and reprimand

(1) Candidates may electronically cancel their registration for module examinations with the examination board until the deadlines indicated in § 13, para. 3; if this is not possible, cancellation can also be submitted in writing. The date of receipt by the examination board determines whether the deadline has been met.

(2) If a candidate withdraws from an examination after the cancellation deadline without good cause, the examination is graded "Insufficient." The same applies when a candidate fails to appear for an examination or to submit an assignment within the specified period of time (failure to appear).

(3) Candidates who have registered for an examination but have good cause to withdraw from that examination, especially due to illness, may do so regardless of the cancellation deadline. The examination board shall be notified of such withdrawals immediately and in writing. Candidates shall immediately provide a written statement credibly substantiating the grounds for their withdrawal or failure to appear. In cases of illness, candidates shall present a medical certificate proving their inability to participate in the examination or, respectively, submit their assignment on time. Candidates who withdraw from an examination due to illness after the start of the examination and assignment of the respective task must consult a medical examiner that same day of the examination to obtain a certificate proving their inability to continue the examination. As a rule, it is not possible to withdraw from an examination after the start of the examination, especially when the candidate has already seen, or otherwise obtained knowledge of, the examination result. The examination board may, in individual cases, require the submission of a certificate from a medical examiner designated by the University if there are sufficient factual indications that the candidate would in fact have been able to participate in the examination or, respectively, submit their assignment on time or if the examination board deems other proof than that defined by sentence 4 appropriate in that case. If the examination board accepts a medical certificate allowing for withdrawal due to illness or other good cause given by the candidate, the examination attempt shall be deemed void.

(4) Candidates shall immediately reprimand any deficiencies related to an examination with the respective examiner or proctor. The reprimand shall be entered into the record and asserted in front of the examination board. If the examination board accepts the reprimand, the examination attempt shall be deemed void.

§ 22
Deception and disruption of examinations

(1) Candidates who try to influence the outcome of an examination through deception or the use of inadmissible auxiliary means shall receive the grade "Insufficient;" the respective examiner or proctor shall identify deception or use of inadmissible auxiliary means, include it in the record and notify the examination board. The respective examiner or proctor may bar any candidate from continuing an examination who, despite a warning, disrupts the orderly conduct of the examination; in such cases, the examination shall be deemed failed and graded "Insufficient." A record shall be made of the reasons for barring the candidate from the examination.

(2) Candidates may, within a period of two weeks, request that decisions taken pursuant to para. 1, sentences 1 and 2 be reviewed by the examination board.

(3) In cases of repeated or otherwise grave attempts at deception, the candidate may be deregistered from the degree program. The examination board shall determine whether the candidate's attempt at

deception was repeated or otherwise grave. Deregistration of students due to deception is at the rector's discretion. Deregistration is carried out by the Student Registry.

(4)   Violation of the provisions in these Examination Regulations regarding deception in examinations is an administrative offense. This administrative offense may be subject to a fine of up to EUR 50,000. As competent administrative authority, the chancellor of the University of Bonn shall pursue and fine administrative offenses pursuant to sentence 1.

§ 23
Protective regulations

(1)   Regulations on maternity leave stipulated in the Maternity Protection Act (MuSchG) as amended shall be respected; students shall provide all necessary proof. All time frames stipulated in these Examination Regulations shall be suspended by maternity leave; time frames for periods of assessment shall not include periods of maternity leave. The examination board shall notify the student of newly determined examination deadlines once all necessary proof has been submitted.

(2)   Allowances shall likewise be made on application for parental leave under the Parental Allowance and Parental Leave Act (BEEG) as amended. Candidates shall notify the examination board in writing of the period(s) during which they wish to take parental leave, enclosing necessary substantiating documentation, at least four weeks prior to the date on which they wish to enter parental leave. The examination board shall determine whether the statutory requirements have been met which would lead to an employee being entitled to parental leave under the BEEG and shall inform the candidate immediately of its findings and, if applicable, any new examination deadlines. Time frames for the completion of assignments may not be interrupted by a period of parental leave. The assignment topics shall be deemed not issued. The candidate shall receive a new topic at the end of their parental leave. This does not affect § 21, para. 3, sentence 1.

(3)   Allowances shall likewise be made on application for leave taken for the care of spouses, registered partners, direct relatives, second-degree indirect relatives or first-degree in-laws who are in need of care. The examination board shall review whether the requirements defined by sentence 1 are met. The application is to be submitted as soon as these requirements are met. Relevant documentation shall be attached to the application. The examination board shall immediately notify the candidate of the result and, if applicable, of the new examination deadlines. Time frames for the completion of assignments may not be extended based on such leave taken. The assignment topics shall be deemed not issued. The candidate shall receive a new topic at the end of their leave. This does not affect § 21, para. 3, sentence 1.

Part 8
Grading and final documentation

§ 24
Grading of examinations, grading system and pass requirements for the master's examination

(1)   The grade for each examination shall be determined by the respective examiners. If the examination is conducted by more than one examiner, the grade shall be calculated using the average of the individual grades. This does not affect § 12, para. 7. The following grading system shall be used:

1	Very good	Excellent achievement
2	Good	Achievement well above average requirements
3	Satisfactory	Achievement corresponding to average requirements
4	Sufficient	Achievement that still meets necessary requirements despite deficiencies
5	Insufficient	Achievement that does not satisfy requirements due to substantial deficiencies.

In order to produce a graduated grading scale and provide a more nuanced evaluation, individual grades may be raised or lowered by values of 0.3; grades 0.7, 4.3, 4.7 and 5.3 shall not be admissible.

(2)   Only the first decimal place after the decimal shall be used when calculating the grades for individual modules or for overall performance; all further decimal places shall be dropped without rounding off.

(3)   A module examination shall be deemed passed when the module is graded at least "Sufficient". If a module grade includes more than one examination component, it shall be calculated using the individual examination weights indicated in the module structure. This does not affect § 10, para. 3, sentence 4. The grading scale for modules is:

With an average grade up to and including 1.5	= Very good
With an average grade from 1.6 up to and including 2.5	= Good
With an average grade from 2.6 up to and including 3.5	= Satisfactory
With an average grade from 3.6 up to and including 4.0	= Sufficient
With an average of 4.1 or higher	= Insufficient

(4)   Candidates shall have passed the master's examination when they have passed all necessary modules as per § 4, para. 4 as well as the master's thesis and have thus been awarded a total of 120 CP.

(5)   The calculation of the overall grade shall include all graded modules. Each grade from individual modules shall be weighted by multiplying it by the number of credit points assigned to the respective module. The sum of these individually weighted grades is then divided by the total number of credit points (weighted average). Para. 3, sentence 4 applies accordingly. Deviating from this, the overall grade shall be "Excellent" if the overall grade is no lower than "Very good" (1.1) and the master's thesis has been graded "Very good" (1.0). Modules marked "pass" due to lack of comparability between grading systems shall not be included when calculating the overall grade.

(6)   The final attempt at the master's examination shall be deemed failed when
-    the candidate has failed twice to pass a module examination in a compulsory module as defined by § 10, para. 3, sentence 4, or, respectively, § 14, para. 2, or
-    the master's thesis has been graded "Insufficient" in the second attempt.

§ 25
Certificate

(1)   The candidate shall be notified of the results of their successful master's examination in a provisional certificate as soon as all grades have been submitted. A certificate shall thereafter be issued in German. Candidates may also receive an English translation of their certificate on application. The certificate shall include the following information:
-    All modules for which credit points were earned;
-    The semester in which credit points were earned;
-    All grades from individual modules;
-    The topic and grade of the master's thesis;
-    The date of the last examination and
-    The overall grade of the master's examination.

On application by the candidate, results from additional examinations as per § 30 may also be included in the certificate; these shall not be included when calculating the overall grade.

(2)   The certificate shall state the date of issue. The certificate shall be stamped with the seal of the examination board and signed by the chairperson of the examination board.

(3)   Candidates who have or are deemed to have failed their final attempt at the master's examination shall be issued a written notification thereof by the examination board, including information on legal remedies available.

(4)   Candidates who leave the University without a degree shall, after deregistration and on application, be issued a transcript including a list of all completed course work and examinations. This transcript shall be limited to those parts of the student's course of study which were successfully completed. In addition, a notification may be issued on application that indicates which examinations the student did not pass or still needs to complete in order to pass the master's examination.

§ 26
Master's diploma

Along with the certificate for the master's examination, candidates shall receive a master's diploma issued the same day in English and German stating that the candidate has been awarded the academic degree as per § 3. Master's diplomas shall be signed by the dean of the Faculty of Mathematics and Natural Sciences of the University of Bonn and by the chairperson of the examination board as well as stamped with the seal of the Faculty.

§ 27
Diploma supplement

The master's diploma shall be augmented by a diploma supplement. The diploma supplement is a standard document in English and German that shall include the following information:
-    Essential contents of the program underlying the degree;
-    The course of studies;
-    The competences acquired with the degree;
-    Information on the accreditation of the degree program and
-    Information on the university awarding the degree.
The diploma supplement shall give a relative classification of the overall grade of the master's examination on the ECTS grading scale.

§ 28
Access to examination records

(1)   Candidates shall, on application, be granted access to their examinations, the examiners' written reviews as well as records of oral examinations; applications must be submitted within three months after notification of the examination result. This does not affect § 29 of the Administrative Procedure Act (Verwaltungsverfahrensgesetz).

(2)   Candidates shall, on written application within three months after the examination board has issued the certificate as per § 25, be granted access to their examination records. This does not affect § 29 of the Administrative Procedure Act (Verwaltungsverfahrensgesetz).

(3)   The examination board shall determine when and where the examination records may be accessed and notify the candidate hereof in due time. The examination board shall determine the details concerning the possibility of preparing copies or other true reproductions, and shall announce them pursuant to § 8, para. 7. Copies and other reproductions of examination records or parts thereof are only intended for

candidates to pursue their own rights arising under the legal examination relationship and are therefore only to be used by the candidates, or made available to persons engaged by the candidates to safeguard their legal interests. Any other duplication or distribution of copies or other reproductions is not permitted.

§ 29
Invalidity of the master's examination and revocation of the master's degree

(1)   Should it become known after the certificate has been issued that the candidate used deception in an examination or their master's thesis, the examination board may correspondingly correct the grades for those examinations or the thesis in which the candidate used deception as well as the overall grade and declare the entire master's examination or parts thereof failed.

(2)   Should it become known after the certificate has been issued that the candidate had not met the requirements for admission to the master's examination, and should this have happened without any fraudulent intent on the part of the candidate, this defect shall be remedied by the candidate's successful completion of the examination. Should the candidate have wrongfully secured admission with intent, the examination board shall decide on the legal consequences in accordance with the Administrative Procedure Act.

(3)   Candidates shall be heard before the examination board makes a decision.

(4)   The incorrect certificate shall be withdrawn and, where applicable, a new certificate shall be issued. If one or more examinations are declared failed due to deception, the incorrect certificate also makes the master's diploma and all other graduation documentation void. Decisions pursuant to para. 1 and para. 2, sentence 2 may be taken only for a period of five years after the issue of the certificate.

(5)   Should the master's examination be deemed altogether failed, the master's degree shall be revoked and the master's certificate, master's diploma as well as all other graduation documentation shall be withdrawn.

§ 30
Additional examinations

Students may, until the end of the semester in which they complete the master's examination as per § 10, para. 2, extend their standard scope of studies on application with additional modules. These may be modules from this master's degree program as well as other modules for which credit would otherwise not be granted, provided that they are offered at the University of Bonn and eligible as additional module for this degree program. The results of additional examinations shall be included in the certificate in accordance with § 25 on application by the candidate, however it shall not be included when calculating the overall grade.

Part 9
Entry into force

§ 31
Entry into force and publication

These Examination Regulations shall enter into force in summer semester 2020.

J. Beck

The Dean
of the Faculty of Mathematics and Natural Sciences
of the University of Bonn
Professor Dr. Johannes Beck

Executed pursuant to the resolution adopted by the faculty council of the Faculty of Mathematics and Natural Sciences on January 15, 2020 and the resolution passed by the Rectorate on February 11, 2020.

Bonn, March 11, 2020

M. Hoch

The Rector
of the University of Bonn
Professor Dr. Dr. h. c. Michael Hoch

Annex 1:   Module structure for the consecutive master's degree program "Mathematics"

Module structure key:
- Abbreviations of course types: P = practical training course, S = seminar, Pr = problem sessions, L = lecture.
- Marked with asterisk (*): Courses for which the examination board can require compulsory attendance as a prerequisite for participation in the module examination in accordance with § 12, para. 6. In these cases, compulsory attendance is an additional requirement to other listed assessments.
- The "Course Type" column shows the type of a course within the module.
- The "Study Semester/Duration" column assigns the module to a specific study semester and shows the duration of the module (in semesters).
- The "Course Work" column shows requirements that must be met for admission to certain examinations pursuant to § 12, para. 4 or, respectively, to acquire credit points in modules without an examination.

The examination board shall make further details on individual modules, especially regarding the courses offered within or required for completion of a module, available in a module guide before the beginning of the respective semester pursuant to § 8, para. 7.

Compulsory Modules

Module Number/ Abbreviation	Module Name	Course Type	Admission Requirements	Study Semester/ Duration	Subject (content) of Examination and Qualification Objective	Course Work	Type of Examination	CP
T5G1	Master's Thesis		Min. 30 credit points	3rd–4th / 2	Ability to write a scientific exposition featuring own research results.	None	Master's thesis	30
S5G1	Master's Thesis Seminar	S*	Enrollment must take place together with enrollment for the master's thesis.	3rd–4th / 2	Ability to present own research results and to discuss mathematical results critically in a wider context.	Two other talks must be given before the final seminar talk.	Seminar talk	6

Subject-Specific Electives

At least 60 CP must be obtained from subject-specific elective modules. This includes
- 48 CP in lecture modules (basic modules and advanced lecture modules) from areas A to F (at least 23 CP in one area, at least 16 CP in a second area and at least 9 CP in a third area) and
- 12 CP in graduate seminar modules.

Electives – Basic Modules (Lecture Modules)
These modules may be taught in German (the examination board will announce this in due time at the beginning of the semester pursuant to § 8, para. 7).

Area A: Algebra, Number Theory and Logic

Module Number/ Abbreviation	Module Name	Course Type	Admission Requirements	Study Semester/ Duration	Subject (content) of Examination and Qualification Objective	Course Work	Type of Examination	CP
F4A1	Foundations in Algebra, Number Theory and Logic	L, Pr	None	1st or 2nd / 1	First overview and basic understanding of propositions, relations and methods from the area of algebra, number theory and logic. The ability to think abstractly and to identify knowledge gaps independently and close those gaps. Confident handling of learning strategies leading to successful knowledge assimilation.	Successful participation in the problem sessions	Oral examination	9

Area B: Analysis and Differential Equations

Module Number/ Abbreviation	Module Name	Course Type	Admission Requirements	Study Semester/ Duration	Subject (content) of Examination and Qualification Objective	Course Work	Type of Examination	CP
F4B1	Foundations in Analysis and PDE	L, Pr	None	1st or 2nd / 1	First overview and basic understanding of propositions, relations and methods from the area of analysis and differential equations. The ability to think abstractly and to identify knowledge gaps independently and close those gaps. Confident handling of learning strategies leading to successful knowledge assimilation.	Successful participation in the problem sessions	Oral examination	9

Area C: Discrete Mathematics

Module Number/ Abbreviation	Module Name	Course Type	Admission Requirements	Study Semester/ Duration	Subject (content) of Examination and Qualification Objective	Course Work	Type of Examination	CP
F4C1	Foundations in Discrete Mathematics	L, Pr	None	1st or 2nd / 1	First overview and basic understanding of propositions, relations and methods from the area of discrete mathematics. The ability to think abstractly and to identify knowledge gaps independently and close those gaps. Confident handling of learning strategies leading to successful knowledge assimilation.	Successful participation in the problem sessions	Oral examination	9

Area D: Geometry and Topology

Module Number/ Abbreviation	Module Name	Course Type	Admission Requirements	Study Semester/ Duration	Subject (content) of Examination and Qualification Objective	Course Work	Type of Examination	CP
F4D1	Foundations in Geometry and Topology	L, Pr	None	1st or 2nd / 1	First overview and basic understanding of propositions, relations and methods from the area of geometry and topology. The ability to think abstractly and to identify knowledge gaps independently and close those gaps. Confident handling of learning strategies leading to successful knowledge assimilation.	Successful participation in the problem sessions	Oral examination	9

Area E: Numerical Mathematics and Scientific Computing

Module Number/ Abbreviation	Module Name	Course Type	Admission Requirements	Study Semester/ Duration	Subject (content) of Examination and Qualification Objective	Course Work	Type of Examination	CP
F4E1	Foundations in Numerical Mathematics and Scientific Computing	L, Pr	None	1st or 2nd / 1	First overview and basic understanding of propositions, relations and methods from the area of numerical mathematics and scientific computing. The ability to think abstractly and to identify knowledge gaps independently and close those gaps. Confident handling of learning strategies leading to successful knowledge assimilation.	Successful participation in the problem sessions	Oral examination	9

Area F: Probability and Stochastic Analysis

Module Number/ Abbreviation	Module Name	Course Type	Admission Requirements	Study Semester/ Duration	Subject (content) of Examination and Qualification Objective	Course Work	Type of Examination	CP
F4F1	Foundations in Probability and Stochastic Analysis	L, Pr	None	1st or 2nd / 1	First overview and basic understanding of propositions, relations and methods from the area of probability and stochastic analysis. The ability to think abstractly and to identify knowledge gaps independently and close those gaps. Confident handling of learning strategies leading to successful knowledge assimilation.	Successful participation in the problem sessions	Oral examination	9

Elective Modules – Advanced Lecture Modules

Area A: Algebra, Number Theory and Logic

Module Number/ Abbreviation	Module Name	Course Type	Admission Requirements	Study Semester/ Duration	Subject (content) of Examination and Qualification Objective	Course Work	Type of Examination	CP
V4A1	Algebraic Geometry I	L, Pr	None	1st or 2nd / 1	Broad overview and understanding of propositions, relations and methods from the area of algebraic geometry. Competence to evaluate the scope, utility and limits of the methods and techniques and to independently apply abstract mathematical results to concrete problems.	Successful participation in the problem sessions	Oral examination	9
V4A2	Algebraic Geometry II	L, Pr	None	2nd or 3rd / 1	Broad overview and deep understanding of propositions, relations and methods from the area of algebraic geometry. Competence to place the results in a more general mathematical context. Overview of connections to other areas and ability to arrive at rigorous mathematical proofs starting from heuristic considerations.	Successful participation in the problem sessions	Oral examination	9

Module Number/ Abbreviation	Module Name	Course Type	Admission Requirements	Study Semester/ Duration	Subject (content) of Examination and Qualification Objective	Course Work	Type of Examination	CP
V4A3	Representation Theory I	L, Pr	None	1st or 2nd / 1	Broad overview and understanding of propositions, relations and methods from the area of representation theory. Competence to evaluate the scope, utility and limits of the methods and techniques and to independently apply abstract mathematical results to concrete problems.	Successful participation in the problem sessions	Oral examination	9
V4A4	Representation Theory II	L, Pr	None	1st or 2nd / 1	Broad overview and deep understanding of propositions, relations and methods from the area of representation theory. Competence to place the results in a more general mathematical context. Overview of connections to other areas and ability to arrive at rigorous mathematical proofs starting from heuristic considerations.	Successful participation in the problem sessions	Oral examination	9
V4A5	Advanced Algebra I	L, Pr	None	1st or 2nd / 1	Broad overview and understanding of propositions, relations and methods from the area of algebra. Competence to evaluate the scope, utility and limits of the methods and techniques and to independently apply abstract mathematical results to concrete problems.	Successful participation in the problem sessions	Oral examination	9
V4A6	Advanced Algebra II	L, Pr	None	2nd or 3rd / 1	Broad overview and deep understanding of propositions, relations and methods from the area of algebra. Competence to place the results in a more general mathematical context. Overview of connections to other areas and ability to arrive at rigorous mathematical proofs starting from heuristic considerations.	Successful participation in the problem sessions	Oral examination	9

Module Number/ Abbreviation	Module Name	Course Type	Admission Requirements	Study Semester/ Duration	Subject (content) of Examination and Qualification Objective	Course Work	Type of Examination	CP
V4A7	Advanced Mathematical Logic	L, Pr	None	1st / 1	Broad overview and deep understanding of propositions, relations and methods from the area of mathematical logic. Competence to evaluate the scope, utility and limits of the methods and techniques and to independently apply abstract mathematical results to concrete problems. Competence to place the results in a more general mathematical context. Overview of connections to other areas and ability to arrive at rigorous mathematical proofs starting from heuristic considerations.	Successful participation in the problem sessions	Oral examination	9
V5A1	Advanced Topics in Algebra	L	None	3rd or 4th / 1	Deep understanding and detailed overview of a current research focus from the area of algebra. Ability to verify the validity of propositions from original literature independently and to question research results critically. Competence to engage in independent study of current research topics.	None	Oral examination	7
V5A2	Selected Topics in Algebra	L	None	3rd or 4th / 1	Deep understanding and detailed overview of a current research focus from the area of algebra. Ability to verify the validity of propositions from original literature independently and to question research results critically. Competence to engage in independent study of current research topics.	None	Oral examination	5
V5A3	Advanced Topics in Algebraic Geometry	L	None	3rd or 4th / 1	Deep understanding and detailed overview of a current research focus from the area of algebraic geometry. Ability to verify the validity of propositions from original literature independently and to question research results critically. Competence to engage in independent study of current research topics.	None	Oral examination	7

Module Number/ Abbreviation	Module Name	Course Type	Admission Requirements	Study Semester/ Duration	Subject (content) of Examination and Qualification Objective	Course Work	Type of Examination	CP
V5A4	Selected Topics in Algebraic Geometry	L	None	3rd or 4th / 1	Deep understanding and detailed overview of a current research focus from the area of algebraic geometry. Ability to verify the validity of propositions from original literature independently and to question research results critically. Competence to engage in independent study of current research topics.	None	Oral examination	5
V5A5	Advanced Topics in Representation Theory	L	None	3rd or 4th / 1	Deep understanding and detailed overview of a current research focus from the area of representation theory. Ability to verify the validity of propositions from original literature independently and to question research results critically. Competence to engage in independent study of current research topics.	None	Oral examination	7
V5A6	Selected Topics in Representation Theory	L	None	3rd or 4th / 1	Deep understanding and detailed overview of a current research focus from the area of representation theory. Ability to verify the validity of propositions from original literature independently and to question research results critically. Competence to engage in independent study of current research topics.	None	Oral examination	5
V5A7	Advanced Topics in Mathematical Logic	L	None	3rd or 4th / 1	Deep understanding and detailed overview of a current research focus from the area of mathematical logic. Ability to verify the validity of propositions from original literature independently and to question research results critically. Competence to engage in independent study of current research topics.	None	Oral examination	7

Module Number/ Abbreviation	Module Name	Course Type	Admission Requirements	Study Semester/ Duration	Subject (content) of Examination and Qualification Objective	Course Work	Type of Examination	CP
V5A8	Selected Topics in Mathematical Logic	L	None	3rd or 4th / 1	Deep understanding and detailed overview of a current research focus from the area of mathematical logic. Ability to verify the validity of propositions from original literature independently and to question research results critically. Competence to engage in independent study of current research topics.	None	Oral examination	5

Area B: Analysis and Differential Equations

Module Number/ Abbreviation	Module Name	Course Type	Admission Requirements	Study Semester/ Duration	Subject (content) of Examination and Qualification Objective	Course Work	Type of Examination	CP
V4B1	Nonlinear Partial Differential Equations I	L, Pr	None	1st / 1	Broad overview and understanding of propositions, relations and methods from the area of nonlinear (in particular elliptical and parabolic) PDEs. Competence to evaluate the scope, utility and limits of the methods and techniques and to independently apply abstract mathematical results to concrete problems.	Successful participation in the problem sessions	Oral examination	9
V4B2	Nonlinear Partial Differential Equations II	L, Pr	None	2nd / 1	Broad overview and deep understanding of propositions, relations and methods from the area of nonlinear PDEs. Competence to place the results in a more general mathematical context. Overview of connections to other areas and ability to arrive at rigorous mathematical proofs starting from heuristic considerations.	Successful participation in the problem sessions	Oral examination	9
V4B3	Advanced Global Analysis I	L, Pr	None	1st or 3rd / 1	Broad overview and understanding of propositions, relations and methods from the area of global analysis. Competence to evaluate the scope, utility and limits of the methods and techniques and to independently apply abstract mathematical results to concrete problems.	Successful participation in the problem sessions	Oral examination	9
V4B4	Advanced Global Analysis II	L, Pr	None	2nd or 4th / 1	Broad overview and deep understanding of propositions, relations and methods from the area of global analysis. Competence to place the results in a more general mathematical context. Overview of connections to other areas and ability to arrive at rigorous mathematical proofs starting from heuristic considerations.	Successful participation in the problem sessions	Oral examination	9

Module Number/ Abbreviation	Module Name	Course Type	Admission Requirements	Study Semester/ Duration	Subject (content) of Examination and Qualification Objective	Course Work	Type of Examination	CP
V4B5	Real and Harmonic Analysis	L, Pr	None	2nd / 1	Broad overview and deep understanding of propositions, relations and methods from the area of real and harmonic analysis. Competence to evaluate the scope, utility and limits of the methods and techniques and to independently apply abstract mathematical results to concrete problems. Competence to place the results in a more general mathematical context. Overview of connections to other areas and ability to arrive at rigorous mathematical proofs starting from heuristic considerations.	Successful participation in the problem sessions	Oral examination	9
V5B1	Advanced Topics in Analysis and Partial Differential Equations	L	None	3rd or 4th / 1	Deep understanding and detailed overview of a current research focus from the area of analysis and PDEs. Ability to verify the validity of propositions from original literature independently and to question research results critically. Competence to engage in independent study of current research topics.	None	Oral examination	7
V5B2	Selected Topics in Analysis and Partial Differential Equations	L	None	3rd or 4th / 1	Deep understanding and detailed overview of a current research focus from the area of analysis and PDEs. Ability to verify the validity of propositions from original literature independently and to question research results critically. Competence to engage in independent study of current research topics.	None	Oral examination	5

Module Number/ Abbreviation	Module Name	Course Type	Admission Requirements	Study Semester/ Duration	Subject (content) of Examination and Qualification Objective	Course Work	Type of Examination	CP
V5B3	Advanced Topics in PDE and Mathematical Models	L	None	3rd or 4th / 1	Deep understanding and detailed overview of a current research focus from the area of PDEs and mathematical models. Ability to verify the validity of propositions from original literature independently and to question research results critically. Competence to engage in independent study of current research topics.	None	Oral examination	7
V5B4	Selected Topics in PDE and Mathematical Models	L	None	3rd or 4th / 1	Deep understanding and detailed overview of a current research focus from the area of PDEs and mathematical models. Ability to verify the validity of propositions from original literature independently and to question research results critically. Competence to engage in independent study of current research topics.	None	Oral examination	5
V5B5	Advanced Topics in Analysis and Calculus of Variations	L	None	3rd or 4th / 1	Deep understanding and detailed overview of a current research focus from the area of analysis and calculus of variations. Ability to verify the validity of propositions from original literature independently and to question research results critically. Competence to engage in independent study of current research topics.	None	Oral examination	7
V5B6	Selected Topics in Analysis and Calculus of Variations	L	None	3rd or 4th / 1	Deep understanding and detailed overview of a current research focus from the area of analysis and calculus of variations. Ability to verify the validity of propositions from original literature independently and to question research results critically. Competence to engage in independent study of current research topics.	None	Oral examination	5

Module Number/ Abbreviation	Module Name	Course Type	Admission Requirements	Study Semester/ Duration	Subject (content) of Examination and Qualification Objective	Course Work	Type of Examination	CP
V5B7	Advanced Topics in Analysis	L	None	3rd or 4th / 1	Deep understanding and detailed overview of a current research focus from the area of analysis. Ability to verify the validity of propositions from original literature independently and to question research results critically. Competence to engage in independent study of current research topics.	None	Oral examination	7
V5B8	Selected Topics in Analysis	L	None	3rd or 4th / 1	Deep understanding and detailed overview of a current research focus from the area of analysis. Ability to verify the validity of propositions from original literature independently and to question research results critically. Competence to engage in independent study of current research topics.	None	Oral examination	5

Area C: Discrete Mathematics

Module Number/ Abbreviation	Module Name	Course Type	Admission Requirements	Study Semester/ Duration	Subject (content) of Examination and Qualification Objective	Course Work	Type of Examination	CP
V4C1	Combinatorial Optimization	L, Pr	None	1st or 3rd / 1	Broad overview and deep understanding of propositions, relations and methods from the area of combinatorial optimization. Competence to evaluate the scope, utility and limits of the methods and techniques and to independently apply abstract mathematical results to concrete problems. Competence to place the results in a more general mathematical context. Overview of connections to other areas and ability to arrive at rigorous mathematical proofs starting from heuristic considerations.	Successful participation in the problem sessions	Oral examination	9
V4C2	Approximation Algorithms	L, Pr	None	2nd / 1	Broad overview and deep understanding of propositions, relations and methods from the area of approximation algorithms. Competence to evaluate the scope, utility and limits of the methods and techniques and to independently apply abstract mathematical results to concrete problems. Competence to place the results in a more general mathematical context. Overview of connections to other areas and ability to arrive at rigorous mathematical proofs starting from heuristic considerations.	Successful participation in the problem sessions	Oral examination	9

Module Number/ Abbreviation	Module Name	Course Type	Admission Requirements	Study Semester/ Duration	Subject (content) of Examination and Qualification Objective	Course Work	Type of Examination	CP
V4C3	Chip Design	L, Pr	None	2nd / 1	Broad overview and deep understanding of propositions, relations and methods from the area of chip design. Competence to evaluate the scope, utility and limits of the methods and techniques and to independently apply abstract mathematical results to concrete problems. Competence to place the results in a more general mathematical context. Overview of connections to other areas and ability to arrive at rigorous mathematical proofs starting from heuristic considerations.	Successful participation in the problem sessions	Oral examination	9
V5C1	Advanced Topics in Discrete Mathematics	L	None	3rd or 4th / 1	Deep understanding and detailed overview of a current research focus from the area of discrete mathematics. Ability to verify the validity of propositions from original literature independently and to question research results critically. Competence to engage in independent study of current research topics.	None	Oral examination	7
V5C2	Selected Topics in Discrete Mathematics	L	None	3rd or 4th / 1	Deep understanding and detailed overview of a current research focus from the area of discrete mathematics. Ability to verify the validity of propositions from original literature independently and to question research results critically. Competence to engage in independent study of current research topics.	None	Oral examination	5

Area D: Geometry and Topology

Module Number/ Abbreviation	Module Name	Course Type	Admission Requirements	Study Semester/ Duration	Subject (content) of Examination and Qualification Objective	Course Work	Type of Examination	CP
V4D1	Algebraic Topology I	L, Pr	None	1st / 1	Broad overview and understanding of propositions, relations and methods from the area of algebraic topology. Competence to evaluate the scope, utility and limits of the methods and techniques and to independently apply abstract mathematical results to concrete problems.	Successful participation in the problem sessions	Oral examination	9
V4D2	Algebraic Topology II	L, Pr	None	2nd / 1	Broad overview and deep understanding of propositions, relations and methods from the area of algebraic topology. Competence to place the results in a more general mathematical context. Overview of connections to other areas and ability to arrive at rigorous mathematical proofs starting from heuristic considerations.	Successful participation in the problem sessions	Oral examination	9
V4D3	Advanced Geometry I	L, Pr	None	1st or 3rd / 1	Broad overview and understanding of propositions, relations and methods from the area of geometry. Competence to evaluate the scope, utility and limits of the methods and techniques and to independently apply abstract mathematical results to concrete problems.	Successful participation in the problem sessions	Oral examination	9
V4D4	Advanced Geometry II	L, Pr	None	2nd or 4th / 1	Broad overview and deep understanding of propositions, relations and methods from the area of geometry. Competence to place the results in a more general mathematical context. Overview of connections to other areas and ability to arrive at rigorous mathematical proofs starting from heuristic considerations.	Successful participation in the problem sessions	Oral examination	9

Module Number/ Abbreviation	Module Name	Course Type	Admission Requirements	Study Semester/ Duration	Subject (content) of Examination and Qualification Objective	Course Work	Type of Examination	CP
V5D1	Advanced Topics in Topology	L	None	3rd or 4th / 1	Deep understanding and detailed overview of a current research focus from the area of topology. Ability to verify the validity of propositions from original literature independently and to question research results critically. Competence to engage in independent study of current research topics.	None	Oral examination	7
V5D2	Selected Topics in Topology	L	None	3rd or 4th / 1	Deep understanding and detailed overview of a current research focus from the area of topology. Ability to verify the validity of propositions from original literature independently and to question research results critically. Competence to engage in independent study of current research topics.	None	Oral examination	5
V5D3	Advanced Topics in Geometry	L	None	3rd or 4th / 1	Deep understanding and detailed overview of a current research focus from the area of geometry. Ability to verify the validity of propositions from original literature independently and to question research results critically. Competence to engage in independent study of current research topics.	None	Oral examination	7
V5D4	Selected Topics in Geometry	L	None	3rd or 4th / 1	Deep understanding and detailed overview of a current research focus from the area of geometry. Ability to verify the validity of propositions from original literature independently and to question research results critically. Competence to engage in independent study of current research topics.	None	Oral examination	5

Module Number/ Abbreviation	Module Name	Course Type	Admission Requirements	Study Semester/ Duration	Subject (content) of Examination and Qualification Objective	Course Work	Type of Examination	CP
V5D5	Advanced Topics in Differential Geometry	L	None	3rd or 4th / 1	Deep understanding and detailed overview of a current research focus from the area of differential geometry. Ability to verify the validity of propositions from original literature independently and to question research results critically. Competence to engage in independent study of current research topics.	None	Oral examination	7
V5D6	Selected Topics in Differential Geometry	L	None	3rd or 4th / 1	Deep understanding and detailed overview of a current research focus from the area of differential geometry. Ability to verify the validity of propositions from original literature independently and to question research results critically. Competence to engage in independent study of current research topics.	None	Oral examination	5

Area E: Numerical Mathematics and Scientific Computing

Module Number/ Abbreviation	Module Name	Course Type	Admission Requirements	Study Semester/ Duration	Subject (content) of Examination and Qualification Objective	Course Work	Type of Examination	CP
V4E1	Numerical Algorithms	L, Pr	None	1st / 1	Broad overview and deep understanding of propositions, relations and methods from the area of numerical algorithms. Competence to evaluate the scope, utility and limits of the methods and techniques and to independently apply abstract mathematical results to concrete problems. Competence to place the results in a more general mathematical context. Overview of connections to other areas and ability to arrive at rigorous mathematical proofs starting from heuristic considerations.	Successful participation in the problem sessions	Oral examination	9
V4E2	Numerical Simulation	L, Pr	None	2nd / 1	Broad overview and deep understanding of propositions, relations and methods from the area of numerical simulation. Competence to evaluate the scope, utility and limits of the methods and techniques and to independently apply abstract mathematical results to concrete problems. Competence to place the results in a more general mathematical context. Overview of connections to other areas and ability to arrive at rigorous mathematical proofs starting from heuristic considerations.	Successful participation in the problem sessions	Oral examination	9
V5E1	Advanced Topics in Numerical Methods in Science and Technology	L	None	3rd or 4th / 1	Deep understanding and detailed overview of a current research focus from the area of numerical methods in science and technology. Ability to verify the validity of propositions from original literature independently and to question research results critically. Competence to engage in independent study of current research topics.	None	Oral examination	7

Module Number/ Abbreviation	Module Name	Course Type	Admission Requirements	Study Semester/ Duration	Subject (content) of Examination and Qualification Objective	Course Work	Type of Examination	CP
V5E2	Selected Topics in Numerical Methods in Science and Technology	L	None	3rd or 4th / 1	Deep understanding and detailed overview of a current research focus from the area of numerical methods in science and technology. Ability to verify the validity of propositions from original literature independently and to question research results critically. Competence to engage in independent study of current research topics.	None	Oral examination	5
V5E3	Advanced Topics in Scientific Computing	L	None	3rd or 4th / 1	Deep understanding and detailed overview of a current research focus from the area of scientific computing. Ability to verify the validity of propositions from original literature independently and to question research results critically. Competence to engage in independent study of current research topics.	None	Oral examination	7
V5E4	Selected Topics in Scientific Computing	L	None	3rd or 4th / 1	Deep understanding and detailed overview of a current research focus from the area of scientific computing. Ability to verify the validity of propositions from original literature independently and to question research results critically. Competence to engage in independent study of current research topics.	None	Oral examination	5
V5E5	Advanced Topics in Numerical Analysis	L	None	3rd or 4th / 1	Deep understanding and detailed overview of a current research focus from the area of numerical analysis. Ability to verify the validity of propositions from original literature independently and to question research results critically. Competence to engage in independent study of current research topics.	None	Oral examination	7

Module Number/ Abbreviation	Module Name	Course Type	Admission Requirements	Study Semester/ Duration	Subject (content) of Examination and Qualification Objective	Course Work	Type of Examination	CP
V5E6	Selected Topics in Numerical Analysis	L	None	3rd or 4th / 1	Deep understanding and detailed overview of a current research focus from the area of numerical analysis. Ability to verify the validity of propositions from original literature independently and to question research results critically. Competence to engage in independent study of current research topics.	None	Oral examination	5

Area F: Probability and Stochastic Analysis

Module Number/ Abbreviation	Module Name	Course Type	Admission Requirements	Study Semester/ Duration	Subject (content) of Examination and Qualification Objective	Course Work	Type of Examination	CP

Module Number/ Abbreviation	Module Name	Course Type	Admission Requirements	Study Semester/ Duration	Subject (content) of Examination and Qualification Objective	Course Work	Type of Examination	CP
V4F1	Stochastic Analysis	L, Pr	None	1st or 2nd / 1	Broad overview and deep understanding of propositions, relations and methods from the area of stochastic analysis. Competence to evaluate the scope, utility and limits of the methods and techniques and to independently apply abstract mathematical results to concrete problems. Competence to place the results in a more general mathematical context. Overview of connections to other areas (e.g. financial mathematics, numerical and geometric analysis) and ability to arrive at rigorous mathematical proofs starting from heuristic considerations.	Successful participation in the problem sessions	Oral examination	9
V4F2	Markov Processes	L, Pr	None	1st or 2nd / 1	Broad overview and deep understanding of propositions, relations and methods from the area of Markov processes. Competence to evaluate the scope, utility and limits of the methods and techniques and to independently apply abstract mathematical results to concrete problems. Competence to place the results in a more general mathematical context. Overview of connections to other areas (e.g. spectral and ergodic theory, partial differential equations, mathematical physics and biology) and ability to arrive at rigorous mathematical proofs starting from heuristic considerations.	Successful participation in the problem sessions	Oral examination	9

Module Number/ Abbreviation	Module Name	Course Type	Admission Requirements	Study Semester/ Duration	Subject (content) of Examination and Qualification Objective	Course Work	Type of Examination	CP
V5F1	Advanced Topics in Probability Theory	L	None	3rd or 4th / 1	Deep understanding and detailed overview of a current research focus from the area of probability theory. Ability to verify the validity of propositions from original literature independently and to question research results critically. Competence to engage in independent study of current research topics.	None	Oral examination	7
V5F2	Selected Topics in Probability Theory	L	None	3rd or 4th / 1	Deep understanding and detailed overview of a current research focus from the area of probability theory. Ability to verify the validity of propositions from original literature independently and to question research results critically. Competence to engage in independent study of current research topics.	None	Oral examination	5
V5F3	Advanced Topics in Stochastic Analysis	L	None	3rd or 4th / 1	Deep understanding and detailed overview of a current research focus from the area of stochastic analysis. Ability to verify the validity of propositions from original literature independently and to question research results critically. Competence to engage in independent study of current research topics.	None	Oral examination	7
V5F4	Selected Topics in Stochastic Analysis	L	None	3rd or 4th / 1	Deep understanding and detailed overview of a current research focus from the area of stochastic analysis. Ability to verify the validity of propositions from original literature independently and to question research results critically. Competence to engage in independent study of current research topics.	None	Oral examination	5

Module Number/ Abbreviation	Module Name	Course Type	Admission Requirements	Study Semester/ Duration	Subject (content) of Examination and Qualification Objective	Course Work	Type of Examination	CP
V5F5	Advanced Topics in Applied Probability	L	None	3rd or 4th / 1	Deep understanding and detailed overview of a current research focus from the area of applied probability. Ability to verify the validity of propositions from original literature independently and to question research results critically. Competence to engage in independent study of current research topics.	None	Oral examination	7
V5F6	Selected Topics in Applied Probability	L	None	3rd or 4th / 1	Deep understanding and detailed overview of a current research focus from the area of applied probability. Ability to verify the validity of propositions from original literature independently and to question research results critically. Competence to engage in independent study of current research topics.	None	Oral examination	5

Elective Modules – Graduate Seminars

Module Number/ Abbreviation	Module Name	Course Type	Admission Requirements	Study Semester/ Duration	Subject (content) of Examination and Qualification Objective	Course Work	Type of Examination	CP
S4A1	Graduate Seminar on Algebraic Geometry	S*	None	2nd or 3rd / 1	Ability to undertake independent study of an advanced topic in algebraic geometry using specialized literature. Assessment and presentation of current research results. Didactic preparation and presentation as a seminar talk and in the form of a written paper covering the contents of the talk. Competence in scientific discussions.	A written paper is required.	Seminar talk	6
S4A2	Graduate Seminar on Representation Theory	S*	None	2nd or 3rd / 1	Ability to undertake independent study of an advanced topic in representation theory using specialized literature. Assessment and presentation of current research results. Didactic preparation and presentation as a seminar talk and in the form of a written paper covering the contents of the talk. Competence in scientific discussions.	A written paper is required.	Seminar talk	6
S4A3	Graduate Seminar on Advanced Algebra	S*	None	2nd or 3rd / 1	Ability to undertake independent study of an advanced topic in algebra using specialized literature. Assessment and presentation of current research results. Didactic preparation and presentation as a seminar talk and in the form of a written paper covering the contents of the talk. Competence in scientific discussions.	A written paper is required.	Seminar talk	6
S4A4	Graduate Seminar on Logic	S*	None	2nd / 1	Ability to undertake independent study of an advanced topic in logic using specialized literature. Assessment and presentation of current research results. Didactic preparation and presentation as a seminar talk and in the form of a written paper covering the contents of the talk. Competence in scientific discussions.	A written paper is required.	Seminar talk	6

Module Number/ Abbreviation	Module Name	Course Type	Admission Requirements	Study Semester/ Duration	Subject (content) of Examination and Qualification Objective	Course Work	Type of Examination	CP
S4A5	Graduate Seminar on Advanced Number Theory	S*	None	1st–4th / 1	Ability to undertake independent study of an advanced topic in number theory using specialized literature. Assessment and presentation of current research results. Didactic preparation and presentation as a seminar talk and in the form of a written paper covering the contents of the talk. Competence in scientific discussions.	A written paper is required.	Seminar talk	6
S4B1	Graduate Seminar on Analysis	S*	None	1st–4th / 1	Ability to undertake independent study of an advanced topic in analysis using specialized literature. Assessment and presentation of current research results. Didactic preparation and presentation as a seminar talk and in the form of a written paper covering the contents of the talk. Competence in scientific discussions.	A written paper is required.	Seminar talk	6
S4B2	Graduate Seminar on Partial Differential Equations	S*	None	1st–4th / 1	Ability to undertake independent study of an advanced topic in PDEs using specialized literature. Assessment and presentation of current research results. Didactic preparation and presentation as a seminar talk and in the form of a written paper covering the contents of the talk. Competence in scientific discussions.	A written paper is required.	Seminar talk	6
S4B3	Graduate Seminar on Global Analysis	S*	None	1st–4th / 1	Ability to undertake independent study of an advanced topic in global analysis using specialized literature. Assessment and presentation of current research results. Didactic preparation and presentation as a seminar talk and in the form of a written paper covering the contents of the talk. Competence in scientific discussions.	A written paper is required.	Seminar talk	6

Module Number/ Abbreviation	Module Name	Course Type	Admission Requirements	Study Semester/ Duration	Subject (content) of Examination and Qualification Objective	Course Work	Type of Examination	CP
S5B1	Graduate Seminar on Advanced Topics in Partial Differential Equations	S*	None	1st–4th / 1	Ability to undertake independent study of an advanced topic in PDEs using specialized literature. Assessment and presentation of current research results. Didactic preparation and presentation as a seminar talk and in the form of a written paper covering the contents of the talk. Competence in scientific discussions.	A written paper is required.	Seminar talk	6
S5B2	Graduate Seminar on Partial Differential Equations in the Sciences	S*	None	1st–4th / 1	Ability to undertake independent study of an advanced topic in PDEs in the sciences using specialized literature. Assessment and presentation of current research results. Didactic preparation and presentation as a seminar talk and in the form of a written paper covering the contents of the talk. Competence in scientific discussions.	A written paper is required.	Seminar talk	6
S5B3	Graduate Seminar on New Developments in Partial Differential Equations	S*	None	1st–4th / 1	Ability to undertake independent study of an advanced topic in new developments in PDEs using specialized literature. Assessment and presentation of current research results. Didactic preparation and presentation as a seminar talk and in the form of a written paper covering the contents of the talk. Competence in scientific discussions.	A written paper is required.	Seminar talk	6
S5B4	Graduate Seminar on Modelling and Simulation with Partial Differential Equations	S*	None	1st–4th / 1	Ability to undertake independent study of an advanced topic in modeling and simulation with PDEs using specialized literature. Assessment and presentation of current research results. Didactic preparation and presentation as a seminar talk and in the form of a written paper covering the contents of the talk. Competence in scientific discussions.	A written paper is required.	Seminar talk	6

Module Number/ Abbreviation	Module Name	Course Type	Admission Requirements	Study Semester/ Duration	Subject (content) of Examination and Qualification Objective	Course Work	Type of Examination	CP
S4C1	Graduate Seminar on Discrete Optimization	S*	None	2nd or 4th / 1	Ability to undertake independent study of an advanced topic in discrete optimization using specialized literature. Assessment and presentation of current research results. Didactic preparation and presentation as a seminar talk and in the form of a written paper covering the contents of the talk. Competence in scientific discussions.	A written paper is required.	Seminar talk	6
S4C2	Graduate Seminar on Applied Combinatorial Optimization	S*	None	3rd / 1	Ability to undertake independent study of an advanced topic in combinatorial optimization using specialized literature. Assessment and presentation of current research results. Didactic preparation and presentation as a seminar talk and in the form of a written paper covering the contents of the talk. Competence in scientific discussions.	A written paper is required.	Seminar talk	6
S4D1	Graduate Seminar on Differential Geometry	S*	None	1st–4th / 1	Ability to undertake independent study of an advanced topic in differential geometry using specialized literature. Assessment and presentation of current research results. Didactic preparation and presentation as a seminar talk and in the form of a written paper covering the contents of the talk. Competence in scientific discussions.	A written paper is required.	Seminar talk	6
S4D2	Graduate Seminar on Topology	S*	None	1st or 2nd / 1	Ability to undertake independent study of an advanced topic in topology using specialized literature. Assessment and presentation of current research results. Didactic preparation and presentation as a seminar talk and in the form of a written paper covering the contents of the talk. Competence in scientific discussions.	A written paper is required.	Seminar talk	6

Module Number/ Abbreviation	Module Name	Course Type	Admission Requirements	Study Semester/ Duration	Subject (content) of Examination and Qualification Objective	Course Work	Type of Examination	CP
S4D3	Graduate Seminar on Advanced Geometry	S*	None	1st–4th / 1	Ability to undertake independent study of an advanced topic in geometry using specialized literature. Assessment and presentation of current research results. Didactic preparation and presentation as a seminar talk and in the form of a written paper covering the contents of the talk. Competence in scientific discussions.	A written paper is required.	Seminar talk	6
S4D4	Graduate Seminar on Advanced Topology	S*	None	2nd or 3rd / 1	Ability to undertake independent study of an advanced topic in topology using specialized literature. Assessment and presentation of current research results. Didactic preparation and presentation as a seminar talk and in the form of a written paper covering the contents of the talk. Competence in scientific discussions.	A written paper is required.	Seminar talk	6
S4E1	Graduate Seminar on Scientific Computing	S*	None	1st–4th / 1	Ability to undertake independent study of an advanced topic in scientific computing using specialized literature. Assessment and presentation of current research results. Didactic preparation and presentation as a seminar talk and in the form of a written paper covering the contents of the talk. Competence in scientific discussions.	A written paper is required.	Seminar talk	6
S4E2	Graduate Seminar on Numerical Simulation	S*	None	1st–4th / 1	Ability to undertake independent study of an advanced topic in numerical simulation using specialized literature. Assessment and presentation of current research results. Didactic preparation and presentation as a seminar talk and in the form of a written paper covering the contents of the talk. Competence in scientific discussions.	A written paper is required.	Seminar talk	6

Module Number/ Abbreviation	Module Name	Course Type	Admission Requirements	Study Semester/ Duration	Subject (content) of Examination and Qualification Objective	Course Work	Type of Examination	CP
S5E1	Graduate Seminar on Numerical Analysis	S*	None	1st–4th / 1	Ability to undertake independent study of an advanced topic in numerical analysis using specialized literature. Assessment and presentation of current research results. Didactic preparation and presentation as a seminar talk and in the form of a written paper covering the contents of the talk. Competence in scientific discussions.	A written paper is required.	Seminar talk	6
S5E2	Graduate Seminar on Efficient Simulation	S*	None	1st–4th / 1	Ability to undertake independent study of an advanced topic in efficient simulation using specialized literature. Assessment and presentation of current research results. Didactic preparation and presentation as a seminar talk and in the form of a written paper covering the contents of the talk. Competence in scientific discussions.	A written paper is required.	Seminar talk	6
S4F1	Graduate Seminar on Probability Theory	S*	None	1st–4th / 1	Ability to undertake independent study of an advanced topic in probability theory using specialized literature. Assessment and presentation of current research results. Didactic preparation and presentation as a seminar talk and in the form of a written paper covering the contents of the talk. Competence in scientific discussions.	A written paper is required.	Seminar talk	6
S4F2	Graduate Seminar on Stochastic Analysis	S*	None	1st–4th / 1	Ability to undertake independent study of an advanced topic in stochastic analysis using specialized literature. Assessment and presentation of current research results. Didactic preparation and presentation as a seminar talk and in the form of a written paper covering the contents of the talk. Competence in scientific discussions.	A written paper is required.	Seminar talk	6

Module Number/ Abbreviation	Module Name	Course Type	Admission Requirements	Study Semester/ Duration	Subject (content) of Examination and Qualification Objective	Course Work	Type of Examination	CP
S4F3	Graduate Seminar on Applied Probability	S*	None	1st–4th / 1	Ability to undertake independent study of an advanced topic in applied probability using specialized literature. Assessment and presentation of current research results. Didactic preparation and presentation as a seminar talk and in the form of a written paper covering the contents of the talk. Competence in scientific discussions.	A written paper is required.	Seminar talk	6

Elective Modules – Practical Training Courses

Module Number/ Abbreviation	Module Name	Course Type	Admission Requirements	Study Semester/ Duration	Subject (content) of Examination and Qualification Objective	Course Work	Type of Examination	CP
P4G1	Practical Teaching Course	P*	Admission to the master's examination procedure in the mathematics degree program	1st–4th / 1	Structured reflection with respect to - the ability to present mathematical topics in an understandable manner appropriate for the target group, - the ability to assess and evaluate mathematical arguments, - communication at different hierarchical levels while teaching (lecturer, assistants, students in the tutorial group, other tutors).	None	Portfolio and presentation (weighting: 1:1)	9
P4G2	External Internship	P	Admission to the master's examination procedure in the mathematics degree program	1st–4th / 1	Ability to present mathematical topics in an understandable manner appropriate for the target group (possibly also for non-mathematicians). Ability to apply mathematical knowledge to practical problems in industry. Ability to work in a hierarchy with superiors. Ability to communicate at different hierarchical levels within a company.	None	Project report and presentation (weighting: 1:1)	9
P4A1	Practical Project in Mathematical Logic	P	None	1st–4th / 1	Completion of a practical formalization or programming project in one of the following areas: formal mathematics, automatic proof testing and automatic proving.	None	Project report and presentation (weighting: 1:1)	9
P4C1	Combinatorial Algorithms	P	None	2nd or 4th / 1	Ability to implement difficult combinatorial algorithms and to handle nontrivial data structures, testing and documentation. Acquisition or extension of knowledge of advanced software techniques.	None	Project report and presentation (weighting: 1:1)	9
P4C2	Algorithms for Chip Design	P	None	3rd / 1	Ability to implement algorithms for VLSI design and to handle very large instances, testing and documentation of the software efficiently. Acquisition or extension of knowledge of advanced software techniques.	None	Project report and presentation (weighting: 1:1)	9

Module Number/ Abbreviation	Module Name	Course Type	Admission Requirements	Study Semester/ Duration	Subject (content) of Examination and Qualification Objective	Course Work	Type of Examination	CP
P4E1	Practical Lab Numerical Simulation	P	None	1st–4th / 1	Ability to implement numerical simulation methods.	None	Project report and presentation (weighting: 1:1)	9

The examination board may approve further elective modules and shall announce them before the beginning of the semester pursuant to § 8, para. 7.

Elective Modules – Additional Modules

Students can, upon request, retake a graduate seminar, advanced topics or selected topics module that they have already completed if the content and subject matter of the examination are sufficiently different. The decision is made by the examination board.

Module Number/ Abbreviation	Module Name	Course Type	Admission Requirements	Study Semester/ Duration	Subject (content) of Examination and Qualification Objective	Course Work	Type of Examination	CP
F5X1	Additional Graduate Seminar	S*	Graduate Seminar Module	3rd or 4th / 1	Ability to undertake independent study of an advanced topic using specialized literature. Assessment and presentation of current research results. Didactic preparation and presentation as a seminar talk and in the form of a written paper covering the contents of the talk. Competence in scientific discussions.	A written paper is required.	Seminar talk	6
F5X2	Additional Advanced Topics	L	Advanced Topics Module	3rd or 4th / 1	Deep understanding and detailed overview of a current research focus. Ability to verify the validity of propositions from original literature independently and to question research results critically. Competence to engage in independent study of current research topics.	None	Oral examination	7
F5X3	Additional Selected Topics	L	Selected Topics Module	3rd or 4th / 1	Deep understanding and detailed overview of a current research focus. Ability to verify the validity of propositions from original literature independently and to question research results critically. Competence to engage in independent study of current research topics.	None	Oral examination	5

Module Number/ Abbreviation	Module Name	Course Type	Admission Requirements	Study Semester/ Duration	Subject (content) of Examination and Qualification Objective	Course Work	Type of Examination	CP
physik420	Theoretical Physics III (Quantum Mechanics)				The legal provisions on examinations for the "Physics" bachelor's degree program in the corresponding examination regulations, as amended on the date of registration for the module examination, apply to this module.			9
physik520	Theoretical Physics IV (Statistical Physics)				The legal provisions on examinations for the "Physics" bachelor's degree program in the corresponding examination regulations, as amended on the date of registration for the module examination, apply to this module.			9

The examination board may approve other elective modules. The examination board shall announce the approved elective modules before the beginning of the semester pursuant to § 8, para. 7.

Non-Subject-Specific Electives

No more than 24 CP can be obtained from non-subject-specific elective modules pursuant to § 4, para. 5. The modules being offered will be announced for each semester.

Annex 2:   Procedure for the aptitude test for foreign applicants to a degree program who are not given equivalent status to Germans by or based on international treaties

I.   General principles

(1)   The admission requirements in § 5 of the Examination Regulations must be satisfied for admission to the "Mathematics" consecutive master's degree program. Under § 5, para. 4 of the Examination Regulations, foreign applicants who are not given equivalent status to Germans by or based on international treaties must take part in a procedure for the aptitude test for university studies.

(2)   This Annex sets down the provisions governing the procedure for the aptitude test for university studies specified in paragraph 1.

(3)   The objective of the procedure is to determine whether applicants have the aptitude necessary to be expected to successfully graduate from the degree program.

(4)   §§ 6 (Recognition of and granting credit for academic achievements), 8 (Examination board and exam office), 9 (Examiners and assistant examiners), 28 (Access to examination records) and 29 (Invalidity of the master's examination and revocation of the master's degree) of these Examination Regulations shall apply accordingly.

II.   Eligibility and application procedure/admission to the examination procedure

(1)   Foreign applicants who satisfy the other admission requirements in § 5 of the Examination Regulations or are expected to satisfy them in accordance with para. 5, sentence 2, can participate in the examination procedure for the aptitude test for university studies specified in Part I, para. 3.

(2)   Applications for admission to the examination procedure must be submitted electronically in German or English using the application forms provided by the examination board. Admission takes place each summer and winter semester. The application deadline for the current procedure will be announced in timely fashion on the webpage for the degree program. The time of electronic receipt by the University of Bonn determines whether the application deadline has been met. The application deadline and issuing of the notices in Part VI shall be coordinated with the enrollment deadline.

(3)   The following documents shall be included in English in electronic form with the application:
  1. Proof of formal qualification in accordance with § 5, para. 1 and 2 of the Examination Regulations or a provisional certificate in accordance with para. 5, sentence 2;
  2. A completed admission application form;
  3. A curriculum vitae with a detailed description of prior education;
  4. Proof of English language proficiency in accordance with § 5, para. 3 of the Examination Regulations.

(4)   The chairperson of the examination board established in accordance with § 8 of the Examination Regulations shall make the decision on the application for admission to the examination procedure.

(5)   Admission shall be rejected if the application is incomplete. If the documents specified in para. 3 are not yet available at the time the application is submitted, a corresponding certificate from the university concerned and list of the modules completed and their grades shall be sufficient for the application. The applicant must submit formal proof immediately upon receipt.

III.   Performing the examination procedure

(1)   The examination board formed in accordance with § 8 of the Examination Regulations is responsible for organizing and carrying out the examination procedure. The examination board shall hold discussions and make decisions in closed meetings. It shall appoint a committee consisting of a chairperson and at least two other professors in the master's degree program "Mathematics" to carry out the procedure. Decisions shall be made by simple majority. In the event of a tie vote, the chairperson's vote shall be the deciding vote.

(2)   The examination board appoints the examiners for the examination procedure. § 9 of the Examination Regulations applies accordingly.

IV. Examination procedure

(1)   The application documents will be checked to determine the level of education achieved in the field of mathematics in the first degree. Particular attention will be given to whether the applicant has the knowledge in the following areas that are required for successfully completing the "Mathematics" consecutive master's degree program:

-    Analysis
-    Linear algebra
-    Basic knowledge of numerical mathematics, probability theory and discrete mathematics
-    Advanced knowledge in at least one of the following areas:
-    Algebra, number theory and logic
-    Analysis and differential equations
-    Discrete mathematics
-    Geometry and topology
-    Numerical mathematics and scientific computing
-    Probability theory and stochastic analysis

The standard used shall be the level of knowledge reached in the "Mathematics" bachelor's degree program at the University of Bonn at the end of the 5th program-related semester. The committee appointed by the examination board decides whether the aptitude test for university studies must be taken in order to assess the qualifications of the applicant based on the criteria above.

(2)   Applicants who completed their bachelor's studies in the "Mathematics" degree program or in a related or comparable degree program at another institution of higher education within the scope of the German Basic Law (Grundgesetz) or at an institution of higher education in a Member State of the European Union or a state that has ratified the Convention on the Recognition of Qualifications concerning Higher Education in the European Region (Lisbon Recognition Convention) have already proven their aptitude for university studies and are exempt from the test. This also applies to applicants with German university entrance qualifications; § 5, para. 1 and 2 of the Examination Regulations remain unaffected.

(3)   Written examinations shall be a maximum of three hours in length. Oral examinations shall be a maximum of one hour in length. Applicants who satisfy the admission requirements for the aptitude test for university studies in Part II shall be notified in writing of the type of examination and examination date. Examinations shall take place in English.

(4)   § 18 of the Examination Regulations applies accordingly.

V.   Grading of examinations

(1)   A point score is assigned for the written or oral examination. The highest possible score is 100 points. The assessment is considered passed if a score of at least 50 points is achieved.

(2)   Applicants who try to influence the outcome of an examination through deception or the use of inadmissible auxiliary means shall receive an overall score of "0" (zero) points. If an examiner or proctor determines that such deception has taken place, the applicant can request that the examination board review the decision.

(3)   Written examinations shall be graded by two examiners. The two examiners assign separate point scores for the examination. The overall score for the paper is calculated as the arithmetic average of the individual scores assigned by the two examiners.

(4)   Oral examinations shall be conducted by either a panel of several examiners or a single examiner in the presence of a competent assistant examiner (§ 9, para. 1 of the Examination Regulations), with candidates being examined either individually or in a group. If the examination is only conducted by a single examiner, the examiner shall hear the assistant examiner in private prior to setting a grade.

(5)   Otherwise, § 12, para. 7 of the Examination Regulations shall apply accordingly.

VI.   Notification of the results and repetition of the examination procedure

(1)   Candidates shall be informed of their results on an oral examination immediately following the examination. The examination board shall also notify the applicant in writing of the results of the examination. If the notice indicates a negative decision, it must include information on legal remedies. The reasons for the negative decision must be included.

(2)   Applicants who do not pass the examination procedure may repeat the examination on the date in the following semester at the earliest; a new application is required. A second repetition is not possible.

VII.   Students who change the location of their studies

For students who change the location of their studies and were previously enrolled in a master's degree program in the field of mathematics or a comparable degree program at another institution of higher education, the examination board shall assess their individual qualifications, including an examination procedure if one was performed. If the examination board decides that the degree program and examination procedure are equivalent, the applicant will be exempt from participating in the examination procedure at the University of Bonn.

Annex 3:   Regulations for admission to courses

If admission to a course, due to its nature, purpose or to other reasons, needs to be limited and the number of registrations exceeds the defined capacities, it is handled as follows:

Applicants shall be admitted in the following order:

- **Group 1:**
   Students who are enrolled at the University of Bonn, for whom, according to the curriculum, participation in this course is mandatory and who are in the same or a higher study semester as/than the one specified for participation in the curriculum, provided they
   a.   were kept from registering for the course due to a delay in the first semester, or
   b.   were not selected in a random selection procedure at least once in the past;

- **Group 2:**
   Students who are enrolled at the University of Bonn and who are in the same or a higher study semester as/than the one specified for participation in the curriculum, and who do not belong to Group 1;

- **Group 3:**
   All other students enrolled at the University of Bonn who are eligible for participation in this course pursuant to the curriculum;

- **Group 4:**
   All other students.

This does not affect further admission requirements. Within the groups – except Group 4 – students who have collected the largest number of credit points for this degree program or for another degree program at the University of Bonn that imports modules from this degree program shall have priority. Remaining places are allocated by drawing lots.