

Care was taken to ensure the text of these regulations is accurate and up-to-date; the present version may nevertheless contain errors. The official, legally binding version can be viewed in the Examinations Office, the Student Advising Office, or online at <https://www.amtliche-bekanntmachungen.uni-bayreuth.de/de/>. Please note the effective dates of the amendments.

Subject-Specific Examination Regulations
for the Elite International Master's Programme in
Scientific Computing
as part of the Elite Network of Bavaria (ENB)
at the University of Bayreuth
dated 7 June 2019
in the version
dated 9 January 2023

Article 13 para 1 sentence 2 in conjunction with Article 61 para 2 sentence 1 and Article 61 para 2 sentence 1 of the Bavarian Higher Education Act (*BayHSchG*) forms the basis for the following examination regulations issued by the University of Bayreuth.

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§ 1

Purpose of the master's examination

¹The interdisciplinary approach of this elite English-taught programme allows students to acquire and apply specialized knowledge in numerical methods for solving differential and integral equations and in data analysis, while broadening their horizons to other subject areas. ²A doctorate within the framework of a fast-track process is possible. The master's examination, carried out over the course of the master's programme Scientific Computing, is used to determine whether the candidate has acquired the expertise stipulated in the present regulations and has the following competencies:

- the ability to think abstractly,
- precision in analytical thinking,
- valid argumentation,
- the proven ability to structure complex interrelationships,
- a high level of perseverance in solving difficult problems,
- broad insights into interdisciplinary interrelationships,
- the proven ability to implement mathematical methods for complex scientific-technical problems and to implement them professionally on modern computer systems,
- the ability to carry out advanced independent scientific work,
- ability to function as a responsible mathematician in interdisciplinary teams of mathematicians, computer scientists, natural scientists, engineers and economists in business and industry.

⁴Upon the candidate's passing of the master's examination, the University of Bayreuth, by way of the Faculty of Mathematics, Physics & Computer Science, awards the academic degree "Master of Science" (abbreviated as M.Sc.).

§ 2

General Examination & Study Regulations

The proper implementation of all examinations addressed in the present regulations is governed by the applicable General Examination and Study Regulations for Bachelor's and Master's Programmes in Mathematics at the University of Bayreuth (General Examination and Study Regulations).

§ 3

Board of examiners

Notwithstanding § 2 para 1 sentence 4 of the General Examination and Study Regulations, the board of examiners shall be elected by the faculty council of the Faculty of Mathematics, Physics and Computer Science from among the university instructors participating in the elite study programme.

§ 4

Structure of studies and master's examination, standard period of study

(1) The master's programme Scientific Computing is structured in modules and consists of the following sub-areas:

A Module area A: "Numerical Mathematics"

In this module area, the foundations of the field of numerics are to be laid for the degree programme.

A1: Module "Numerical Methods for Partial Differential Equations"

If the contents of module A1 were already acquired in the bachelor's programme, a module comprising eight credit points is to be selected from the core elective modules A as an alternative to A1. In this case, a total of 8 to 16 credit points can be earned in module area A.

A2: Core elective modules "Advanced Topics in Numerical Mathematics"

Further modules shall be completed with a maximum of 16 credit points from the modules listed in Annex 1.

b) Module area B: "Modeling and Simulation"

The assessment components include the study of scientific-technical or statistical fields of application whose mathematical modelling leads to problems that are interesting for scientific computing due to their complexity. At the same time, areas of applied mathematics are to be studied that form the basis for modelling:

B1: Module "Applied Functional Analysis"

If the contents of module A1 were already acquired in the bachelor's programme, a module comprising 8 credit points is to be selected from the elective modules B2 as an alternative to B1.

B2: Core elective module "Modeling and Simulation"

Additional modules shall be completed in the amount of 8 to 16 credit points from the modules listed in Annex 1. Modules must include at least 8 credit points from the non-mathematical courses offered. On request, the board of examiners may admit modules from other fields of application provided that they meet the requirements given above. Furthermore, the board of examiners may also approve introductory modules from the relevant field of application if these are required for successful participation in a module.

B3: Module "Industrial Internship"

In order to apply the learned methods and to receive impulses for their own research, the students complete an industrial internship of at least six weeks. As a rule, industrial internships are to be organized by the student and integrated into the programme within the standard period of study. Students can obtain help in organizing the industrial internship from the scientists involved in the elite degree programme. A report of at least 10 pages must be submitted within 4 weeks of completing the internship. The internship is assessed as "passed" or "failed". As an alternative to the industrial internship, students can successfully complete further modules worth eight credit points from the core elective modules D1 in Annex 1.

B4: Module "Modeling and Status Seminar"

The module comprises the annual modelling week and the annual status seminar of the programme. Students are obligated to actively participate in two of these courses. During the modeling week, which is held as a block seminar outside the university, students work in groups to mathematically formulate current scientific and technical problems and apply modern numerical methods to them. The results are presented and discussed at the end in 30 - 60 minute lectures. Furthermore, at the latest four weeks after the end of the modelling week, a paper that is at least 10 pages in length must be submitted. The oral presentation and elaboration are assessed in groups. The module grade for the "Modeling and Status Seminar" module is calculated from the average of the two grades for the oral presentations and the two grades for the written papers from the annual modeling week; §12 para 2 sentence 4 of the General Examination and Study Regulations applies. In the status seminar, students give a short 15-30 minute presentation on their activities, study status and the results of their own research. The status seminar is assessed as "passed" or "failed".

c) Module area C: "High-Performance Computing"

Another central component of the degree programme is the professional and efficient implementation of mathematical methods on high-performance computers.

C1: Core elective module "High-Performance Computing"

Modules shall be completed in the amount of 12 credit points from the modules listed in Annex 1.

C2: Computer Internship "Parallel Numerical Methods"

d) Module area D: "Scientific Computing"

This module area is the central area of the degree programme.

D1: Core elective module "Complexity Reduction"

These modules address current methods that are based on the reduction of the information content of a problem and/or of data sets. The complexity is reduced to such an extent that the problem can be dealt with efficiently on parallel computers. Modules shall be completed in the amount of 16 to 24 credit points from the modules listed in Annex 1.

D2: Module "Special Skills in Scientific Computing"

A specialization module from the research areas listed in D1 or A2.

e) Module area E: "Soft Skills"

In order to develop non-subject-specific key qualifications (lecture and presentation techniques, computer use, literature research, dealing with foreign-language specialist literature, teamwork), students must attend seminars totaling 60 hours. This corresponds to 3 - 4 seminars. Completion of the module will be demonstrated by submitting the relevant confirmation of participation and will be assessed as "passed" or "failed".

f) Module area F: "Master's Thesis"

During the first year, students make contact with one of the research groups involved in the elite degree programme. With the support of a supervisor or several supervisors, the students select a research topic for a master's thesis from among the university instructors involved in the elite degree programme, taking into account the student's research interests, which will also offer potential for a later doctorate. The master's thesis should deal with interdisciplinary and application-oriented issues and relate to the focus of the degree program *Scientific Computing* degree programme. Finding a topic in cooperation with an

industrial company, other research institutions, or authorities is expressly desired. In order to support the most efficient and successful processing of the topic, the students are to be placed in research stays of several weeks with proven experts in the respective fields.

- (2) ¹The master's programme Scientific Computing can be completed as a full-time or part-time student. ²Upon enrolment, the applicant must decide whether he or she wants to complete the programme of study as a full-time or part-time student. ³Changing from full-time to part-time study or from part-time to full-time study is possible within the enrolment period of each new semester. ⁴The programme comprises four semesters of full-time study including the master's thesis (standard period of study). ⁵The programme comprises eight semesters of part-time study including the master's thesis. ⁶Unless special provisions are made in the present regulations, the deadlines specified for full-time study also apply to part-time study.
- (3) A total of 120 credit points must be earned in accordance with the European Credit Transfer System (ECTS).
- (4) New students may begin the programme in the winter semester or the summer semester.

§ 5

Admission to the programme

- (1) Prerequisites for admission to the degree programme are:
 - a) a university degree with an examination grade of at least 1,9 in a bachelor's degree programme in mathematics, computer science, natural sciences or engineering at the University of Bayreuth or an equivalent degree and
 - b) proven knowledge of numerics amounting to at least 16 credit points. Applicants who are unable to provide proof of these skills will be enrolled on the condition that they submit the proof by the end of the second semester of study at the latest, and
 - c) proof of English skills at level B2 or better of the Common European Framework of Reference for Languages for applicants who neither earned their higher education entrance qualification nor their initial higher education degree in the English language.
 - d) proof of German language skills at level A1 or better of the Common European Framework of Reference for applicants who neither earned their higher education entrance qualification nor their initial higher education degree in the German language; Applicants who are unable to provide proof of these skills will be enrolled on the condition that they submit the proof by the end of the second semester of study at the latest and
 - e) the determination of course-specific aptitude in the aptitude assessment process in accordance with Annex 2.

- (2) ¹The qualifications may not differ substantially in terms of the earned competences (learning outcomes) from the qualifications referred to in para 1 item a. ²If there are substantial compensable differences, applicants may be admitted subject to the proviso that, in addition to the assessment components to be completed in the master's programme and the assessment components from para 1 item b, they also successfully complete coursework and examinations in the amount of up to 10 credit points by the end of the second semester of study at the latest; otherwise, the prerequisites for admission to the programme are deemed not to have been fulfilled. ³In such cases, the examination and study regulations for the bachelor's programmes at the University of Bayreuth given in para 1 item a (as amended) shall apply. ⁴Art. 86 BayHIG applies to determining the eligibility of domestic and foreign degrees.
- (3) Such decisions as described in paragraphs 1 and 2 are to be made by the board of examiners established under the terms of § 2 of the General Examination and Study Regulations and § 3 of the present regulations.
- (4) ¹If the bachelor's certificate or equivalent diploma has not yet been issued, a confirmation of all individual grades and examinations for courses completed up to the date of registration must be submitted. ²These components must comprise partial examinations with a total of at least 150 credit points and must correspond to an average grade of at least 1,9 in the overall grade calculation. ³Applicants who meet the requirements according to sentence 2 will be enrolled on condition that they submit the relevant degree certificate with a grade of at least 1,9 by the end of the second semester.

§ 6

Admission to the examinations

Students who are enrolled in the master's programme Scientific Computing are considered ipso facto to be admitted to the examinations.

§ 7

Credit transfer and recognition

- (1) The recognition and crediting of competencies shall be determined in accordance with Art. 86 BayHIG.
- (2) ¹If credits are recognized for competencies, the grades are to be carried over and included when calculating the final grade, as long as the grading systems are analogous. ²If the grading system of the competences to be recognized does not correspond to the grading system of Section 12 of the General Examination and Study Regulations for Bachelor's and Master's Programmes in Mathematics at the University of Bayreuth dated 1 June 2011, as amended, the grades of the other

university shall be taken into account by the Examination Board according to the modified Bavarian formula

$$x = 1 + 3 \cdot (N_{\max} - N_d) / (N_{\max} - N_{\min})$$

with If the grades of the other university do not correspond to the grading system of § 12 of the General Examination and Study Regulations for Bachelor's and Master's Programmes in Mathematics at the University of Bayreuth dated 1 June 2011, as amended, the grades of the other university will be converted by the board of examiners according to the modified Bavarian formula $x = 1 + 3 \cdot (N_{\max} - N_d) / (N_{\max} - N_{\min})$ with the conversion grade x sought, the best achievable grade N_{\max} , the lowest pass grade N_{\min} and the grade achieved N_d ; only one decimal place will be taken into account in the calculated grades and no adjustment will be made to the grades specified in § 12 of the General Examination and Study Regulations for Bachelor's and Master's Programmes in Mathematics at the University of Bayreuth dated 1 June 2011, as amended. ³If a conversion according to sentence 2 is not possible, the board of examiners shall determine a corresponding key for the grade conversion. ⁴If a grade is not available and cannot be determined, the remark "passed" will be entered; in this case, it will not be included in the calculation of the final grade. ⁵The board of examiners in consultation with the relevant representative from the subject area shall decide whether the requirements have been met for credit transfer. ⁶If credit transfer is denied, the person concerned can appeal the decision by submitting a request for the University Governing Board to review the decision within four weeks of notification of denial. ⁷The University Governing Board shall provide the board of examiners with a recommendation on how to proceed with the request.

- (3) Credit transfer requests are to be submitted to the board of examiners as soon as possible following enrolment and in any event prior to completing the examination proceedings in the relevant module.
- (4) Paragraphs 2 and 3 shall apply mutatis mutandis to the crediting of competencies, subject to the maximum limit pursuant to Art. 86 para 2 Sentence 2 BayHIG.

§ 8

Elements of the examination

- (1) The master's examination comprises the module examinations listed in Annex 1 and the master's thesis.
- (2) The examinations serve to demonstrate that the examinee has satisfied the desired learning outcomes of the individual modules.

§ 9

Early transition to doctoral research

Admission to one of the doctoral programmes offered by the Bayreuth Graduate School of Mathematics and Natural Sciences (BayNAT) - e. g. Computational Mathematics in Science and Engineering (Bay-CompMath) - can be made in accordance with § 4 para 2 of the Doctoral Regulations of the Bayreuth Graduate School of Mathematical and Natural Sciences (BayNAT).

§ 10

Master's thesis

- (1) ¹The master's thesis of the candidate should demonstrate that he or she is able to utilize relevant resources and adequately address and write about current issues in the field using scientific methods over a time frame of 900 hours of work. ²The topic should include interdisciplinary issues.
- (2) ¹The chair of examiners is to determine an examiner to act as supervisor and assessor if possible in consideration of the candidate's wishes. ²The topic of the master's thesis is assigned by a university instructor who is involved in the elite study programme or a university instructor who is involved in the elite study programme via the chair of examiners, as a rule at the end of the second semester for full-time students and at the end of the fourth semester for part-time students. ³Record is to be made of the date on which the topic was assigned.
- (3) ¹The master's thesis is to be integrated into the third and fourth semesters of study for full-time students and the fifth to eighth semesters for part-time students. ²The master's thesis is to be submitted no later than 10 months after the topic was assigned for full-time students and no later than 20 months after the topic was assigned for part-time students. ³In cases in which the candidate was not at fault for missing a deadline, at the request of the candidate, the chair of examiners may, after having heard the supervisor, extend the deadline by up to two weeks. ⁴If the candidate demonstrates via a medical certificate that he or she was unable to work on the thesis, the deadline is to be extended accordingly. ⁵Theses that are not submitted by the stated deadline are graded as "nicht ausreichend" ["unsatisfactory"].
- (4) ¹The master's thesis must be submitted in electronic form (printable PDF document) by the deadline. ²Submission is carried out by uploading the document via the form server. ³The Examinations Office will make a note of the date on which the thesis was submitted.
- (5) ¹The thesis must contain a table of contents and bibliography. ²One additional copy of the master's thesis in typewritten form, bound and paginated, must also be submitted to the examiner by the deadline at the latter's request.

- (6) ¹The master's thesis may be written in German or English. ²The master's thesis shall contain a statement at the end in which the author confirms that he or she wrote the thesis independently and did not make use of any sources or materials that are not cited in the thesis. It shall also be confirmed that the thesis had never before been submitted toward fulfilment of an academic degree. ³A synopsis in the German language is to be included if the master's thesis was written in English.
- (7) ¹The candidate may return the topic to the board of examiners once within the first two weeks. ²Paragraphs 1 to 6 also apply when assigning and working on a new topic.
- (8) ¹The chair of examiners is to be informed by the Examinations Office of submission and shall determine an additional assessor from among the examiners described in § 3 of the General Examination and Study Regulations. ²Examinations Office shall forward the thesis to the reviewers appointed. ³The grades shall be made available no later than two months after submission of the thesis. ⁴Each reviewer recommends acceptance or rejection of the thesis to the board of examiners and at the same time sets one of the grades listed in § 12 of the General Examination and Study Regulations. ⁵In special cases, the board of examiners may call upon an additional examiner, especially if the grades assigned vary by more than one point.
- (9) ¹If their assessments differ under the terms of § 10 para 8 sentence 5, the reviewers shall engage in a discussion in which they try to agree on a grade in consideration of subject-related aspects. ²If they cannot reach agreement, they are to inform the chair of examiners. ³In such cases, the chair of examiners shall appoint a third reviewer, who shall determine the grade on the basis of the two assessments available.
- (10) If the master's thesis is deemed "nicht ausreichend" ["unsatisfactory"], the chair of examiners or his or her deputy shall inform the candidate of the decision.
- (11) One copy of the master's thesis is to remain on record.
- (12) The Master's thesis can also be completed as part of a fast-track doctorate in one of the doctoral programmes (e. g. Computational Mathematics in Science and Engineering (BayCompMath)) of the Bayreuth Graduate School of Mathematics and Natural Sciences (BayNAT).

§ 11

Final grade

- (1) ¹The overall grade of the master's examination is calculated from the average of the module grades relevant to the final grade (§ 12 of the General Examination and Study Regulations) in accordance with Annex 1 and from the grade of the master's thesis (§ 10 of the present regulations), which are weighted with the credit points of the respective module. ²In this calculation, the grade shall only be given to one decimal place; the remaining digits are to be truncated (not

rounded).³If the required total of 120 credit points is exceeded, the student must submit a written declaration to the Examination Office by the time the Master's thesis is submitted at the latest.⁴In this declaration, the student specifies which core elective modules are to be included in the overall examination grade and which core elective modules are to be assessed as additional examination achievements or, if the 120 credit points are only exceeded proportionately, which of the compulsory elective modules is to be included in the calculation of the overall grade only proportionately with the credit points still required.

- (2) Candidates who pass the master's examination are to receive a final grade as follows: an average grade of 1,2 or better is "ausgezeichnet", up to 1,5 is "sehr gut", up to 2,5 is "gut", up to 3,5 is "befriedigend", up to 4,0 "ausreichend".
- (3) The certificate or an attached document shall indicate how the final grade was calculated.
- (4) ¹In addition to the degree certificate, an ECTS grading table will be issued as stipulated in the ECTS guidelines in the version dated 6 February 2009. ²This table displays what percentage of programme graduates in a given time frame received the same final grade as described in para 2. ³Those programme graduates who were awarded their diplomas in the previous four semesters shall serve as the reference group as long as it includes at least 30 persons. ⁴The date of the last examination shall be decisive in assigning graduates to a particular semester. ⁵If the minimum number of graduates is not reached, the number of previous semesters is to be extended until the minimum number is reached. ⁶If the programme of study does not yet have as many graduates as the minimum number required of the reference group, an ECTS grading table will be issued as soon as the minimum number is reached. ⁷For degrees awarded before the minimum number is reached, an ECTS grading table will be issued at a later date upon request once the minimum number has been reached. ⁸The graduate's own graduating class is also to be included in the reference group. ⁹The size of the reference group and the time frame is to be included.

§ 12

Passing the master's examination

- (1) ¹The master's examination is only passed if the grade of the master's thesis and each module examination is at least "sufficient" and all required 120 credit points have been achieved and any conditions in accordance with § 5 of the present regulations have been fulfilled. ²If more modules than the ones required by the present regulations are taken in a core elective module, failed examinations do not affect the passing of the master's examination as long as the required credit points given in sentence 1 were earned.
- (2) ¹If the candidate has not fulfilled the requirements given in paragraph 1 by the end of his or her sixth semester in full-time study or twelfth semester in part-time study due to reasons under his or her control, then the candidate shall be considered as having failed the master's examination

on the first attempt. ²Examinations that were taken on time and for which the candidate received a passing grade need not be repeated.

- (3) ¹If the missing examinations or the master's thesis are not passed by the student within a year of the deadline given in para 2 sentence 1, or if all possibilities to repeat the examinations have been exhausted, then the candidate shall be considered as having failed the master's examination on the final attempt. ²The deadline shall not take into account periods of leave and periods during which the candidate withdrew from study. ³Notice shall be sent to inform the candidate that he or she has failed an examination at the final attempt in accordance with § 2 para 5 of the General Examination and Study Regulations in conjunction with Article 41 of the Bavarian Administrative Procedures Act (BayVwVfG) as amended. ⁴The board of examiners may grant the student an extension of the deadline for circumstances beyond his or her control if the student submits a request prior to the deadline described in sentence 1.

§ 13

Repeating examinations

- (1) Any examination that was failed on the first attempt may be repeated once.
- (2) ¹Voluntarily repeating examinations that were already passed or the master's thesis is not permitted. ²If the compulsory elective modules (A2, B2, C1, D1) are completed in addition to the required examinations (additional examinations), there is no obligation to repeat these examinations.
- (3) ¹Repeating an examination for a second time is only permitted for up to three examinations. ²Repeating a failed examination for a third time is only permissible after subject-specific advising. ³Students who fail the final repetition of an examination are to be considered as having failed the master's examination on the final attempt. ⁴The second or third repetition may be held as a different form of examination in accordance with § 9 of the General Examination and Study Regulations; this is determined by the examiner.
- (4) ¹If a selection of several different courses is available for a module (core elective module), both the course and the module to be taken with it must be specified to the Examinations Office when registering for an examination. ²Each examination attempt in the module examination for the course counts as one examination attempt for the specified module. ³On application to the Examinations Office, the course selected for the module may be changed either before the first or before the second repetition examination within the scope of the module's options; such a change may only take place once per module.
- (5) ¹The master's thesis can be repeated with a new topic if the student receives a failing grade for the thesis. ²Repeating the master's thesis for a second time is not permitted.

- (6) Administrative measures shall be taken to ensure that it is possible to repeat the failed examinations or a failed master's thesis within six months.

§ 14

Awarding the master's degree; degree certificate

- (1) ¹Upon the student's request, a diploma and a degree certificate for successful completion of the master's examination are to be issued within four weeks of demonstrating completion of the required module credits. ²The diploma is to include the title of the programme of study. ³It is to be signed by the Dean of the Faculty of Mathematics, Physics & Computer Science and stamped with the seal of the University. ⁴Upon issuance of the diploma, the graduate is given the right to bear the title "Master of Science". ⁵This title is to be abbreviated "M.Sc." and placed behind the surname.
- (2) ¹The degree certificate is to include the title of the programme of study, the final grade, the module examinations undertaken (including credit points and grades achieved), as well as the topic of the master's thesis and the grade received for the thesis. ²The certificate is to be signed by the chair of examiners. ³The date to be used is the day of the last module examination. ⁴An English translation of the diploma and a Diploma Supplement shall be issued in addition; the Diploma Supplement shall be signed by the chair of examiners. ⁵In addition to the certificate, an ECTS grading table is to be issued under the terms of § 11 para 4.
- (3) Revoking the degree "Master of Science" is to be carried out in accordance with the legal regulations (Article 101 BayHIG).

§ 15

Effective date

¹These regulations go into effect on 08 June 2019. ²They shall be valid for those students enrolling in this programme for the first time in Winter Semester 2019/2020 or later.

*) The set of amendments dated 9 January 2023 contains the following provisions with regard to the effective date:

These examination regulations shall take effect on 2 January 2023.

Annex 1: Module overview, credit points, examinations, overall grade

The following overview shows how many credit points are earned in each module, the form of assessment for the module, and the modules that are included in the overall grade.

Area / Modules	Credit points and semester hours	Type of examination	Assessment components relevant to the final grade
Area A "Numerical Mathematics"	6-22 credit points		
Module A1 "Numerical Methods for Partial Differential Equations" (§ 4 para 1 item a)	6 credits 6 semester hours	Written or oral exam	X
Core elective modules A2 "Advanced Topics in Numerical Mathematics" (§ 4 para 1 item a)	0-16 credit points	written or oral examinations	X
Module A2.1 "Numerical Methods for General Types of PDEs"	8 credits 6 semester hours		
Module A2.2 "Discontinuous Galerkin Finite Element Methods"	4 credits 3 semester hours		
Module A2.3 "Constructive Approximation Methods"	8 credits 6 semester hours		
Module A2.4 "Mathematical Control Theory"	8 credits 6 semester hours		
Module A2.5 "Nonlinear Optimization"	8 credits 6 semester hours		
Module A2.6 "Optimization of Differential Equations"	8 credits 6 semester hours		

Area / Modules	Credit points and semester hours	Type of examination	Assessment components relevant to the final grade
Area B "Modeling and Simulation"	32-40 credit points		
Module B1 "Applied Functional Analysis" (§ 4 para 1 item b)	8 credits 6 semester hours	Written or oral exam	X
Core elective modules B2 "Modeling and Simulation" (§ 4 para 1 item b)	8-16 credit points	written or oral examinations	X
Module B2.1 "Partial Differential Equations and Integral Equations"	8 credits 6 semester hours		
Module B2.2 "Modeling with Differential Equations"	4 credits 3 semester hours		
Module B2.3 "Mathematical Modeling for Climate and Environment"	8 credits 6 semester hours		
Module B2.4 "Pattern Recognition"	4 credits 2 semester hours	oral examination	
Module B2.5 "Mechanics of Continua"	8 credits 4 semester hours		
Module B2.6 "Molecular Dynamics Simulations of Biophysical Systems"	4 credits 4 semester hours		
Module B2.7 "Bioinformatics: Molecular Modeling"	4 credits 3 semester hours		
Module B2.8 "Foundations of Bioinformatics"	4 credits 5 semester hours		

Area / Modules	Credit points and semester hours	Type of examination	Assessment components relevant to the final grade
Module B2.9 "Higher Strengths of Materials"	4 credits 4 semester hours	Written examination	
Module B2.10 "Computer Aided Engineering"	4 credits 2x2 semester hours	Written examination	
Module B2.11 "Model Building and Simulation of Mechanical Systems"	6 credit points 3+2 semester hours	Written examination	
Module B2.12 "Model Building and Simulation of Electrochemical Storage"	6 credit points 3+2 semester hours	oral examination	
Module B2.13 "Foundations of Data Management"	4 credit points 2+1 semester hours		
Module B3 "Industrial Internship" or alternative components amounting to eight credit points from the core elective modules D1 (§ 4 para 1 item b)	8 credit points	Internship report	
Module B4 "Modeling and Status Seminar"	8 credit points	Presentation and elaboration	X

Area C "High-Performance Computing"	14 credit points		
Core elective module C1 "High-Performance Computing"	12 credit points	written or oral examinations	X
Module C1.1 "Algorithms and Data Structures II"	8 credits 6 semester hours		

Area / Modules	Credit points and semester hours	Type of examination	Assessment components relevant to the final grade
Module C1.2 "Algorithms and Data Structures III"	4 credits 3 semester hours		
Module C1.3 "Parallel and Distributed Systems I"	4 credits 3 semester hours	Written examination	
Module C1.4 "Parallel and Distributed Systems II"	4 credits 3 semester hours	Written examination	
Module C1.5 "High-Performance Computing"	8 credits 6 semester hours	Written examination	
Module C1.6 "Parallel Algorithms"	4 credits 3 semester hours		
Module C1.7 "Programming and Data Analysis in Python"	4 credits 3 semester hours		
Internship "Parallel Numerical Methods"	2 credit points	oral examination	X

Area D "Scientific Computing"	20-28 credit points		
Core elective modules "Complexity Reduction"	16-24 credit points	written or oral examinations	X
Module D1.1 "Efficient Treatment of Non-Local Operators"	8 credits 6 semester hours		
Module D1.2 "Fast Methods for Differential and Integral Equations"	8 credits 6 semester hours		

Area / Modules	Credit points and semester hours	Type of examination	Assessment components relevant to the final grade
Module D1.3 "Efficient Numerical Treatment of Multiscale Problems"	8 credits 6 semester hours		
Module D1.4 "Numerical Methods for Uncertainty Quantification"	4 credits 3 semester hours		
Module D1.5 "High-Dimensional Approximation"	4 credits 3 semester hours		
Module D1.6 "Data Analytics"	8 credits 2x3 semester hours		
Module D1.7 "Complexity Reduction in Control"	4 credits 3 semester hours		
Module D1.8 "Meshfree Methods"	4 credits 3 semester hours		
Module D1.9 "Boundary Element Methods"	4 credits 3 semester hours		
Module D1.10 "Optimization Methods in Machine Learning"	4 credits 3 semester hours		
Module "Special Skills in Scientific Computing"	4 credits 3 semester hours	Written or oral exam	X

Area / Modules	Credit points and semester hours	Type of examination	Assessment components relevant to the final grade
Area E "Soft Skills"	2 credit points	Certificates of attendance for seminars amounting to 60 hours (this corresponds to 3 - 4 seminars)	
Area F Master's Thesis	30 credit points	Master's thesis	X
TOTAL	120 credit points		

Annex 2: Aptitude assessment process

1. Purpose of aptitude assessment process

¹The aim of the aptitude assessment process is to open access to the elite degree programme *Scientific Computing* to qualified and particularly motivated students. ²The aptitude assessment process plays a special role in interdisciplinary, internationally oriented elite study programmes because it is aimed at applicants who come from different subject cultures, grade cultures and countries of origin. ³The supplementary selection process will assess the applicant's suitability.

2. Board responsible for the aptitude assessment process

The preparation and implementation of the aptitude assessment process is the responsibility of the board of examiners in accordance with § 2 of the General Examination and Study Regulations for Bachelor's and Master's Programmes in Mathematics at the University of Bayreuth (as amended).

3. Process for determining aptitude

3.1 ¹The aptitude assessment process is administered twice annually, in the summer and winter semesters. ²The application for admission to the aptitude assessment process must be submitted online to the University of Bayreuth. ³The online application for admission is made available on the university's website. ⁴The online application for admission must be received electronically by the University of Bayreuth by 15 May of the respective year for admission to the following winter semester or by 15 November of the previous year for admission to the following summer semester (cut-off deadlines). ⁵Documents according to no. 3.2.2 and 3.2.5, as well as other relevant documents for the examination of the relevant first degree can be submitted by 15 June for the winter semester or by 15 December for the summer semester.

3.2 The following are to be enclosed with the completed application as described in number 3.1 sentence 2:

3.2.1 A cover letter in English briefly explaining the reasons for the application.

3.2.2 ¹The certificate of the relevant initial degree as well as a confirmation with individual grades of the examinations and coursework completed during the programme of study. ²If the bachelor's certificate is not yet available, confirmation containing the individual grades for all examinations and courses up registration deadline must be

submitted. ³Such coursework must amount to at least 150 ECTS points and correspond to a final grade point average of 1,9 or better. ⁴The relevant initial degree certificate is to be submitted by the end of the second semester of study.

3.2.3 a list of modules from the applicant's initial degree programme for which evidence of completion cannot yet be submitted.

3.2.4 a CV as supplementary information.

3.2.5 If available, evidence of special qualifications (e.g. vocational training, awards, internships, scholarships, stays abroad).

3.2.6 If applicable, a request for compensation for disadvantages in accordance with § 10 of the General Examination and Study Regulations for Bachelor's and Master's Programmes in Mathematics at the University of Bayreuth (as amended).

4. Admission to the aptitude assessment process

4.1 Admission to the assessment process requires that the documents listed in number 3.2 be submitted on time.

4.2 The aptitude assessment process (number 5) is to be administered to those applicants who fulfil the requirements.

4.3 Applicants who are not admitted are to be sent a notice of denial with a rationale and information concerning legal remedies available; number 6.2 applies mutatis mutandis.

5. Overview of the aptitude assessment process

5.1 ¹On the basis of the application documents submitted, the board of examiners shall determine whether the applicant is suited for studies in the master's programme Scientific Computing in view of his or her qualification and the specific talents and abilities he or she described. ²The assessment is made by two committee members according to the following criteria:

5.1.1 ¹The additional qualifications resulting from the documents according to no. 3.2.2 and 3.2.5 are assessed with a maximum of 4.0 points. ²The assessment criteria are the extent to which the applicant's previous achievements demonstrate distinct skills and competencies in the field of Scientific Computing and the potential for interdisciplinary and international work. ³These qualifications can be demonstrated in accordance with letters a and b below:

- a) Proof of international competencies such as stays abroad, language courses, attendance of foreign language courses
- b) Proof of interdisciplinary skills such as the completion of interdisciplinary courses, internships, vocational training.

⁴The awarding of points for the individual assessments is described in more detail in the Annex to this aptitude assessment process.

5.1.2 ¹The subject-specific coursework and examinations from the bachelor's programme or an equivalent programme of study according to § 5 are to be graded on a scale of up to "4.0". ²Specific conversion factors may be applied for foreign applicants. ³The following shall be taken into account

- The assessment components in mathematics with applied mathematics and numerics (up to 2 points)
- Knowledge of computer science and programming (max. 1 point)
- Knowledge of an applied subject related to the fields of application represented in the degree programme (max. 1 point)

5.1.3 ¹The number of points for the assessment is calculated as the sum of the individual assessments (number 5.1.1 to 5.1.2). ²The number of points for the applicant is determined by taking the arithmetic mean of the individual assessments of the committee members. ³The score is to be rounded to one decimal place behind the comma.

5.2 Applicants who received 5.0 points or more shall be sent a notice of having passed the aptitude assessment process.

5.3 Applicants who have scored less than 3.0 points will receive a letter of denial under the terms of No. 6.2.

5.4 ¹The remaining applicants will be invited to an aptitude interview. ²The date and time of the interview are to be announced at least two weeks in advance. ³The applicant is to comply with the date and time of the interview. ⁴Anyone who fails to appear on the date and time announced will be denied admission. ⁵If a reason beyond the applicant's control prevents him or her from participating in the interview, a new appointment is to be scheduled no later than two weeks prior to the start of lectures upon justified request.

5.5 ¹The aptitude interview in English must be conducted individually for each applicant. ²The interview is to last between 15 and 30 minutes for each applicant and should demonstrate whether it is to be expected that the aim of the programme of study can be achieved given the applicant's skills and abilities. ³The interview should corroborate the impression that he or she is suited for the programme of study. ⁴In a short talk, the applicant presents his or her bachelor's thesis or a corresponding project. ⁵The applicant should demonstrate

his/her professional qualification and ability to communicate in an interdisciplinary manner in the talk and the subsequent discussion. ⁶With the applicant's consent, a student representative may be admitted as a listener. ⁷The interview is to be conducted by at least two members of the committee. ⁸Each member records the result of the interview on a scale of 0 to 4.0 points, with 0 being the worst score and 4.0 the best score. ⁹The talk and discussion should be taken into account in the assessment. ¹⁰The number of points for the applicant is determined by taking the arithmetic mean of the individual assessments of the committee members. ¹¹The score is to be rounded to one decimal place behind the comma.

5.6 ¹The overall assessment of the aptitude assessment process is made up of the score for the interview and the previous studies as described in number 5.1.2. ²Applicants who received 5.0 points or more in the second stage of the aptitude assessment process shall be sent a confirmation of having passed the aptitude assessment process. ³The remaining applicants have not passed the aptitude assessment process and will be sent a notice of denial with a rationale and information on their right to appeal; number 6.2 applies mutatis mutandis.

5.7 ¹A written record shall be made of the interview, indicating the date, duration, location, name of committee members involved, the name of the applicant, the assessment of the board members, and the overall outcome. ²The record must show the topics of the interview with the applicant and the rationale for the assessment. ³The reasons and topics may be listed in note form. ⁴The record sheet is to be signed by the committee members who were present.

6. Determining and announcing results

6.1 The course of the aptitude assessment process must be documented; in particular, the decisions of the board in accordance with the present regulations and the overall outcome must be evident.

6.2 ¹The outcome of the aptitude assessment process is to be sent to the applicant in writing. ²A notice of denial must be accompanied by a rationale and information on the applicant's right to appeal. ³As part of its supervisory duties in accordance with Article 30 para 3 sentence 1 BayHIG, the chair of the selection committee, on behalf of the University Governing Board, shall check a random sample of 10 % of denials of admission.

6.3 Admission based on the aptitude assessment process for the master's programme Scientific Computing shall remain valid for future applications to this programme of study as long as the content and goals of the programme do not change so significantly that aptitude for this programme can no longer be demonstrated by having undergone the aptitude assessment process at an earlier date.

7. Repeating the process

Applicants who did not provide evidence of aptitude for the master's programme Scientific Computing may register for the aptitude assessment process one more time.

8. Aptitude assessment process for higher semesters

For applicants who wish to enter advanced semesters (university transfer, career changers), nos. 3 to 7 apply accordingly.

Annex to the aptitude assessment process:

The following assessment shall be authoritative for the award of points for suitability on the basis of the documents referred to in point 5.1.1:

POINTS	ASSESSMENT
4.0 – 3.0 points	very well-suited for the programme of study
2.9 – 2.0 points	above-average suitability for the programme of study
1.9 – 1.0 points	average suitability for the programme of study
0.9 – 0.0 points	below-average suitability for the programme of study