Some information about the structure, organisation, and content of the international Master's program "Advanced and Computational Mathematics" at Chemnitz University of Technology

During the four-semester program, 120 Credit Points (CP) have to be acquired. These CP are awarded for passed exams, passed seminars, and upon successful completion of the Master's thesis. The degree of Master of Science (MSc) is awarded upon successful completion of the program.

While there are some compulsory courses which have to be taken, students can select most of the courses according to their personal interest - in accordance with the study regulations of the program. A translation of the relevant part of the study regulation document is included below, starting on the second page.

During the first semester students have to attend one basic course from each of the three possible fields of specialization "Advanced Pure Mathematics", "Computational Mathematics", and "Data Science" (so-called Orientation Modules APM, CM, and DS in the terminology of the study regulation below). While students may select each of the courses from the respective list according to their personal interests, it should be noted that not each of the listed courses will be held in every term. In addition to the three basic courses, students also have to attend the so-called "Leveling-up course" which is an online, self-studying course. As an online-course, the "Leveling-up course" may, and should, be started as soon as possible once students obtain the online access.

Starting from the second semester, students select one of the following fields of specialisation: "Advanced Pure Mathematics", "Computational Mathematics" or "Data Science". In their chosen specialisations, students earn at least 38 CP by selecting courses from the respective list of so-called Basic Modules. In preparation for the Master's thesis, students will participate in a seminar (8 CP) during the second or (preferably) third semester. Finally, during the fourth semester, students write their Master's thesis (30 CP) on a subject from their field of specialisation. In addition to courses in mathematics, students may earn up to 15 CP in language courses (5 CP per course), in particular, German language courses[1]. For a detailed list of selectable courses see below.

Please note that it is usually not required to register for any mathematics course unless it is explicitly stated otherwise. In addition, these courses may be attended even if the enrollment process is not yet completed. On the other hand, participation in a language course requires a registration for the course and is only possible for completely enrolled students. For details about how to register, please consult the webpage of the Foreign Language Centre (note "clickability").

During the program, exams are usually taken at the end of each semester. While exams in mathematics courses are mostly oral exams, exams to language courses are written ones. In order to take an exam, students have to register for each exam during the exam registration period (which is announced on the webpage of the Central Examination Office (clickable) under "registration of examinations" and which usually takes place during December for the winter term, respectively June for the summer term) via the SB-Service.

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[1]Upon completion of the program, students are required to have German knowledge of level A2 which, depending on each student's personal background, requires students to take no, one or two in German courses during the whole course of the program.

The following is an unofficial translation of the study regulations, pages 3 to 6. For the complete document, please visit the following (clickable) webpage where you also find the exam regulations (German: Prüfungsordnung) (for legal reasons both are only available in German): https://www.tu-chemnitz.de/zpa/sopo/88/C4B.php. In the study regulations (German: Studienordnung), the notion of "module" is a collective term for a course, a seminar, and - depending on the particular module - the Master's thesis.

Study regulations of the Master's program
Advanced and Computational Mathematics
at Chemnitz University of Technology

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Part 1
General Clauses

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Part 2
Structure and Content of the program

§ 6 Structure of the program

(1) In the program, a total of 120 Credit Points (CP) are awarded, made up as follows:

1. Orientation Modules (37 CP):
220000-338 Leveling-up module, 5 CP (compulsory module)

From the following list of so-called Orientation Modules for the categories "Advanced Pure Mathematics" (APM), "Computational Mathematics" (CM), and "Data Science" (DS), precisely one module of 8 CP has to be chosen from each of the categories Orientation Modules APM, Orientation Modules CM, and Orientation Modules DS:

Orientation Modules APM:
220000-302 Algebraic Geometry, 8 CP (compulsory elective module)
220000-303 Algebraic Topology, 8 CP (compulsory elective module)
220000-304 Differential Geometry, 8 CP (compulsory elective module)
220000-305 Geometric Analysis, 8 CP (compulsory elective module)
220000-306 Fourier Analysis, 8 CP (compulsory elective modules)
220000-307 Stochastic Analysis, 8 CP (compulsory elective module)
220000-308 Stochastic Processes, 8 CP (compulsory elective module)
220000-309 Functional Analysis II, 8 CP (compulsory elective module)
220000-322 Graph Theory, 8 CP (compulsory elective module)

Orientation Modules CM:
220000-310 Numerical Methods for Ordinary Differential Equations, 8 CP (compulsory elective module)
220000-311 Numerical Methods for Partial Differential Equations, 8 CP (compulsory elective module)
220000-312 Numerical Linear Algebra, 8 CP (compulsory elective module)

220000-313 Numerical Optimization, 8 CP (compulsory elective module)
220000-314 Inverse Problems, 8 CP (compulsory elective module)

Orientation Modules DS:
220000-315 Introduction to Data Science, 8 CP (compulsory elective module)
220000-316 Mathematical Foundations of Learning Theory, 8 CP (compulsory elective module)
220000-317 Mathematical Methods of Uncertainty Quantification, 8 CP (compulsory elective module)
220000-318 Matrix Methods in Data Science, 8 CP (compulsory elective module)

From the possible fields of study "Advanced Pure Mathematics" (APM), "Computational Mathematics" (CM), and "Data Science" (DS), one field has to be selected.

In case of selecting "Advanced Pure Mathematics" (APM) as the field of study, the following module has to be taken:
220000-301 Graduate Seminar, 8 CP (compulsory module)

In case of selecting "Computational Mathematics" (CM) or "Data Science" (DS) as the field of study, one of the following modules has to be taken:
220000-301 Graduate Seminar, 8 CP (compulsory elective module)
220000-334 Modelling Seminar, 8 CP (compulsory elective module)

According to the selected field of study, from the lists below named "2. Basic Modules" and "3. Supplementary Modules", a total amount of 53 CP have to be selected. Modules which have been selected as "Orientation Modules" cannot be selected again.

2. Basic Modules (at least 38 CP, at most 53 CP)

Basic Modules APM
In case of selecting "Advanced Pure Mathematics" (APM) as the field of study, from the following list Basic Modules in APM totaling at least 38 CP have to be selected:
220000-302 Algebraic Geometry, 8 CP (compulsory elective module)
220000-303 Algebraic Topology, 8 CP (compulsory elective module)
220000-304 Differential Geometry, 8 CP (compulsory elective module)
220000-305 Geometric Analysis, 8 CP (compulsory elective module)
220000-306 Fourier Analysis, 8 CP (compulsory elective modules)
220000-307 Stochastic Analysis, 8 CP (compulsory elective module)
220000-308 Stochastic Processes, 8 CP (compulsory elective module)
220000-309 Functional Analysis II, 8 CP (compulsory elective module)
220000-316 Mathematical Foundations of Learning Theory, 8 CP (compulsory elective module)
220000-319 Hilbert Space Methods, 8 CP (compulsory elective module)
220000-320 Harmonic Analysis, 8 CP (compulsory elective module)
220000-321 Dirichlet Forms, markov Processes and Semigroups, 8 CP (compulsory elective module)
220000-322 Graph Theory, 8 CP (compulsory elective module)
220000-323 Complex Geometry, 8 CP (compulsory elective module)
220000-324 Fractals, 8 CP (compulsory elective module)
220000-325 Time Series Analysis, 6 CP (compulsory elective module)
220000-335 Research Module Advanced Pure Mathematics, 6 CP (compulsory elective module)

Basic Modules CM

In case of selecting "Computational Mathematics" (CM) as the field of study, from the following list Basic Modules in CM totaling at least 38 CP have to be selected:

220000-305 Geometric Analysis, 8 CP (compulsory elective module)

220000-306 Fourier Analysis, 8 CP (compulsory elective module)

220000-307 Stochastic Analysis, 8 CP (compulsory elective module)

220000-308 Stochastic Processes, 8 CP (compulsory elective module)

220000-310 Numerical Methods for Ordinary Differential Equations, 8 CP (compulsory elective module)

220000-311 Numerical Methods for Partial Differential Equations, 8 CP (compulsory elective module)

220000-312 Numerical Linear Algebra, 8 CP (compulsory elective module)

220000-313 Numerical Optimization, 8 CP (compulsory elective module)

220000-314 Inverse Problems, 8 CP (compulsory elective module)

220000-316 Mathematical Foundations of Learning Theory, 8 CP (compulsory elective module)

220000-317 Mathematical Methods of Uncertainty Quantification, 8 CP (compulsory elective module)

220000-318 Matrix Methods in Data Science, 8 CP (compulsory elective module)

220000-319 Hilbert Space Methods, 8 CP (compulsory elective module)

220000-320 Harmonic Analysis, 8 CP (compulsory elective module)

220000-322 Graph Theory, 8 CP (compulsory elective module)

220000-325 Time Series Analysis, 6 CP (compulsory elective module)

220000-326 Discrete Optimization, 8 CP (compulsory elective module)

220000-327 Variational Methods, 8 CP (compulsory elective module)

220000-328 Introduction to the Theory of Wavelets, 8 CP (compulsory elective module)

220000-329 Optimization in Machine Learning, 8 CP (compulsory elective module)

220000-330 Foundations of Actuarial Mathematics and Financial Mathematics, 6 CP (compulsory elective module)

220000-331 Game Theory, 8 CP (compulsory elective module)

220000-336 Research Module Computational Mathematics, 6 CP (compulsory elective module)

Basic Modules DS

In case of selecting "Data Science" (DS) as the field of study, from the following list Basic Modules in DS totaling at least 38 CP have to be selected:

220000-306 Fourier Analysis, 8 CP (compulsory elective module)

220000-307 Stochastic Analysis, 8 CP (compulsory elective module)

220000-308 Stochastic Processes, 8 CP (compulsory elective module)

220000-310 Numerical Methods for Ordinary Differential Equations, 8 CP (compulsory elective module)

220000-311 Numerical Methods for Partial Differential Equations, 8 CP (compulsory elective module)

220000-312 Numerical Linear Algebra, 8 CP (compulsory elective module)

220000-313 Numerical Optimization, 8 CP (compulsory elective module)

220000-314 Inverse Problems, 8 CP (compulsory elective module)

220000-316 Mathematical Foundations of Learning Theory, 8 CP (compulsory elective module)

220000-317 Mathematical Methods of Uncertainty Quantification, 8 CP (compulsory elective module)

220000-318 Matrix Methods in Data Science, 8 CP (compulsory elective module)

220000-319 Hilbert Space Methods, 8 CP (compulsory elective module)
220000-321 Dirichlet Forms, markov Processes and Semigroups, 8 CP (compulsory elective module)
220000-322 Graph Theory, 8 CP (compulsory elective module)
220000-325 Time Series Analysis, 6 CP (compulsory elective module)
220000-326 Discrete Optimization, 8 CP (compulsory elective module)
220000-327 Variational Methods, 8 CP (compulsory elective module)
220000-328 Introduction to the Theory of Wavelets, 8 CP (compulsory elective module)
220000-329 Optimization in Machine Learning, 8 CP (compulsory elective module)
220000-330 Foundations of Actuarial Mathematics and Financial Mathematics, 6 CP (compulsory elective module)
220000-331 Game Theory, 8 CP (compulsory elective module)
220000-332 Statistics in Data Science, 6 CP (compulsory elective module)
220000-333 Mathematical Foundations of Big Data Analytics, 6 CP (compulsory elective module)
220000-337 Research Module Data Science, 6 CP (compulsory elective module)

3. Supplementary Modules (at most 15 CP):
Students who are not German native speaker and who not hold an A1 certificate in German have to take the following Supplementary Module:
136004-005 German as a Foreign Language I (Level A1), 5 CP (compulsory module/compulsory elective module)

Students who are not German native speaker and who not hold an A2 certificate in German have to take the following Supplementary Module:
136004-006 German as a Foreign Language II (Level A2), 5 CP (compulsory module/compulsory elective module)

Students may select Supplementary Modules from the following list totalling up to 15 CP. The total amount of CP awarded in Supplementary Modules may not exceed 15:
136001-004 English III (Level C1), 5 CP (compulsory elective module)
136001-006 English V (Level C1), 5 CP (compulsory elective module)
136001-007 English VI (Level C1), 5 CP (compulsory elective module)
136002-001 Arabic I (Level A1/1), 5 CP (compulsory elective module)
136002-002 Arabic II (Level A1/2), 5 CP (compulsory elective module)
136003-001 Chinese I (Level A1/1), 5 CP (compulsory elective module)
136003-002 Chinese II (Level A1/2), 5 CP (compulsory elective module)
136003-003 Chinese III (Level A2/1), 5 CP (compulsory elective module)
136003-004 Chinese IV (Level A2/2), 5 CP (compulsory elective module)
136005-001 French I (Level A1), 5 CP (compulsory elective module)
136005-002 French II (Level A2), 5 CP (compulsory elective module)
136005-003 French III (Level A2/B1), 5 CP (compulsory elective module)
136005-004 French IV (Level B1), 5 CP (compulsory elective module)
136005-005 French V (Level B1/B2), 5 CP (compulsory elective module)
136005-006 French VI (Level B2), 5 CP (compulsory elective module)
136006-001 Italian I (Level A1), 5 CP (compulsory elective module)
136006-002 Italian II (Level A2), 5 CP (compulsory elective module)
136006-003 Italian III (Level A2/B1), 5 CP (compulsory elective module)
136006-004 Italian IV (Level B1), 5 CP (compulsory elective module)

136006-005 Italian V (Level B1/B2), 5 CP (compulsory elective module)
136006-006 Italian VI (Level B2), 5 CP (compulsory elective module)
136007-001 Polish I (Level A1), 5 CP (compulsory elective module)
136007-002 Polish II (Level A2), 5 CP (compulsory elective module)
136007-003 Polish III (Level A2/B1), 5 CP (compulsory elective module)
136007-004 Polish IV (Level B1), 5 CP (compulsory elective module)
136008-001 Russian I (Level A1), 5 CP (compulsory elective module)
136008-002 Russian II (Level A2), 5 CP (compulsory elective module)
136008-003 Russian III (Level A2/B1), 5 CP (compulsory elective module)
136008-004 Russian IV (Level B1), 5 CP (compulsory elective module)
136008-005 Russian V (Level B1/B2), 5 CP (compulsory elective module)
136008-006 Russian VI (Level B2), 5 CP (compulsory elective module)
136009-001 Spanish I (Level A1), 5 CP (compulsory elective module)
136009-002 Spanish II (Level A2), 5 CP (compulsory elective module)
136009-003 Spanish III (Level A2/B1), 5 CP (compulsory elective module)
136009-004 Spanish IV (Level B1), 5 CP (compulsory elective module)
136010-001 Czech I (Level A1), 5 CP (compulsory elective module)
136010-002 Czech II (Level A2), 5 CP (compulsory elective module)
136010-003 Czech III (Level A2/B1), 5 CP (compulsory elective module)
136010-004 Czech IV (Level B1), 5 CP (compulsory elective module)

4. Module Master's Thesis:
220000-300 Master's Thesis, 30 CP (compulsory module)

(2) The recommended course of studies in the Master's program Advanced and Computational Mathematics at Chemnitz University of Technology during its regular 4 semester duration of studies arises from the plan of studies[2] on the one hand and the modular character of the program on the other hand.

§ 7 Content of the program

(1) Students deepen their knowledge in the selected field of study "Advanced Pure Mathematics", "Computational Mathematics", or "Data Science" in several mathematical topics, among others in Mathematical Analysis, Algebra, Geometry, Discrete Mathematics, Numerical Mathematics, Optimization, Stochstics, Data Science, Financial Mathematics, and Economic Mathematics. Mathematical expertise is conveyed in courses covering the most important areas of mathematics as well as the core competency of the Faculty of Mathematics. The courses available to choose from ensure a sufficient width of training. In addition, a graduate seminar or a modelling seminar has to be attended which is intended to teach independent and autonomous study of the existing literature as well as to prepare to write the Master's thesis. The entire fourth semester is reserved for the preparation of the Master's thesis. The topic of the Master's thesis is chosen in consultation with a professor or qualified lecturer who teaches the chosen field and who then also supervises the student. With the Master's thesis the student shall give proof that he/she is able to independently work on a problem in the corresponding field of mathematics using scientific methods within a given period of time. Students without previous knowledge of German gain basic German language skills by attending one or two compulsory language modules and are thereby qualified for the German-speaking job market.

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[2]see the official study regulation document starting on p. 8

(2) Contents, goals, forms of teaching, credit points, examinations as well as the frequency of teaching and the duration of the individual modules are specified in the description of modules[3].

Part 3
Conduct of Studies

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Part 4
Final Clauses

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[3]see the official study regulation document starting on p. 23