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23 September 1999

Studies Regulations of the Integrated International Master and PhD Program in Mathematics at the Chemnitz University of Technology

Studies Regulations of the Integrated International Master and PhD Program in Mathematics at the Chemnitz University of Technology from September 23-rd 1999¹

According to §21 par. 1 of the Law on higher education in the Free State of Saxony (Saxon Law on higher education - Sächsische Hochschulgesetz (SächsHG)) from June 11-th, 1999 (SächsGVBl. 11/1999, pp. 293), the Senate of the Chemnitz University of Technology enacts the following Studies Regulations:

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Within these Regulations masculine person designations are used for both genders.

I. General Clauses

§1

Area of validity

The present Studies Regulations describe with respect to the presently valid Master Examination Regulations (PO) and PhD Studies Regulations of the Faculty of Mathematics the goals, content and structure of the Integrated International Master and PhD Program in Mathematics at the Chemnitz University of Technology. Among other things, the Studies Regulations contains recommendations concerning the execution of the studies in the standard period of studies.

§2

Objectives of the Program

(1) The Master and PhD studies in Mathematics shall prepare as professional and research qualifying studies the local and foreign students for a future professional occupation as mathematicians in the scientific and applied oriented working areas, being meant in particular to train young scientists. To this pertains the formation of the scientific thinking and of responsible acting. The students should upgrade abilities such as skill of abstract thinking, exact working techniques, ingenuity, independent working, communication and cooperation capacities, as well as active and passive criticism abilities.

¹This translation is not official, one should consider it just only as orientative, the only official version being the German one available at <http://www.tu-chemnitz.de/mathematik/ordnungen/ab110intmath.pdf>

(2) Because the mathematicians must be adaptable to new vocational components, the education is laid out such that the abilities acquired by the students to be trained later within multiple tasks in different activities. In the foreground of the studies stands the comprehending familiarization with the basic mathematical approaches and methods. The students should get to know the most important branches of the pure and applied mathematics in a deepened form.

(3) Learning a minor subject is scheduled in the Master Course of Studies in Mathematics (the first stage of the integrated program) in order to offer the students the possibility to acquire the basics of a possible application field at their choice. The minor subject can be chosen from the offers of the faculties of natural sciences, mechanical engineering, electrical and information engineering, computer science and economics. As a general rule, as minor subject should be chosen the one for which basic knowledge was scientifically proven at admission.

(4) The vocational training during the study of mathematics includes

- * the appropriation of the basic mathematical knowledge
- * the learning of mathematical methods
- * the handling of internal-mathematical problems
- * the mathematical modelling of practical problems and
- * the numerical solutions of concrete problems using computers.

(5) After passing the Master final examination, according to §§2 and 22 of the Examination Regulations the academic degree of “Master of Science” (M.Sc.) will be conferred.

(6) According to the PhD Studies Regulations of the Faculty, the academic degree of “Doctor rerum naturalium (Dr.rer.nat)” will be conferred after successfully concluding the Doctoral studies.

(7) The studies offer the foreign students the opportunity to acquire linguistic knowledge of German. The knowledge of English can be deepened.

§3

Admission requirements

(1) For the first phase of the Integrated International Master and PhD program can be admitted someone who

1. has acquired one of the following certificates

a) Bachelor’s Degree or equivalent with Mathematics as the Major Subject from an accredited German or foreign university,

b) professional school conclusion in Mathematics in a German university of applied sciences (Fachhochschule) or amalgamated university (Gesamthochschule)

and in the final examination has obtained a higher-than-average grade and

2. proves to have the necessary knowledge of English in order to participate successfully at the lectures and to study the mathematical literature.

(2) A prerequisite for the admission in the second phase of the integrated program is the graduation with a higher-than-average grade of the first stage (Master). An alternative premise is a higher-than-average grade obtained at the diploma examination within a mathematical course of studies.

§4

Admission procedures

(1) The board of the Faculty of Mathematics appoints an admission commission for the Integrated International Master and PhD Program in Mathematics.

(2) The applicants must address a written admission application for the Master and PhD Studies to the admission commission.

(3) The following must be attached to the application

1. a Curriculum Vitae
2. certificates and evidences as well as
3. two recommendation letters that should present information concerning the aspects named in §3 par. 1 as well as regarding the scientific qualification of the candidate.

For the foreign achieved degrees a note scale in order to equate them to the German grades and degrees is required. Furthermore, certificates and other documents presenting the accomplished subject areas (see §6) and the performances must be submitted.

(4) After consulting also other university lecturers, the admission commission decides upon the

admittance in the Integrated International Master and PhD Program in Mathematics.

(5) The admission commission decides also regarding the promotion from the Master studies (1st phase) into the PhD studies (2nd phase).

(6) The decision will be communicated to the applicant in written form. In case of negative decision the communication is provided with a legal remedy.

§5

Beginning and standard period of the studies

(1) The standard period for the Master studies (first phase of the integrated program) including the final examination amounts four semesters.

(2) The standard period for the integrated Master and PhD program amounts ten semesters.

(3) The curriculum is conceived for the beginning of the studies in the winter semester. An inception in the summer semester leads therefore to an extension of the period of study.

II. Study Contents and Structure of the Studies

§6

Supposed basic knowledge

The following basic knowledge is required for a successful completion of the studies:

1. Mathematical basic knowledge regarding Analysis and Linear Algebra,
 - a) Analysis:
differential and integral calculus for functions with one and several variables, functions with complex variables theory, ordinary differential equations theory,
 - b) Linear Algebra:
theory of the linear and affine spaces, theory of the euclidian and unitary spaces, normal forms,
2. Basic knowledge in Numerical Mathematics, Optimization and Stochastics,
3. Basic knowledge in at least two of the following domains
 - * Theory of Partial Differential Equations,
 - * Functional Analysis,

* Numerics of Ordinary Differential Equations,

* Differential Geometry,

* Measure Theory,

* Complex Analysis,

4. Basic knowledge in informatics, in particular in programming,

5. Basic knowledge in some non-mathematical minor subject.

§7

Structure of the studies

(1) The studies are structured into two phases. The first phase ends with the Master final examination, the second with the Doctorate.

(2) In the first phase (Master studies) 58 SWS (1 SWS means one hour (i.e. 45 minutes) per week during one semester) are obligatory in the basic and specialization of the mathematical instruction areas, as well as at least 12 SWS in the minor subject.

(3) In the second phase (PhD studies) 28 SWS in the basic and specialization of the mathematical instruction areas have to be attested.

§8

Master studies

(1) The Master studies have as aim the deepening of the knowledge in abstract and applied Mathematics and the development of the ability of independent scientific work. While during the first two semesters the main emphasis is the deepening of the mathematical basic knowledge, from the third semester a specialization in one of the directions Algebra, Analysis, Geometry, Numerical Mathematics, Optimization and Stochastics will take place alongside the deepening of the mathematical basic knowledge and also the Master thesis will be written.

(2) At least four out of the six specializations will be offered per year. Each student will be advised by the graduate advisor (Studienfachberater) (see §11) for orientation in the selection and planning of the studies.

(3) The offered lectures are structured into lectures that conduct to the deepening of the basic knowledge and lectures serving to the specialization looking forward to the Master and PhD theses.

(4) The basic lectures will be offered, among others, in the areas of Functional Analysis, Algebra, Geometry, Graph Theory, Differential Geometry, Partial Differential Equations Theory, Numerics of Partial Differential Equations, Numerics of Ordinary Differential Equations, Numerical Linear Algebra, Stochastics, Theory of Approximation and Control Theory.

(5) Specializations will be offered in the following fields, among others:

- Algebra:
 - Representation Theory of Algebras,
 - Representation Theory of Groups,
 - Homological Algebras,
 - Theory of Invariants,
 - Combinatorial Methods of the Linear Algebra,
 - Algebraical Geometry,
 - Algebraical Groups,
 - Computer Algebra,
 - Logic and Set Theory,
 - Discrete Mathematics,
 - Graph Theory.
- Analysis:
 - Banach Algebras,
 - Inverse Problems,
 - Mathematical Elasticity Theory,
 - Analysis of Pseudo Differential Equations,
 - Operator Theory and Integral Equations,
 - Optimal Control,
 - Partial Differential Equations,
 - Boundary Integral Methods,
 - Systems Theory.
- Geometry:
 - Projective Geometry,
 - Basics of Geometry,
 - Differential Geometry,
 - Non-Euclidean Geometry,
 - Geometric Convexity,
 - Combinatorial Geometry,
 - Selected Problems from the Classical Geometry,
 - Algebraic Topology.
- Numerical Mathematics:
 - Discretization Methods for Ordinary and Partial Differential Equations,
 - Numerical Methods of Linear Algebra,
 - Numerical Methods for Algebraic Differential Equations,
 - Numerical Methods for Nonlinear Equations and Minimization Problems,

Numerical Methods for Boundary Integral and Integral Equations,
 Numerical Methods for Inverse Problems,
 Numerical Methods for Control Theory,
 Approximation Methods,
 Parallel Scientific Computing.

- Optimization:
 - Analysis and Numerics of Differentiable and Non-Differentiable Optimization Problems,
 - Discrete Optimization,
 - Graph Theory and Network Optimization,
 - Linear Optimization,
 - Models of Operations Research,
 - Game Theory,
 - Multicriterial Optimization,
 - Convex Analysis.
- Stochastics:
 - Mathematical Statistics,
 - Random Functions,
 - Statistical Modelling and Experimental Design,
 - Stochastic Analysis,
 - Actuarial Theory,
 - Stochastic Differential Equations,
 - Explorative Data Analysis,
 - Weak Correlated Random Functions,
 - Stochastic Simulation.

Lecture modules and sample-study-flat are components of the study leader of a university. This contains also other information concerning the achievement point system ECTS. The proof of the knowledge in the specialization areas takes place in the subject examination III for the subject chosen for the Master thesis. Furthermore, there are required the certificates of attending three seminars to the extent of each to acquire 2 SWS, from which two must be in the area chosen for the specialization for the Master thesis.

(6) Alongside the mathematical education the Master studies include also the basic training in a non-mathematical minor subject from the offers of the faculties of natural sciences, mechanical engineering, electrical and information engineering, computer and economic sciences to the extent of at least 12 SWS. The proof of the successful attendance of these lectures takes place in the subject examination IV.

(7) The Master thesis, based on a specialization subject, which will be finished in the fourth semester, shall prove that the students are in the situation to work independently on a problem in some area of Mathematics following some

scientific methods in a given period of time.

(8) The Master thesis can be proposed and supervised by any Professor or qualified lecturer of the Faculty of Mathematics of Chemnitz University of Technology involved in teaching or research.

§9 PhD studies

(1) The PhD studies deepen the knowledge and ability, in particular the capability of independent scientific work, with the aim of a qualified and determined training of the young scientists. Besides the deepening of the specialization there is the possibility to work within the actual research areas and to discuss open research problems.

(2) Lectures and seminars are offered for this purpose. The proof of the acquired knowledge takes place within the framework of the Rigorosum (cf. §13 of the PhD Studies Regulations (Promotionsordnung)).

(3) The PhD thesis will be prepared during the PhD studies and it proves that the students are, through independent scientific work, in the situation to obtain results that represent a development of the scientific branch, of its theory and methods (cf. §9 of the the Graduate Studies Regulations (Promotionsordnung)).

(4) The dissertation (PhD thesis) can be proposed, supervised and reviewed by any Professor or qualified member of the Faculty of Mathematics of Chemnitz University of Technology involved in teaching and research.

§10 Course of the studies

The Integrated International Master and PhD Program in Mathematics distinguishes itself by a high flexibility; therefore the attached timetable serves only as orientation of the course of studies, in order to conclude the studies in the standard period.

III. Carrying out the Studies §11 Study counselling

At the Faculty of Mathematics there is to be named a graduate advisor (Studienfachberater) for the Integrated International Master and PhD Program in Mathematics; moreover all the members of the staff of the Faculty of Mathematics

stand as contact persons and advisors concerning their field of specialization at the students' disposal for questions regarding the configuration of the studies. The students should consider asking for some qualified advice in the following cases, for instance:

- * in the beginning of the studies,
- * after failed examinations,
- * before choosing the minor subject and
- * before the choice of a specialization.

§12 Study performance proofs

Certificates with grades as proof of the successful participation at the lectures will be given after each course due to oral or written examinations according to §10 par. 2 of the examination rules for the Master program in Mathematics. The form of the examinations will be announced in the beginning of the lectures.

IV. Final Clauses §13 Coming into force

(1) These Studies Regulations apply for the students matriculated since the winter semester 1999/2000

(2) The display of theses Studies Regulations is acknowledged by the Saxon State Ministry of Science and Culture through Decision AZ: 2-7841-11/84-2 from July 16-th, 1999. It becomes valid at the day after its publication in the official proclamations of Chemnitz University of Technology.

Chemnitz, September 23-rd, 1999

The Rector of Chemnitz University of Technology

Prof. Dr. C. von Borczyskowski

**Attachment
to §10**

**Recommended schedule for the international Master Program in Mathematics
(first phase)**

Semester	Basics	Specialization	Seminar	Minor subject
1	$2 \times (4/2)$	-	2S	$(4/2)$
2	$(4/2)$	$(4/2)$	2S	$(4/2)$
3	$(4/2)$	$2 \times (4/2)$	2S	-
4	-	$(4/2)$	4S	-

The specification $(4/2)$ denotes 4 SWS of lectures and 2 SWS of assisted training. In the first two semesters of high priority will be the attendance of lectures meant to improve the basic knowledge in different areas of Mathematics. These basic lectures can constitute also an entrance towards the specialization. From the second semester will take place the specialization having as goal the Master thesis. The seminars are one of the modules of the specialization. The seminars from the first two semesters should, besides improving the basic knowledge, train the exercise of scientific presentation. The fourth semester serves for finishing the Master thesis. The seminars should accompany this purpose.

Recommended schedule for the PhD Program in Mathematics (second phase)

Semester	Specialization	Lectures presenting actual research directions	Seminar
5	2V	6V or S	2S
6	2V	6V or S	2S
7			2S
8			2S
9			2S
10			2S

In the fifth and sixth semester of the studies should be visited, besides lectures within the area of specialization that serve to the deepening of the knowledge and to the preparation of the PhD thesis, other lectures and seminars dealing either with actual research areas of the Mathematics, or with discussions regarding open research problems. The dissertation (PhD thesis) will be prepared between the seventh and the tenth semester.