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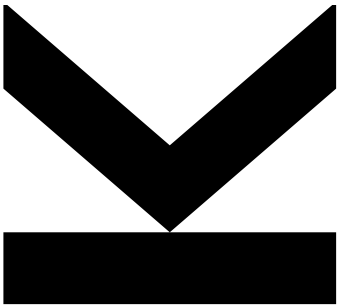
CURRICULUM FOR THE MASTER'S PROGRAM IN **COMPUTATIONAL MATHEMATICS.**



JOHANNES KEPLER
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§ 1 Qualification Profile

The bachelor's program Technical Mathematics and the master's programs Industrial Mathematics and Computational Mathematics at the Johannes Kepler University (JKU) share the common general goal of preparing their students for the following activities:

- The design and analysis of mathematical models for processes appearing in technology, economy, and natural sciences.
- The application of known and the development of new problem solving methods for such models according to the current state of the mathematical sciences.
- The application and use of computational methods, typically by implementing algorithms on computers according to the current state of software sciences.

All graduates of our programs are therefore prepared to contribute to a variety of different areas, including, but not limited to:

- Research and development institutions in industry, economy, or the public sector.
- Companies offering financial services, such as banks or insurance companies.
- Companies in the areas of software development and information technology.
- Universities, or other institutions of higher education, or other scientific institutions.

The master's program Computational Mathematics offers a comprehensive training in modern mathematics, with a special focus on areas of mathematics that are related to computation. In this curriculum, Computational Mathematics is understood in a broad sense, covering both symbolic and numeric computation and going far beyond the mere ability to use existing mathematical software. Students of this program will get acquainted with all steps of the development process that underlies such software systems: the translation of real-world situations into a suitable mathematical formalism (modeling), the exploration of the relevant theoretical background, the design and analysis of algorithms, the implementation of algorithms into software, the testing and evaluation of implementations, and the application of mathematical software to problems arising in other areas of mathematics or computer science, in natural sciences, in engineering, or in social or economic contexts.

Students focus on three core subjects of computational mathematics, where they will acquire highly specialized knowledge touching the edge of current research. They will develop a critical awareness of the opportunities and limitations of relevant theory and its applications, which will serve them as a basis for independently finding innovative solutions and integrating new external expertise and techniques from other areas. They will be prepared to take responsible leading positions, in particular, when complex and unpredictable contexts require new and individualized solution approaches.

With the education received on all these matters, graduates of the master's program Computational Mathematics are excellently prepared for a broad variety of jobs in the public sector or in the private sector.

§ 2 Admissions

(1) In accordance with § 54 para. 1 UG the Master's program belongs to the category of engineering degrees and is taught in English.

(2) The Master's program Computational Mathematics is based on the Bachelor's program in Technical Mathematics (033 201) at JKU. Graduates of this Bachelor's program are admitted to the Master's program without any restrictions.

(3) Admission is also granted for graduates of programs in Mathematics, Technical Mathematics, Mathematics Education, Computer Science, Engineering, Natural Sciences or related programs (e.g., the Bachelor's programs Artificial Intelligence (033 536), Mechatronics (033 281), or Technical Physics (033 261) at JKU) of at least the same level of higher education at recognized national or international post-secondary educational institutions, provided that at least 60 ECTS of the program correspond to courses which appear as mandatory or elective courses in the Bachelor's program Technical Mathematics at JKU.

(4) Graduates of programs that do not meet the requirements in accordance to para. 3 can be granted admission on condition to complete supplementary examinations with up to 40 ECTS points to be taken by the end of the second semester of their master's studies.

§ 3 Structure and Outline

(1) The Master's program in Computational Mathematics covers 4 semesters and consists of 120 ECTS points, which are distributed among the following subjects:

Subject	**ECTS**
Core Subjects	36
Elective Subjects	31.5
Master's Thesis (incl. Master's Thesis Seminars)	36
Master's Examination	4.5
Free Electives	12
Total	120

(2) For the Free Electives students have to pass courses corresponding to 12 ECTS points, which can be chosen from any recognized national or international post-secondary educational institution. The Free Electives shall provide additional skills beyond Computational Mathematics and can be taken anytime during the Master's study.

(3) The recommended study plan is listed in annex 1. This recommendation is based on the requirements of a full-time degree program. However, taking program restrictions into account, the program can also be completed by those who have a flexible work schedule or family care responsibilities: Some courses are also offered remotely and although attendance is usually not mandatory, attendance is recommended. In other courses, attendance is usually mandatory; however, attempts are made to offer multiple courses at alternative times and/or remotely. In regard to exams, there is no guarantee that they can be held remotely or during off-peek hours. Depending on the extent of work flexibility and/or family care responsibilities, a longer period of studies is to be expected.

§ 4 Core Subjects/Modules

(1) Students have to select and successfully complete three of the following Core Subjects with an extent of 12 ECTS each:

Code	Name	ECTS
404ALBR23	Algebra	0/12
404ANAC23	Analysis	0/12
404CANC23	Computer Algebra and Number Theory	0/12
404GEOC23	Geometry	0/12
404MMMC23	Mathematical Methods in Modeling and Data Analysis	0/12
404MAMC23	Mathematical Models	0/12
404NUMC23	Numerical Methods	0/12
404STCC23	Stochastics	0/12
404SLOC23	Symbolic Logic	0/12

(2) If courses of the Core Subjects have already been taken as courses during the Bachelor's studies on which the admission to the Master's studies was based, additional courses with the corresponding amount of ECTS have to be taken from the elective subjects.

(3) Upon request by the student, up to 6 ECTS of courses appearing in a Core Subject may be replaced by related courses appearing in the Elective Subjects, provided that these courses were not already taken as courses during the Bachelor's studies on which the admission to the Master's studies was based. The request must be justified and requires the approval of the Vice Rector of Academic Affairs.

§ 5 Elective Subjects/Modules

(1) Students have to select additional courses with a total of 31.5 ECTS from the non-selected Core Subjects or the following Elective Subjects:

Code	Name	ECTS
404ANAS23	Analysis	0-31.5
404NUAN23	Numerical analysis	0-31.5
404PTMS23	Probability theory and mathematical statistics	0-31.5
404MMNS23	Mathematical methods in the natural sciences	0-31.5
404MMEN23	Mathematical methods in engineering	0-31.5
404MMES23	Mathematical methods in the economic sciences	0-31.5
404OPTI23	Optimization	0-31.5
404SYCO23	Symbolic computation	0-31.5
404ADMA23	Algebra and discrete mathematics	0-31.5
404FUAN23	Functional analysis	0-31.5
404GEOM23	Geometry	0-31.5
404KBMS23	Knowledge-based Mathematical Systems	0-31.5
404NUTH23	Number theory	0-31.5

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Code	Name	ECTS
404SOSK23	Soft Skills	0-6
404ELEC23	Supplementary Subjects	0-9

(2) Students must select only such courses from the Elective Subjects or the Core Subjects that have not been completed in the Bachelor's program on which the admission to the Master's studies was based.

§ 6 Area of Specialization

Students may or may not choose an area of specialization, which is defined by the topic of the Master's thesis and by the choice of Core Subjects. If the criteria for an area of specialization are met, the area of specialization is listed in the program's certificate.

1. Area of Specialization "Symbolic Computation": two of the three selected Core Subjects must be "Computer Algebra and Number Theory" and "Symbolic Logic", and the topic of the Master's thesis must be in the area of one of these two Core Subjects.

2. Area of Specialization "Applied Mathematics": two of the three selected Core Subjects must be "Numerical Methods" and "Stochastics", and the topic of the Master's thesis must be in the area of one of these two Core Subjects.

§ 7 Courses

(1) The names and the types of all courses of the Core and Elective Subjects, as well as their ECTS points, their duration in hours per week, their codes, their registration requirements, and their admission procedures (in case of limited availability of places) are described in the study handbook of JKU (www.studienhandbuch.jku.at).

(2) The possible types of courses as well as the examination regulations are described in §§ 13 and 14 of the JKU statute (Section "Studienrecht").

§ 8 Replacement of Subjects and Courses

Core Subjects and Elective Subjects according to §§ 4 and 5 as well as courses according to § 6 para. 1 may be replaced to a total extent of 18 ECTS points by other study specific subjects and courses upon student's request, provided that the purpose of academic professional preparatory training is not affected and the choice of the proposed subjects and courses seems reasonable with regard to the defined aims in the qualification profile, the academic context as well as to the addition to the professional preparatory training. The application of replacing subjects and courses has to be filed to the Vice Rector of Academic Affairs.

§ 9 Master's Thesis

(1) Students of the Master's program in Computational Mathematics must complete a Master's thesis according to § 81 UG and § 36 of the JKU statute (Section "Studienrecht").

(2) The Master's thesis is a written scientific paper corresponding to an effort of 20 ECTS points.

(3) The Master's thesis serves as a proof that graduates are able to perform scientific work autonomously and systematically. The topic of the thesis must be related to one of the core subjects. It must permit completion within a period of 6 months.

(4) The Curricular Committee for Technical Mathematics may specify guidelines for the formal structure of a Master's thesis.

(5) In addition to the Master's thesis, students must pass two Master's thesis seminars with 8 ECTS points each.

§ 10 Examination Regulations

(1) The regulations for subject examinations and course examinations are described in the study handbook of JKU.

(2) The Master's program in Computational Mathematics is concluded by a Master's examination.

(3) The Master's examination consists of two parts: The first part is the successful completion of the core and elective subjects according to §§ 4 and 5.

(4) The second part of the Master's examination is a comprehensive oral exam (4.5 ECTS points) conducted by an examination committee. Prior to being admitted to this second part of the Master's examination, students must complete the first part of the Master's examination, the Master's Thesis Seminars, the Master's thesis, and the Free Electives.

(5) The second part of the Master's examination starts with a presentation and defense of the Master's thesis, followed by an oral exam that covers the contents of the subject area from which the Master's thesis topic was chosen as well as an oral exam that covers the contents of one additional subject. The second examination area is proposed by the student and determined by the Vice Rector of Academic Affairs.

(6) The oral exam shall focus on the general overview and the familiarity with thematic scientific contexts.

(7) The examination committee consists of three members and is formed by the Vice Rector of Academic Affairs. The candidate may submit a proposal for the committee members. In general, the advisor of the Master's thesis is a member of the examination committee, but not its chair. The head of the committee suggests the assessment of the presentation and of the defense of the thesis. The other two examiners suggest the assessment of the subject they have examined, respectively.

§ 11 Academic Degree

(1) Graduates of the Master's program in Computational Mathematics are awarded the academic degree „Diplom-Ingenieurin/Diplom-Ingenieur“, abbreviated „Dipl.-Ing.“ or „Dipl.-Ing. (JKU)“ or “DI” or “DI (JKU)”.

(2) The certificate about the academic degree is issued in German and in English translation.

§ 12 Legal Validity

(1) This Curriculum comes into effect on October 1, 2023.

(2) The curriculum of the Master's program in Computer Mathematics in the version published in the official newsletter of Johannes Kepler University Linz on June 30, 2020, 30th piece, item 342 expires by the end of September 30, 2023. Transitional provisions shall remain in force as long as they still apply in scope and content.

§ 13 Transitional Provisions

(1) Students who have passed examinations within the curriculum of the Master's program Computer Mathematics will continue their studies according to the curriculum of the Master's program Computational Mathematics.

(2) For students who have passed examinations within the curriculum of the Master's program Computer Mathematics or Mathematik in den Naturwissenschaften, the equivalences listed in the study handbook of JKU (studienhandbuch.jku.at) apply.

(3) In addition to the mentioned equivalences given in the study handbook of JKU, the following equivalence tables apply:

lectures/package of lectures in the Master Computer Mathematics 2020 or Master Mathematik in den Naturwissenschaften 2022W	**equivalent lectures/package of lectures in the Master Computational Mathematics 2023**
TMAPAVOSPEK: VO Spektraltheorie und Distributionen (6 ECTS)	404ANACSTDV23: VL Spectral theory and distributions (4.5 ECTS) + *404ANAC23: lecture from electives (1.5 ECTS)*
TMAPAVOFUNK: VO Funktionentheorie (6 ECTS)	404ANACCANV23: VL Complex Analysis (4.5 ECTS) + *404ANAC23: lecture from electives (1.5 ECTS)*

(4) Credits which were earned for courses that were mandatory in the former curriculum Computer Mathematics before September 30, 2024 can be counted towards Core Subjects Algebra, Computer Algebra and Number Theory, or Symbolic Logic, or towards Elective Subjects. Credits which were earned for Elective Subjects in the former curriculum Computer Mathematics before September 30, 2024 can be counted towards Elective Subjects.

(5) Credits which were earned for courses that were mandatory in the former curriculum Mathematik in den Naturwissenschaften can be counted towards Core Subjects Analysis, Mathematical Methods in Modeling and Data Analysis, or Stochastics, or towards Elective Subjects. Credits which were earned for Elective Subjects in the former curriculum Mathematik in den

Naturwissenschaften can be counted towards Elective Subjects.

Global map of study subjects - Master's Program "Computational Mathematics"

1st Semester (WS)		2nd Semester (SS)		3rd Semester (WS)		4th Semester (SS)	
Subject/Course	**ECTS**	**Subject/Course**	**ECTS**	**Subject/Course**	**ECTS**	**Subject/Course**	**ECTS**
Core Subjects	24	**Core Subjects**	12	**Master's Thesis Seminar I**	8	**Master's Thesis Seminar II**	8
Electives	6	**Electives**	12				
		Free electives	6	**Master Thesis**	8,5	**Master Thesis**	11,5
				Electives	13,5	**Final Exam**	4,5
						Free electives	6
	30		**30**		**30**		**30**
							120