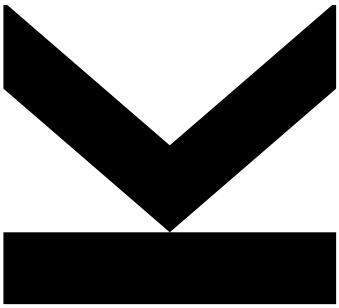
UK 066/403

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



JOHANNES KEPLER
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Contents

§ 1 Qualification Profile

(1) The bachelor's degree program Technical Mathematics and the master's degree programs Computational Mathematics and Industrial 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, other institutions of higher education, or other scientific institutions.

(2) The master's degree program Industrial Mathematics offers special training in mathematical methods and techniques necessary for successfully solving problems in technology and economy but also in other scientific application areas. Here the total development process, starting from modeling, via simulation, optimization and identification of process parameters is in focus. In particular, students acquire in-depth knowledge in the areas

- numerical analysis,
- applied geometry,
- stochastic analysis,
- inverse problems and parameter identification.

Students will not only learn how to use specific existing methods. Instead, they will get acquainted with all steps of the development process for new algorithms: 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, and also in social or economic contexts.

Students will acquire highly specialized knowledge touching the edge of current research in industrial mathematics. 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, 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 degree program Industrial Mathematics are excellently prepared for a broad variety of jobs, in particular in industry, in research and development but also in administration. Additionally, it allows for a career not only in mathematics but in other scientific areas.

§ 2 Admissions

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

(2) The master's degree program Industrial Mathematics is based on the bachelor's degree program Technical Mathematics (033 201) at JKU. Graduates of this bachelor's degree program are admitted to the master's degree 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 of at least the same level of higher education at recognized national or international post-secondary educational institutions, which include the following contents in the stated minimum scope:

- Analysis (12 ECTS points)
- Functional Analysis (4.5 ECTS points)
- Geometry (4.5 ECTS points)
- Linear Algebra (9 ECTS points)
- Mathematical Models in Engineering, Natural or Economic Sciences (3 ECTS points)
- Measure and Integration Theory (3 ECTS points)
- Numerical Methods for Partial Differential Equations (6 ECTS points)
- Optimization (4.5 ECTS points)
- Ordinary Differential Equations and Dynamical Systems (4.5 ECTS points)
- Partial Differential Equations (6 ECTS points)
- Probability Theory and Statistics (6 ECTS points)
- Programming (6 ECTS points)

(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 degree program Industrial Mathematics covers 4 semesters and consists of 120 ECTS points.

(2) The ECTS points are distributed among the following subjects:

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

(3) 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 Industrial Mathematics and can be taken anytime during the master's studies.

(4) The recommended course of study is shown in the 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 persons who have a flexible work schedule or family care responsibilities. Attendance in courses is usually not mandatory but recommended. In some courses, such as exercises or seminars, 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 Compulsory Subjects/Modules

(1) The following mandatory subjects have to be completed successfully:

Code	Name	ECTS
403MAMO22	Mathematical Modeling	22.5
403NUSI22	Numerical Simulation	9

(2) If courses of the Mandatory Subjects have already been completed during the bachelor's studies on which the admission to the master's degree program was based, additional courses with the corresponding amount of ECTS have to be taken from the Elective Subjects.

§ 5 Elective Subjects/Modules

(1) Students have to select courses with a total of 36 ECTS points from the electives below.

Code	Name	ECTS
403COEX22	Core Exercises	4.5-7.5
403MASE22	Mathematical Seminars	6-9
403GEOM22	Geometry	0-15
403MMIE22	Mathematical Methods in Engineering	0-15
403MMES22	Mathematical Methods in the Economic Sciences	0-15
403NUMA22	Numerical Analysis	0-15
403OPTI22	Optimization	0-15
403PTMS22	Probability Theory and Mathematical Statistics	0-15
403ANAS22	Analysis	0-9
403MMMD25	Mathematical Methods in Medicine and Data-Based Modelling	0-9
403ZATH22	Number Theory	0-4.5
403SOSK20	Soft Skills	0-6

(2) Courses completed in the bachelor's studies on which the admission to the master's degree program was based cannot be used again as Electives. Courses of the subject 'Core Exercises' which have already been completed during the bachelor's studies on which the admission to the master's degree program was based have to be replaced by any other courses from the Elective subjects with the corresponding amount of ECTS.

§ 6 Courses

(1) The names and the types of all courses of the mandatory 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").

§ 7 Replacement of Subjects and Courses

Mandatory 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 preprofessional education is not affected and that the choice of the proposed subjects and courses seems reasonable with regard to the defined aims in the qualification profile, to the academic context as well as to the supplementation of the academic pre-professional education. The application of replacing subjects and courses has to be submitted to the Vice Rector of Academic Affairs.

§ 8 Master's Thesis

(1) Students of the master's degree program Industrial 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 taken from the Mandatory Subjectes according to § 4 or from the Elective Subjects Geometry, Mathematical Methods in Engineering, Mathematical Methods in the Economic Sciences, Numerical Analysis, Optimization, or Probability Theory and Mathematical Statistics according to § 5. It must be chosen so that completion is possible 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.

§ 9 Examination Regulations

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

(2) The master's degree program Industrial 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 Mandatory 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 firstly the contents of the subject area from which the master's thesis topic was chosen and secondly the contents of an additional subject, 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 determinded 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. 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.

§ 10 Academic Degree

(1) Graduates of the master's degree program Industrial 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.

§ 11 Legal Validity

(1) This curriculum comes into effect on October 1, 2022.

(2) The curriculum of the master's degree program Industrial Mathematics in the version published in the official newsletter of Johannes Kepler University Linz on June 17, 2021, 31st piece, item 425 expires with the exception of the transitional arrangements by the end of September 30, 2022, unless otherwise specified below.

(3) § 1 para. 1 as published in the official newsletter of the Johannes Kepler University Linz on June 20, 2023, 29th piece, item 507 will take effect on October 1, 2023.

(4) § 5 para. 2 and § 12 para. 3 as published in the official newsletter of the Johannes Kepler University Linz on May 21, 2024, 24th piece, item 375 will take effect on October 1, 2024.

(5) § 12 para. 3 and annex 1 as published in the official newsletter of the Johannes Kepler University Linz on May 6, 2025, 22nd piece, item 246 will take effect on October 1, 2025.

§ 12 Transitional Provisions

(1) For students who have passed examinations within the curriculum of the master's degree program in Industrial Mathematics in a previous version, the equivalences listed in the study handbook of JKU (studienhandbuch.jku.at) apply.

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

Subjects/package of subjects in the Master Industriemathematik 2021	**equivalent subjects/package of subjects in the Master Industrial Mathematics 2022**
403MAMO12: Mathematische Modellierung (22.5 ECTS) + 403NUSI12: Numerische Simulation (9 ECTS) + 403WAFA21: Wahlfächer (36 ECTS)	403MAMO22: Mathematical Modeling (22.5 ECTS) + 403NUSI22: Numerical Simulation (9 ECTS) + 403ELEC22: Electives (36 ECTS)

lectures/package of lectures in the Master Industriemathematik 2021	**equivalent lectures/package of lectures in the Master Industrial Mathematics 2022**
TM1WAUEINTG: UE Integralgleichungen und Randwertprobleme (3 ECTS)	403COEXIEBU22: UE Integral Equations and Boundary Value Problems (1.5 ECTS) + 403ELEC22: lecture from electives (1.5 ECTS)
TM1WEUEMMKM: UE Mathematische Methoden der Kontinuumsmechanik (3 ECTS)	403COEXMMEU22: UE Mathematical Methods in Continuum Mechanics (1.5 ECTS) + 403ELEC22: lecture from electives (1.5 ECTS)
TM1WBUENELL: UE Numerik elliptischer Probleme (3 ECTS)	403COEXNMEU22: UE Numerical Methods for Elliptic Equations (1.5 ECTS) + 403ELEC22: lecture from electives (1.5 ECTS)

(3) Credits earned for elective courses that were part of an earlier version of this curriculum can be counted towards Elective Subjects.

Global map of study subjects - Master's Program "Industrial 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**
Mathematical Modeling	19,5	**Mathematical Modeling**	3	**Master's Thesis Seminar I**	8	**Master's Thesis Seminar II**	8
Electives	10,5	**Numerical Simulation**	3				
		Electives	18	**Master Thesis**	8,5	**Master Thesis**	11,5
		Free electives	6				
				Numerical Simulation	6	**Final Exam**	4,5
				Electives	7,5	Free electives	6
	30		**30**		**30**		**30**
							120