Technische Universität Dresden
Faculty of Mathematics

Study Regulations
for the Master's degree program in Technomathematics
from winter semester 2023/2024

Consolidated version of the official announcements of TU Dresden of March 30, 2023 and according to § 6 para. 6 of the Study Regulations the resolution of the Faculty Board of April 19, 2023 and October 18, 2023.

This is valid for all students enrolled in the Master's degree program Technomathematics.

TUD Dresden University of Technology
Faculty of Mathematics

Study Regulations for the consecutive Master's degree program Technomathematics

as of March 30, 2023
(translated version)

On the basis of § 36 para. 1 of the Act on the Autonomy of Institutions of Higher Education in the Free State of Saxony in the version published on January 15, 2013 (SächsGVBl. p. 3), TUD Dresden University of Technology issues the following Study Regulations as statutes.

Table of contents

§ 1
Scope of application

On the basis of the Act on the Autonomy of Institutions of Higher Education in the Free State of Saxony and the Examination Regulations, these Study Regulations stipulate the objectives, content, structure and organization of the consecutive Master's program in Technomathematics at TUD Dresden University of Technology.

§ 2
Objectives of the degree program

(1) The students possess in-depth knowledge, skills and abilities in such mathematical areas that are particularly relevant for applications in industry. They will become familiar with advanced mathematical thinking, concepts and forms of work inherent to fundamental mathematical disciplines and master a wide range of modern mathematical techniques and algorithms, focusing on methods of mathematical modeling, analysis of mathematical models and their numerical handling. They will have skills to apply this knowledge to solve practical, industry-related problems and to present the results. Students will have a solid knowledge of mathematical programming and the use of simulation tools. They will be able to use computers purposefully as an essential tool in solving complicated problems. Students will be able to independently undertake academic work, apply and develop new scientific findings, and solve problems relevant to practice using the mathematical knowledge they have acquired. Students will have knowledge of a technical discipline such as electrical engineering, computer science, mechanical engineering or physics. They will be able to complete tasks both independently and in interdisciplinary teams. Students will be able to use their knowledge, understanding, and problem-solving skills in new and unfamiliar situations and to work in a team. Students will possess key skills relevant to professional life in areas such as communication and teamwork, presentation skills, work organization, time management, and project planning. Moreover, they will also become capable of critical self-reflection as well as social commitment and will have developed their personalities.

(2) Due to their broad academic studies in applied mathematics including mathematical modeling and training in a technical specialization, graduates of the Master's program in Technomathematics will be able to successfully analyze, model and solve diverse and complex problems in professional practice in a wide variety of areas in industry, business and administration as well as at research institutes and universities. After graduation, they will be familiar with fundamental issues in one of the application areas of mathematics from the user's perspective and will be able to communicate and cooperate with engineers and researchers from other disciplines.

§ 3
Admission requirements

(1) To be admitted to the degree program, candidates must have completed a first university degree recognized in Germany or a qualification from an officially recognized vocational academy in the field of mathematics or a closely related program of study, in particular in Technomathematics or Mathematics in Business and Economics. An Admissions Committee will be established to decide on questions of doubt regarding the assessment of study programs pursuant to sentence 1.

(2) Knowledge of English at the B2 level of the Common European Framework of Reference for Language is a prerequisite. Proof must be provided in the form of a certificate for general university entrance qualification, a certificate for subject-specific university entrance qualification comprising English as a foreign language, a certificate for university entrance qualification from a program completed in English, a certificate of a university degree program completed in English or the result of an internationally recognized language test, e.g. TOEFL (72), IELTS (5.5), UNIcert II.

§ 4
Start and duration of the degree program

(1) The program can be started in the winter semester or the summer semester.

(2) The standard period of study is four semesters and includes on-site attendance, self-study and the final examination.

§ 5
Teaching and learning methods

(1) The curriculum is structured in modules. In the individual modules, the course content is taught, consolidated and deepened through lectures, exercises, seminars, tutorials, practical training, projects, internships, and self-study. In modules that are subject to more than one study regulation, synonyms are permitted for teaching and learning methods with the same content.

(2) The individual teaching and learning forms according to para. 1 sentence 2 are defined as follows:

1. Lectures provide theoretical knowledge on the subject matter of the modules.
2. Exercises allow students to apply the subject matter in exemplary sub-areas.
3. Seminars enable students to familiarize themselves under supervision in a selected subject area on the basis of specialist literature or other material, to report on the results of their work, to discuss them within the group and to present them in writing.
4. During tutorials, more advanced students impart knowledge, skills and interdisciplinary competencies to other students.
5. Practical training serve the application of the subject matter taught and the acquisition of further fundamental academic and practical skills, they support the combination of theory to practice, and explore specialist topics while considering interdisciplinary research questions.
6. Projects serve to apply and develop acquired knowledge and skills that resemble real-world tasks. These are usually undertaken in small groups and as such promote teamwork and communication skills.
7. An internship serves to apply the acquired knowledge and competencies, and to acquire practical skills in potential areas of employment.
8. Self-study allows students to acquire, consolidate and deepen their knowledge and skills on their own.

§ 6
Structure and organization of the degree program

(1) The program is organized in modules, and features a curriculum organized over four semesters. The third semester is particularly suitable for a temporary stay at another university (mobility window). Part-time study is possible in accordance with the regulations on part-time study.

(2) The degree program comprises five compulsory modules, seven elective compulsory modules from the “M” elective compulsory field, and three to four elective compulsory modules from the “N” elective compulsory field, which allow the students to choose their specialization. In the “N” elective compulsory field, students have a choice of the following specializations: Electrical Engineering – Basic, Electrical Engineering – Advanced, Computer Science – Basic, Computer Science – Advanced, Mechanical Engineering – Basic, Mechanical Engineering – Advanced, Physics – Basic, Physics – Advanced. The choice of elective compulsory modules and specializations is binding. Students can change modules by submitting a written request to the Examination Office, in which the module to be replaced and the newly chosen module or specialization are to be named.

(3) Learning goals, content, teaching and learning methods, requirements, applicability including potential combination restrictions, frequency, workload, and duration of the individual modules are all listed in the module descriptions (Annex 1).

(4) The courses are held in English or, if indicated by the module descriptions, in German.

(5) The appropriate allocation of the modules to the individual semester, the observance of which makes it possible to complete the program within the standard period of study, as well as the type and scope of the courses included, and the number and standard time of the required study achievements and examined assessments are defined in the study schedule attached (Annex 2), or in an individual study schedule for part-time studies approved by the Faculty.

(6) Upon proposal of the Academic Affairs Committee, the Faculty Board may change the range of elective compulsory modules as well as the study schedule. The current selection of elective compulsory modules will be announced in the usual manner at the beginning of the semester. The amended study schedule shall apply to all students who have been informed about this in the usual manner at the beginning of their studies. The Examination Committee shall decide, upon application by the student, on any exceptions to sentence 3.

§ 7
Content of the degree program

(1) The Master's program in Technomathematics is application-oriented.

(2) The contents of the degree program include the subject areas of analysis, partial differential equations, numerical methods for partial differential equations and finite element methods. Depending on the modules and courses chosen by the student, the content of the degree program comprises advanced mathematical concepts and structures in the areas of analysis, algebra, differential equations, discrete mathematics, mathematics in business, economics and finance, geometry, numerical analysis, modeling and simulation, optimization and stochastics. Moreover, the degree program also offers opportunities for specialization in current pure and applied mathematics research. This includes important methods of scientific work as well as the rules of good scientific practice. Moreover, the degree program enables students to specialize and refine their academic profile in a technical field, for which they may choose a discipline from one of the following: electrical engineering, computer science, mechanical engineering, and physics. Depending on students' choice of subject area, the degree program includes either foundational or in-depth knowledge of another subject area in addition to mathematics, which opens up opportunities for interdisciplinary work. Moreover, it comprises the study of exemplary topics of an adjacent field.

§ 8
Credit points

(1) ECTS credit points document the average workload of the students and their individual study progress. One credit point corresponds to a 30-hour workload. Normally, 60 credit points are awarded per academic year, i.e. 30 credit points per semester. The total workload for the program corresponds to 120 credit points and comprises the teaching and learning methods according to type and scope stipulated in the module descriptions, the study achievements and examined assessments, and the final thesis.

(2) The module descriptions indicate the number of credits that can be earned by each module. Credits are awarded upon passing the module examination. § 34 of the examination regulations shall remain unaffected.

§ 9
Academic advisory and counseling service

(1) General advice will be provided by the Central Student Information and Counseling Service at TU Dresden. It covers questions regarding study options, enrollment modalities and general student affairs. Subject-specific guidance during studies will be provided by the Academic Advisory Service of the Faculty of Mathematics. This subject-specific advisory service assists students with regard to the design of their studies.

(2) At the beginning of the third semester, each student who has not yet provided proof of academic performance shall make use of the subject-specific advisory services.

§ 10
Amendments to module descriptions

(1) In order to adapt them to changed conditions, module descriptions may be amended in a simplified procedure in order to optimize study organization, with the exemption of the fields “Module name”, “Qualification objectives”, “Content”, “Teaching and learning methods”, “Requirements for earning credit points”, “Credit points and grades” and “Module duration”.

(2) In a simplified procedure, the Faculty Board will adopt the amendments to the module descriptions upon proposal of the Academic Affairs Committee. The amendments must be published in the usual manner.

§ 11
Entry into force, publication and interim arrangements

(1) These Study Regulations enter into force on April 1, 2023, and are published in the official announcements of TU Dresden.

(2) They apply to all newly enrolled students in the Master's program in Technomathematics in the 2023/2024 winter semester or later.

(3) For students who enrolled prior to the 2023/2024 winter semester, the version of the Study Regulations for the consecutive Master's degree program in Technomathematics that has been valid for them up until the amendment continues to apply unless they declare their acceptance of the amendment in writing to the Examination Committee. The form and deadline of this declaration are specified by the Examination Committee and are announced in the usual manner. Switching to the new regulations is possible at the earliest on October 1, 2023.

Issued based on the resolution of the Faculty Board of the Faculty of Mathematics as of January 25, 2023, and the approval of the University Executive Board as of March 14, 2023.

Dresden, March 30, 2023

The Rector
of TUD Dresden University of Technology

Prof. Ursula M. Staudinger

Annex 1:
Module descriptions

Module number	**Module name**	**Responsible lecturer**
Math-Ma-28	Numerical methods for partial differential equations – Basic concepts	Director of the Institute for Numerical Mathematics id.numerik@tu-dresden.de
Qualification objectives	Students are able to independently analyze and numerically solve concrete elliptic problems by choosing appropriate discretization techniques in appropriate Sobolev spaces, and to apply error estimation techniques and adaptive discretization techniques to problems involving partial differential equations.	
Content	The module covers discretization techniques for elliptic problems, a-priori and a-posteriori error estimation techniques, selected properties of Sobolev spaces, and basic principles of convergence analysis.	
Teaching and learning methods	The module comprises 3 hours per week lecture, 1 hour per week exercise and self-study. The lectures and the exercises will be held either in German or English. This will be specified by the lecturer at the beginning of each semester and announced in the usual manner.	
Prerequisites for participation	Knowledge in the numerics of ordinary differential equations, Hilbert spaces, and linear operators at the Bachelor's level is required. Literature (german and english): - Deuflhard, P. / Bornemann, F.: Scientific Computing with Ordinary Differential Equations, Springer, - Alt, H. W.: Linear Functional Analysis - An Application-Oriented Introduction, Springer, - Deuflhard, P. / Bornemann, F.: Numerische Mathematik 2: Gewöhnliche Differentialgleichungen, De Gruyter, - Alt, H. W.: Lineare Funktionalanalysis, Springer.	
Applicability	This module is a compulsory module in the Master's degree program Technomathematics. Furthermore, this module is one of 35 compulsory elective modules in the compulsory elective area M of the Master's degree program Mathematics, of which modules with a total of at least 66 credit points must be selected. In addition, this module is one of 31 compulsory elective modules in the compulsory elective area M of the Master's degree program Mathematics in Business and Economics, of which modules with a total of at least 24 credit points must be selected. The module is a prerequisite for participation in the module Numerical methods for partial differential equations – Advanced concepts.	
Requirements for earning credit points	Credit points are earned after passing the module examination. The module examination consists of a non-public oral examination lasting 25 minutes as an individual examination. The language of the examination is German or English, at the student's choice.	
Credit points and grades	Participants can earn six credit points for this module. The module grade corresponds to the grade of the examined assessment.	
Module frequency	The module is offered each winter semester.	

Workload	The workload comprises a total of 180 hours.
Module duration	The module comprises one semester.

Module number	Module name	Responsible lecturer
Math-Ma-31	Finite element methods – Theory, implementation and applications	Director of the Institute for Scientific Computing id.wir@tu-dresden.de
Qualification objectives	The students have a systematic understanding of the theory of the Finite Element Method (FEM), in particular of convergence results. They have knowledge of algorithmic issues and implementation aspects in finite element software and have basic knowledge and experience in modeling application-oriented problems, e.g. from the fields of fluid mechanics and materials science. Students are able to independently analyze specific problems from the application areas covered and to solve them using appropriate FE methods.	
Content	The module covers theory and practice of the finite element method, in particular variational formulation, discretization, convergence, numerical implementation and application.	
Teaching and learning methods	The module comprises 3 hours per week lecture, 1 hour per week exercise and self-study. The lectures and the exercises will be held either in German or English. This will be specified by the lecturer at the beginning of each semester and announced in the usual manner.	
Prerequisites for participation	Knowledge in numerics of ordinary differential equations at the Bachelor's level is required. Literature (german and english): - Gerald, Wheatley: Applied Numerical Analysis (chapters 1-6), Pearson, 2003, or Ferziger: Numerical Methods for Engineering Application (Chapters 1-5), Wiley, 1998, - Roos, H.-G. / Schwetlick, H.: Numerische Mathematik, Teubner.	
Applicability	This module is a compulsory module in the Master’s degree program Technomathematics. Furthermore, this module is one of 35 compulsory elective modules in the compulsory elective area M of the Master’s degree program Mathematics, of which modules with a total of at least 66 credit points must be selected. In addition, this module is one of 31 compulsory elective modules in the compulsory elective area M of the Master’s degree program Mathematics in Business and Economics, of which modules with a total of at least 24 credit points must be selected.	
Requirements for earning credit points	Credit points are earned after passing the module examination. For more than 20 registered students, the module examination consists of a written test lasting 90 minutes. For up to 20 registered students, the written test will be replaced by a non-public oral examination lasting 25 minutes as an individual examination. The type of examination will be announced in writing at the end of the registration period. The language of the examination corresponds to the language of teaching determined at the beginning of the semester.	
Credit points and grades	Participants can earn six credit points for this module. The module grade corresponds to the grade of the examined assessment.	
Module frequency	The module is offered each winter semester.	

Workload	The workload comprises a total of 180 hours.
Module duration	The module comprises one semester.

Module number	**Module name**	**Responsible lecturer**
Math-Ma-MS	Modelling seminar	Director of the Institute for Scientific Computing id.wir@tu-dresden.de
Qualification objectives	Students have a systematic understanding of how application problems can be mathematically formulated, appropriately simplified, and numerically treated. They are able to present their results in a way that is understandable to non-mathematicians.	
Content	The module covers the mathematical modeling and treatment of problems from application areas, preferably by description by partial differential equations.	
Teaching and learning methods	The module comprises 4 hours per week seminar, 6 hours per week project and self-study.	
Prerequisites for participation	Knowledge in partial differential equations at the Bachelor's level is required.	
Applicability	This module is a compulsory module in the Master’s degree program Technomathematics.	
Requirements for earning credit points	Credit points are earned after passing the module examination. The module examination consists of an ungraded combined term paper equating to 40 hours. The language of the examination is German or English, at the student's choice.	
Credit points and grades	Participants can earn seven credit points for this module. The module examination will be graded as either “pass” or “fail”.	
Module frequency	The module is offered each summer semester.	
Workload	The workload comprises a total of 210 hours.	
Module duration	The module comprises one semester.	

Module number	**Module name**	**Responsible lecturer**
Math-Ma-RP	Research project	Director of the Institute for Scientific Computing id.wir@tu-dresden.de
Qualification objectives	The students are able to familiarize themselves with the task in a project group, to discuss possible ways and approaches and to determine partial steps to fulfill the task, to acquire the necessary detailed theoretical knowledge and computational tools, to contribute to a project with their respective strengths and to use the limited time resources efficiently. They are capable of critical self-reflection and social commitment and have developed their personality.	
Content	The module covers tasks from the application of mathematics in other areas, the study or improvement of algorithms, or the generalization or specialization of mathematical results.	
Teaching and learning methods	The module comprises 4 hours per week project and self-study.	
Prerequisites for participation	None.	
Applicability	This module is a compulsory module in the Master's degree program Technomathematics.	
Requirements for earning credit points	Credit points are earned after passing the module examination. The module examination consists of an ungraded public oral examination lasting 30 minutes as an individual examination. The language of the examination is German or English, at the student's choice.	
Credit points and grades	Participants can earn four credit points for this module. The module examination will be graded as either "pass" or "fail".	
Module frequency	The module is offered each winter semester.	
Workload	The workload comprises a total of 120 hours.	
Module duration	The module comprises one semester.	

Module number	Module name	Responsible lecturer
Math-Ma-SL	Scientific literature – Research topics	Dean of Studies of the Master's study programmes in Mathematics studiendekan.math@tu-dresden.de
Qualification objectives	Students are able to apply their advanced mathematical thinking, concepts, and ways of working. They are able to work independently in a scientific manner, to acquire and develop new scientific knowledge, and to successfully tackle problems using these self-developed methods. They are able to present their results both orally and in writing. Students possess key professional skills such as presentation skills, critical self-reflection, work organization, time management and project planning.	
Content	Depending on the student's choice, the module covers a selected special area of mathematics, such as Analysis, Algebra, Differential equations, Discrete mathematics, Financial and economic mathematics, Geometry, Numerical mathematics, Modeling and simulation, Optimization, or Stochastics, according to the problem to be addressed in the thesis.	
Teaching and learning methods	The module comprises 2 hours per week seminar and self-study.	
Prerequisites for participation	Knowledge in mathematics at the Bachelor's level is required.	
Applicability	This module is a compulsory module in the Master’s degree programmes Mathematics, Technomathematics and Mathematics in Business and Economics.	
Requirements for earning credit points	Credit points are earned after passing the module examination. The module examination consists of a public oral examination lasting 45 minutes as an individual examination. The language of the examination is German or English, at the student's choice.	
Credit points and grades	Participants can earn four credit points for this module. The module grade corresponds to the grade of the examined assessment.	
Module frequency	The module is offered each semester.	
Workload	The workload comprises a total of 120 hours.	
Module duration	The module comprises one semester.	

Module number	Module name	Responsible lecturer
Math-Ma-01	Algebraic structures	Director of the Institute for Algebra id.algebra@tu-dresden.de
Qualification objectives	Students know and are able to apply the important notions and theorems of abstract algebraic objects and their theory. They are able to formulate precise definitions, give proofs, apply the methods to examples, and explain applications. They can apply abstract methods to specific situations and interpret general structure theory appropriately for specific cases. They have developed the ability to understand algebraic problems and to use them in their most efficient generalization, and they have in-depth analytical skills, a developed understanding of mathematical relationships, and analytical-critical thinking skills.	
Content	The module covers basic and advanced ideas and concepts of abstract algebra.	
Teaching and learning methods	The module comprises 3 hours per week lecture, 1 hour per week exercise and self-study. The lectures and the exercises will be held either in German or English. This will be specified by the lecturer at the beginning of each semester and announced in the usual manner.	
Prerequisites for participation	Knowledge in algebraic structures at the Bachelor's level is required. Literature (german and english): - Bosch, S.: Algebra, Springer-Lehrbuch, Springer, - Hungerford, T. W.: Algebra, Graduate Texts in Mathematics, Springer.	
Applicability	This module is one of 35 compulsory elective modules in the compulsory elective area M of the Master’s degree program Mathematics, of which modules with a total of at least 66 credit points must be selected. Furthermore, this module is one of 34 compulsory elective modules in the compulsory elective area M of the Master’s degree program Technomathematics, of which modules with a total of at least 42 credit points must be selected. In addition, this module is one of 31 compulsory elective modules in the compulsory elective area M of the Master’s degree program Mathematics in Business and Economics, of which modules with a total of at least 24 credit points must be selected.	
Requirements for earning credit points	Credit points are earned after passing the module examination. The module examination consists of a non-public oral examination lasting 25 minutes as an individual examination. The language of the examination is German or English, at the student's choice.	
Credit points and grades	Participants can earn six credit points for this module. The module grade corresponds to the grade of the examined assessment.	
Module frequency	The module is offered at least once per academic year.	
Workload	The workload comprises a total of 180 hours.	
Module duration	The module comprises one semester.	

Module number	Module name	Responsible lecturer
Math-Ma-02	Model theory	Director of the Institute for Algebra id.algebra@tu-dresden.de
Qualification objectives	Students have a systematic understanding of the methods of model theory. They know the important concepts and theorems of model theory and are able to formulate precise definitions, give proofs, apply the methods to examples, and explain applications.	
Content	Content includes abstract model theory, including properties of theories, properties of models, and applications of model theory to concrete algebraic and relational structures.	
Teaching and learning methods	The module comprises 3 hours per week lecture, 1 hour per week exercise and self-study. The lectures and the exercises will be held either in German or English. This will be specified by the lecturer at the beginning of each semester and announced in the usual manner.	
Prerequisites for participation	Knowledge in algebraic structures at the Bachelor's level is required. Literature (german and english): - Bosch, S.: Algebra, Springer-Lehrbuch, Springer, - Hungerford, T. W.: Algebra, Graduate Texts in Mathematics, Springer.	
Applicability	This module is one of 35 compulsory elective modules in the compulsory elective area M of the Master's degree program Mathematics, of which modules with a total of at least 66 credit points must be selected. Furthermore, this module is one of 34 compulsory elective modules in the compulsory elective area M of the Master's degree program Technomathematics, of which modules with a total of at least 42 credit points must be selected. In addition, this module is one of 31 compulsory elective modules in the compulsory elective area M of the Master's degree program Mathematics in Business and Economics, of which modules with a total of at least 24 credit points must be selected.	
Requirements for earning credit points	Credit points are earned after passing the module examination. The module examination consists of a non-public oral examination lasting 25 minutes as an individual examination. The language of the examination is German or English, at the student's choice.	
Credit points and grades	Participants can earn six credit points for this module. The module grade corresponds to the grade of the examined assessment.	
Module frequency	The module is offered at least once in four consecutive semesters.	
Workload	The workload comprises a total of 180 hours.	
Module duration	The module comprises one semester.	

Module number	Module name	Responsible lecturer
Math-Ma-03	Discrete structures	Director of the Institute for Algebra id.algebra@tu-dresden.de
Qualification objectives	Students have a systematic understanding of a class of discrete structures and the associated theory. They know the important concepts and theorems of discrete mathematics and are able to formulate precise definitions, give proofs, apply the methods to examples, and explain applications.	
Content	The module covers topics in discrete mathematics, in particular graph theory, combinatorics, and finite model theory, as well as applications in theoretical computer science.	
Teaching and learning methods	The module comprises 3 hours per week lecture, 1 hour per week exercise and self-study. The lectures and the exercises will be held either in German or English. This will be specified by the lecturer at the beginning of each semester and announced in the usual manner.	
Prerequisites for participation	Knowledge in algebraic structures at the Bachelor's level is required. Literature (german and english): - Bosch, S.: Algebra, Springer-Lehrbuch, Springer, - Hungerford, T. W.: Algebra, Graduate Texts in Mathematics, Springer.	
Applicability	This module is one of 35 compulsory elective modules in the compulsory elective area M of the Master's degree program Mathematics, of which modules with a total of at least 66 credit points must be selected. Furthermore, this module is one of 34 compulsory elective modules in the compulsory elective area M of the Master's degree program Technomathematics, of which modules with a total of at least 42 credit points must be selected. In addition, this module is one of 31 compulsory elective modules in the compulsory elective area M of the Master's degree program Mathematics in Business and Economics, of which modules with a total of at least 24 credit points must be selected.	
Requirements for earning credit points	Credit points are earned after passing the module examination. The module examination consists of a non-public oral examination lasting 25 minutes as an individual examination. The language of the examination is German or English, at the student's choice.	
Credit points and grades	Participants can earn six credit points for this module. The module grade corresponds to the grade of the examined assessment.	
Module frequency	The module is offered at least once in four consecutive semesters.	
Workload	The workload comprises a total of 180 hours.	
Module duration	The module comprises one semester.	

Module number	Module name	Responsible lecturer
Math-Ma-04	Algebra and number theory	Director of the Institute for Algebra id.algebra@tu-dresden.de
Qualification objectives	Students understand the connections between algebra and number theory. They know the most important terms and theorems of the areas covered and are able to formulate precise definitions, give proofs, apply the methods to examples, and explain applications.	
Content	The module covers basic and advanced topics in algebraic number theory and arithmetic geometry, in particular global and local fields and rational points on algebraic varieties.	
Teaching and learning methods	The module comprises 3 hours per week lecture, 1 hour per week exercise and self-study. The lectures and the exercises will be held either in German or English. This will be specified by the lecturer at the beginning of each semester and announced in the usual manner.	
Prerequisites for participation	Knowledge in algebraic structures at the Bachelor's level is required. Literature (german and english): - Bosch, S.: Algebra, Springer-Lehrbuch, Springer, - Hungerford, T. W.: Algebra, Graduate Texts in Mathematics, Springer.	
Applicability	This module is one of 35 compulsory elective modules in the compulsory elective area M of the Master's degree program Mathematics, of which modules with a total of at least 66 credit points must be selected. Furthermore, this module is one of 34 compulsory elective modules in the compulsory elective area M of the Master's degree program Technomathematics, of which modules with a total of at least 42 credit points must be selected. In addition, this module is one of 31 compulsory elective modules in the compulsory elective area M of the Master's degree program Mathematics in Business and Economics, of which modules with a total of at least 24 credit points must be selected.	
Requirements for earning credit points	Credit points are earned after passing the module examination. The module examination consists of a non-public oral examination lasting 25 minutes as an individual examination. The language of the examination is German or English, at the student's choice.	
Credit points and grades	Participants can earn six credit points for this module. The module grade corresponds to the grade of the examined assessment.	
Module frequency	The module is offered at least once in four consecutive semesters.	
Workload	The workload comprises a total of 180 hours.	
Module duration	The module comprises one semester.	

Module number	Module name	Responsible lecturer
Math-Ma-05	Group theory	Director of the Institute for Algebra id.algebra@tu-dresden.de
Qualification objectives	Students master the basic methods of group theory and can apply them in new contexts to develop proofs independently. They know the most important definitions and results of group theory, can formulate them precisely and explain the proofs.	
Content	The module covers basic and advanced topics in group theory, in particular abstract structure theory of groups, examples and effective use of group actions.	
Teaching and learning methods	The module comprises 3 hours per week lecture, 1 hour per week exercise and self-study. The lectures and the exercises will be held either in German or English. This will be specified by the lecturer at the beginning of each semester and announced in the usual manner.	
Prerequisites for participation	Knowledge in algebraic structures at the Bachelor's level is required. Literature (german and english): - Bosch, S.: Algebra, Springer-Lehrbuch, Springer, - Hungerford, T. W.: Algebra, Graduate Texts in Mathematics, Springer.	
Applicability	This module is one of 35 compulsory elective modules in the compulsory elective area M of the Master's degree program Mathematics, of which modules with a total of at least 66 credit points must be selected. Furthermore, this module is one of 34 compulsory elective modules in the compulsory elective area M of the Master's degree program Technomathematics, of which modules with a total of at least 42 credit points must be selected. In addition, this module is one of 31 compulsory elective modules in the compulsory elective area M of the Master's degree program Mathematics in Business and Economics, of which modules with a total of at least 24 credit points must be selected.	
Requirements for earning credit points	Credit points are earned after passing the module examination. The module examination consists of a non-public oral examination lasting 25 minutes as an individual examination. The language of the examination is German or English, at the student's choice.	
Credit points and grades	Participants can earn six credit points for this module. The module grade corresponds to the grade of the examined assessment.	
Module frequency	The module is offered at least once in four consecutive semesters.	
Workload	The workload comprises a total of 180 hours.	
Module duration	The module comprises one semester.	

Module number	Module name	Responsible lecturer
Math-Ma-06	Commutative algebra	Director of the Institute of Geometry id.geometrie@tu-dresden.de
Qualification objectives	Students are able to define respectively state and prove the most important notions and results in commutative algebra. and apply them to problems and examples, especially from algebraic geometry.	
Content	The module covers basic definitions and theorems of commutative algebra. Further topics are the theory of local Noetherian rings and homological methods.	
Teaching and learning methods	The module comprises 3 hours per week lecture, 1 hour per week exercise and self-study. The lectures and the exercises will be held either in German or English. This will be specified by the lecturer at the beginning of each semester and announced in the usual manner.	
Prerequisites for participation	Knowledge in algebra at the Bachelor's level is required. Literature (german and english): - Bosch, S.: Lineare Algebra, Springer-Lehrbuch, Springer, - Bosch, S.: Algebra, Springer-Lehrbuch, Springer, - Hungerford, T. W.: Algebra, Graduate Texts in Mathematics, Springer.	
Applicability	This module is one of 35 compulsory elective modules in the compulsory elective area M of the Master's degree program Mathematics, of which modules with a total of at least 66 credit points must be selected. Furthermore, this module is one of 34 compulsory elective modules in the compulsory elective area M of the Master's degree program Technomathematics, of which modules with a total of at least 42 credit points must be selected. In addition, this module is one of 31 compulsory elective modules in the compulsory elective area M of the Master's degree program Mathematics in Business and Economics, of which modules with a total of at least 24 credit points must be selected.	
Requirements for earning credit points	Credit points are earned after passing the module examination. The module examination consists of a non-public oral examination lasting 25 minutes as an individual examination. The language of the examination is German or English, at the student's choice.	
Credit points and grades	Participants can earn six credit points for this module. The module grade corresponds to the grade of the examined assessment.	
Module frequency	The module is offered at least every second academic year in the winter semester.	
Workload	The workload comprises a total of 180 hours.	
Module duration	The module comprises one semester.	

Module number	Module name	Responsible lecturer
Math-Ma-07	Noncommutative geometry	Director of the Institute of Geometry id.geometrie@tu-dresden.de
Qualification objectives	Students are able to define respectively state and prove the most important notions and results in noncommutative geometry and apply them to problems and examples, especially from representation theory.	
Content	The module covers basic definitions and theorems of noncommutative geometry. Further topics are Hopf algebras and representation theory as well as homological methods.	
Teaching and learning methods	The module comprises 3 hours per week lecture, 1 hour per week exercise and self-study. The lectures and the exercises will be held either in German or English. This will be specified by the lecturer at the beginning of each semester and announced in the usual manner.	
Prerequisites for participation	Knowledge in algebra at the Bachelor's level is required. Literature (german and english): - Bosch, S.: Lineare Algebra, Springer-Lehrbuch, Springer, - Bosch, S.: Algebra, Springer-Lehrbuch, Springer, - Hungerford, T. W.: Algebra, Graduate Texts in Mathematics, Springer.	
Applicability	This module is one of 35 compulsory elective modules in the compulsory elective area M of the Master's degree program Mathematics, of which modules with a total of at least 66 credit points must be selected. Furthermore, this module is one of 34 compulsory elective modules in the compulsory elective area M of the Master's degree program Technomathematics, of which modules with a total of at least 42 credit points must be selected. In addition, this module is one of 31 compulsory elective modules in the compulsory elective area M of the Master's degree program Mathematics in Business and Economics, of which modules with a total of at least 24 credit points must be selected.	
Requirements for earning credit points	Credit points are earned after passing the module examination. The module examination consists of a non-public oral examination lasting 25 minutes as an individual examination. The language of the examination is German or English, at the student's choice.	
Credit points and grades	Participants can earn six credit points for this module. The module grade corresponds to the grade of the examined assessment.	
Module frequency	The module is offered at least every second academic year in the summer semester.	
Workload	The workload comprises a total of 180 hours.	
Module duration	The module comprises one semester.	

Module number	**Module name**	**Responsible lecturer**
Math-Ma-08	Algebraic topology	Director of the Institute of Geometry id.geometrie@tu-dresden.de
Qualification objectives	Students have a sound knowledge of the most important notions and theorems of set-theoretic and algebraic topology. They are able to apply the learned geometric, algebraic and topological methods precisely and independently and have a basic understanding of the connection with other areas of mathematics.	
Content	The module covers basic methods, concepts, and theorems of algebraic topology.	
Teaching and learning methods	The module comprises 3 hours per week lecture, 1 hour per week exercise and self-study. The lectures and the exercises will be held either in German or English. This will be specified by the lecturer at the beginning of each semester and announced in the usual manner.	
Prerequisites for participation	Knowledge in linear algebra and group theory at the Bachelor's level is required. Literature (german and english): - Bosch, S.: Lineare Algebra, Springer-Lehrbuch, Springer, - Jänich, K.: Lineare Algebra, Springer-Lehrbuch, Springer, - Hungerford, T. W.: Algebra, Graduate Texts in Mathematics, Springer.	
Applicability	This module is one of 35 compulsory elective modules in the compulsory elective area M of the Master's degree program Mathematics, of which modules with a total of at least 66 credit points must be selected. Furthermore, this module is one of 34 compulsory elective modules in the compulsory elective area M of the Master's degree program Technomathematics, of which modules with a total of at least 42 credit points must be selected. In addition, this module is one of 31 compulsory elective modules in the compulsory elective area M of the Master's degree program Mathematics in Business and Economics, of which modules with a total of at least 24 credit points must be selected.	
Requirements for earning credit points	Credit points are earned after passing the module examination. The module examination consists of a non-public oral examination lasting 25 minutes as an individual examination. The language of the examination is German or English, at the student's choice.	
Credit points and grades	Participants can earn six credit points for this module. The module grade corresponds to the grade of the examined assessment.	
Module frequency	The module is offered at least every second academic year in the winter semester.	
Workload	The workload comprises a total of 180 hours.	
Module duration	The module comprises one semester.	

Module number	Module name	Responsible lecturer
Math-Ma-09	Groups and geometry	Director of the Institute of Geometry id.geometrie@tu-dresden.de
Qualification objectives	Students have a sound knowledge of the most important notions and theorems of geometric group theory and the theory of Lie groups and algebras. They are able to apply the learned geometric, algebraic and analytical methods precisely and independently and have a basic understanding of the connection with other areas of mathematics.	
Content	Contents of the module are basic methods, concepts and theorems of the theory of symmetries of geometric structures.	
Teaching and learning methods	The module comprises 3 hours per week lecture, 1 hour per week exercise and self-study. The lectures and the exercises will be held either in German or English. This will be specified by the lecturer at the beginning of each semester and announced in the usual manner.	
Prerequisites for participation	Knowledge in in geometry and algebraic structures at the Bachelor's level is required. Literature (german and english): - Bosch, S.: Lineare Algebra, Springer-Lehrbuch, Springer, - Bosch, S.: Algebra, Springer-Lehrbuch, Springer, - Hungerford, T. W.: Algebra, Graduate Texts in Mathematics, Springer.	
Applicability	This module is one of 35 compulsory elective modules in the compulsory elective area M of the Master’s degree program Mathematics, of which modules with a total of at least 66 credit points must be selected. Furthermore, this module is one of 34 compulsory elective modules in the compulsory elective area M of the Master’s degree program Technomathematics, of which modules with a total of at least 42 credit points must be selected. In addition, this module is one of 31 compulsory elective modules in the compulsory elective area M of the Master’s degree program Mathematics in Business and Economics, of which modules with a total of at least 24 credit points must be selected.	
Requirements for earning credit points	Credit points are earned after passing the module examination. The module examination consists of a non-public oral examination lasting 25 minutes as an individual examination. The language of the examination is German or English, at the student's choice.	
Credit points and grades	Participants can earn six credit points for this module. The module grade corresponds to the grade of the examined assessment.	
Module frequency	The module is offered at least every second academic year in the summer semester.	
Workload	The workload comprises a total of 180 hours.	
Module duration	The module comprises one semester.	

Module number	Module name	Responsible lecturer
Math-Ma-10	Algebraic methods in geometry	Director of the Institute of Geometry id.geometrie@tu-dresden.de
Qualification objectives	Students have a sound knowledge of the most important notions and theorems of algebraic, algorithmic and combinatorial geometry. They are able to apply geometric, algebraic, algorithmic and combinatorial methods precisely and independently and have a basic understanding of the connections with other areas of mathematics. They are able to formulate precise definitions, give proofs and apply the methods to examples.	
Content	The module covers basic methods, concepts and theorems of algebraic geometry, real algebraic geometry, algorithmic geometry and combinatorial geometry.	
Teaching and learning methods	The module comprises 3 hours per week lecture, 1 hour per week exercise and self-study. The lectures and the exercises will be held either in German or English. This will be specified by the lecturer at the beginning of each semester and announced in the usual manner.	
Prerequisites for participation	Knowledge in in geometry and algebraic structures at the Bachelor's level is required. Literature (german and english): - Bosch, S.: Algebra, Springer-Lehrbuch, Springer, - Shafarevich, I. R.: Basic Algebraic Geometry, Springer, - Hungerford, T. W.: Algebra, Graduate Texts in Mathematics, Springer.	
Applicability	This module is one of 35 compulsory elective modules in the compulsory elective area M of the Master's degree program Mathematics, of which modules with a total of at least 66 credit points must be selected. Furthermore, this module is one of 34 compulsory elective modules in the compulsory elective area M of the Master's degree program Technomathematics, of which modules with a total of at least 42 credit points must be selected. In addition, this module is one of 31 compulsory elective modules in the compulsory elective area M of the Master's degree program Mathematics in Business and Economics, of which modules with a total of at least 24 credit points must be selected.	
Requirements for earning credit points	Credit points are earned after passing the module examination. The module examination consists of a non-public oral examination lasting 25 minutes as an individual examination. The language of the examination is German or English, at the student's choice.	
Credit points and grades	Participants can earn six credit points for this module. The module grade corresponds to the grade of the examined assessment.	
Module frequency	The module is offered at least every second academic year in the winter semester.	
Workload	The workload comprises a total of 180 hours.	
Module duration	The module comprises one semester.	

Module number	Module name	Responsible lecturer
Math-Ma-11	Real algebra	Director of the Institute of Geometry id.geometrie@tu-dresden.de
Qualification objectives	Students have a sound knowledge of the most important concepts and theorems of real algebra. They are able to apply the methods of real algebra and semialgebraic geometry accurately and independently, and have a basic understanding of the connections with other areas of mathematics. They are able to formulate precise definitions, give proofs, and apply the methods to examples.	
Content	The module covers basic methods, concepts, and theorems of real algebra and semialgebraic geometry.	
Teaching and learning methods	The module comprises 3 hours per week lecture, 1 hour per week exercise and self-study. The lectures and the exercises will be held either in German or English. This will be specified by the lecturer at the beginning of each semester and announced in the usual manner.	
Prerequisites for participation	Knowledge in geometry at the Bachelor's level is required. Literature (german and english): - Bosch, S.: Lineare Algebra, Springer-Lehrbuch, Springer, - Jänich, K.: Lineare Algebra, Springer-Lehrbuch, Springer, - Hungerford, T. W.: Algebra, Graduate Texts in Mathematics, Springer.	
Applicability	This module is one of 35 compulsory elective modules in the compulsory elective area M of the Master’s degree program Mathematics, of which modules with a total of at least 66 credit points must be selected. Furthermore, this module is one of 34 compulsory elective modules in the compulsory elective area M of the Master’s degree program Technomathematics, of which modules with a total of at least 42 credit points must be selected. In addition, this module is one of 31 compulsory elective modules in the compulsory elective area M of the Master’s degree program Mathematics in Business and Economics, of which modules with a total of at least 24 credit points must be selected.	
Requirements for earning credit points	Credit points are earned after passing the module examination. The module examination consists of a non-public oral examination lasting 25 minutes as an individual examination. The language of the examination is German or English, at the student's choice.	
Credit points and grades	Participants can earn six credit points for this module. The module grade corresponds to the grade of the examined assessment.	
Module frequency	The module is offered at least every second academic year in the summer semester.	
Workload	The workload comprises a total of 180 hours.	
Module duration	The module comprises one semester.	

Module number	Module name	Responsible lecturer
Math-Ma-12	Functional analysis	Director of the Institute for Analysis id.analysis@tu-dresden.de
Qualification objectives	Students have a sound knowledge of the concepts and techniques of functional analysis. They have a solid competence in recognizing, independently analyzing, processing and applying functional analysis problems and structures. They possess general problem solving and analytical thinking skills.	
Content	The module covers concepts from selected areas of functional analysis. These areas include for example operator theory and spectral theory, theory of Banach algebras and C*-algebras, theory of C_0-semigroups, geometry of Banach spaces, theory of topological vector spaces and their respective applications.	
Teaching and learning methods	The module comprises 3 hours per week lecture, 1 hour per week exercise and self-study. The lectures and the exercises will be held either in German or English. This will be specified by the lecturer at the beginning of each semester and announced in the usual manner.	
Prerequisites for participation	Knowledge in analysis at the Bachelor's level is required. Literature (german and english): - Amann, H. / Escher, J.: Analysis. I, II, III, Birkhäuser Verlag, 2005, 2008, 2009, - Brezis: Functional analysis, Sobolev spaces and partial differential equations, Springer, 2011, - Werner, D.: Funktionalanalysis, Springer.	
Applicability	This module is one of 35 compulsory elective modules in the compulsory elective area M of the Master's degree program Mathematics, of which modules with a total of at least 66 credit points must be selected. Furthermore, this module is one of 34 compulsory elective modules in the compulsory elective area M of the Master's degree program Technomathematics, of which modules with a total of at least 42 credit points must be selected. In addition, this module is one of 31 compulsory elective modules in the compulsory elective area M of the Master's degree program Mathematics in Business and Economics, of which modules with a total of at least 24 credit points must be selected.	
Requirements for earning credit points	Credit points are earned after passing the module examination. The module examination consists of a non-public oral examination lasting 25 minutes as an individual examination. The language of the examination is German or English, at the student's choice.	
Credit points and grades	Participants can earn six credit points for this module. The module grade corresponds to the grade of the examined assessment.	
Module frequency	The module is offered at least once in four consecutive semesters.	
Workload	The workload comprises a total of 180 hours.	
Module duration	The module comprises one semester.	

Module number	Module name	Responsible lecturer
Math-Ma-13	Methods of functional analysis	Director of the Institute for Analysis id.analysis@tu-dresden.de
Qualification objectives	Students understand the connections between basic and advanced functional analysis concepts. They are able to analyze and address specific functional analysis questions using advanced methods and to identify and formulate open questions.	
Content	The module covers advanced concepts and applications of functional analysis based on fundamental functional analytic ideas. These include, for example, nonlinear functional analysis, and here in particular the theory of nonlinear semigroups and nonlinear evolution equations, harmonic analysis on Banach spaces, interpolation theory, and the theory of ordered vector lattices.	
Teaching and learning methods	The module comprises 3 hours per week lecture, 1 hour per week exercise and self-study. The lectures and the exercises will be held either in German or English. This will be specified by the lecturer at the beginning of each semester and announced in the usual manner.	
Prerequisites for participation	Knowledge in analysis at the Bachelor's level is required. Literature (german and english): - Amann, H. / Escher, J.: Analysis. I, II, III, Birkhäuser Verlag, 2005, 2008, 2009, - Brezis: Functional analysis, Sobolev spaces and partial differential equations, Springer, 2011, - Werner, D.: Funktionalanalysis, Springer.	
Applicability	This module is one of 35 compulsory elective modules in the compulsory elective area M of the Master's degree program Mathematics, of which modules with a total of at least 66 credit points must be selected. Furthermore, this module is one of 34 compulsory elective modules in the compulsory elective area M of the Master's degree program Technomathematics, of which modules with a total of at least 42 credit points must be selected. In addition, this module is one of 31 compulsory elective modules in the compulsory elective area M of the Master's degree program Mathematics in Business and Economics, of which modules with a total of at least 24 credit points must be selected.	
Requirements for earning credit points	Credit points are earned after passing the module examination. The module examination consists of a non-public oral examination lasting 25 minutes as an individual examination. The language of the examination is German or English, at the student's choice.	
Credit points and grades	Participants can earn six credit points for this module. The module grade corresponds to the grade of the examined assessment.	
Module frequency	The module is offered at least once in four consecutive semesters.	
Workload	The workload comprises a total of 180 hours.	
Module duration	The module comprises one semester.	

Module number	Module name	Responsible lecturer
Math-Ma-14	Nonlinear analysis	Director of the Institute of Geometry id.geometrie@tu-dresden.de
Qualification objectives	Students have a sound knowledge of the concepts and techniques of nonlinear analysis. They have a solid competence to independently analyze and work on specific problems from this area and to identify and formulate open questions.	
Content	The module covers fundamental and advanced results of nonlinear analysis, typical ways of thinking, and applications.	
Teaching and learning methods	The module comprises 3 hours per week lecture, 1 hour per week exercise and self-study. The lectures and the exercises will be held either in German or English. This will be specified by the lecturer at the beginning of each semester and announced in the usual manner.	
Prerequisites for participation	Knowledge in analysis and differential equations at the Bachelor's level is required. Literature (german and english): - Königsberger, K.: Analysis 1+2, Springer, - Werner, D.: Funktionalanalysis, Springer, - Evans, L. C.: Partial Differential Equations, AMS.	
Applicability	This module is one of 35 compulsory elective modules in the compulsory elective area M of the Master's degree program Mathematics, of which modules with a total of at least 66 credit points must be selected. Furthermore, this module is one of 34 compulsory elective modules in the compulsory elective area M of the Master's degree program Technomathematics, of which modules with a total of at least 42 credit points must be selected. In addition, this module is one of 31 compulsory elective modules in the compulsory elective area M of the Master's degree program Mathematics in Business and Economics, of which modules with a total of at least 24 credit points must be selected.	
Requirements for earning credit points	Credit points are earned after passing the module examination. The module examination consists of a non-public oral examination lasting 25 minutes as an individual examination. The language of the examination is German or English, at the student's choice.	
Credit points and grades	Participants can earn six credit points for this module. The module grade corresponds to the grade of the examined assessment.	
Module frequency	The module is offered at least once in four consecutive semesters.	
Workload	The workload comprises a total of 180 hours.	
Module duration	The module comprises one semester.	

Module number	Module name	Responsible lecturer
Math-Ma-15	Methods of analysis	Director of the Institute of Geometry id.geometrie@tu-dresden.de
Qualification objectives	Students understand the connections between basic and advanced concepts in analysis. They have a solid competence to analyze and work independently on specific problems in the field and to identify and formulate open questions.	
Content	The module covers fundamental and advanced results of nonlinear analysis, typical ways of thinking, and applications.	
Teaching and learning methods	The module comprises 3 hours per week lecture, 1 hour per week exercise and self-study. The lectures and the exercises will be held either in German or English. This will be specified by the lecturer at the beginning of each semester and announced in the usual manner.	
Prerequisites for participation	Knowledge in analysis and differential equations at the Bachelor's level is required. Literature (german and english): - Königsberger, K.: Analysis 1+2, Springer, - Werner, D.: Funktionalanalysis, Springer, - Evans, L. C.: Partial Differential Equations, AMS.	
Applicability	This module is one of 35 compulsory elective modules in the compulsory elective area M of the Master's degree program Mathematics, of which modules with a total of at least 66 credit points must be selected. Furthermore, this module is one of 34 compulsory elective modules in the compulsory elective area M of the Master's degree program Technomathematics, of which modules with a total of at least 42 credit points must be selected. In addition, this module is one of 31 compulsory elective modules in the compulsory elective area M of the Master's degree program Mathematics in Business and Economics, of which modules with a total of at least 24 credit points must be selected.	
Requirements for earning credit points	Credit points are earned after passing the module examination. The module examination consists of a non-public oral examination lasting 25 minutes as an individual examination. The language of the examination is German or English, at the student's choice.	
Credit points and grades	Participants can earn six credit points for this module. The module grade corresponds to the grade of the examined assessment.	
Module frequency	The module is offered at least once in four consecutive semesters.	
Workload	The workload comprises a total of 180 hours.	
Module duration	The module comprises one semester.	

Module number	Module name	Responsible lecturer
Math-Ma-16	Partial differential equations	Director of the Institute of Geometry id.geometrie@tu-dresden.de
Qualification objectives	Students have a sound knowledge of concepts and techniques in the field of partial differential equations. They have a solid competence to independently analyze and work on specific problems in this field and to identify and formulate open questions.	
Content	Contents of the module are concepts from selected areas of the theory of partial differential equations, typical ways of thinking and applications.	
Teaching and learning methods	The module comprises 3 hours per week lecture, 1 hour per week exercise and self-study. The lectures and the exercises will be held either in German or English. This will be specified by the lecturer at the beginning of each semester and announced in the usual manner.	
Prerequisites for participation	Knowledge in analysis and differential equations at the Bachelor's level is required. Literature (german and english): - Königsberger, K.: Analysis 1+2, Springer, - Werner, D.: Funktionalanalysis, Springer, - Evans, L. C.: Partial Differential Equations, AMS.	
Applicability	This module is one of 35 compulsory elective modules in the compulsory elective area M of the Master's degree program Mathematics, of which modules with a total of at least 66 credit points must be selected. Furthermore, this module is one of 34 compulsory elective modules in the compulsory elective area M of the Master's degree program Technomathematics, of which modules with a total of at least 42 credit points must be selected. In addition, this module is one of 31 compulsory elective modules in the compulsory elective area M of the Master's degree program Mathematics in Business and Economics, of which modules with a total of at least 24 credit points must be selected.	
Requirements for earning credit points	Credit points are earned after passing the module examination. The module examination consists of a non-public oral examination lasting 25 minutes as an individual examination. The language of the examination is German or English, at the student's choice.	
Credit points and grades	Participants can earn six credit points for this module. The module grade corresponds to the grade of the examined assessment.	
Module frequency	The module is offered at least every second academic year in the winter semester.	
Workload	The workload comprises a total of 180 hours.	
Module duration	The module comprises one semester.	

Module number	Module name	Responsible lecturer
Math-Ma-17	Methods for partial differential equations	Director of the Institute of Geometry id.geometrie@tu-dresden.de
Qualification objectives	Students understand the connections between basic and advanced concepts and techniques in the field of partial differential equations. They have a solid competence to independently analyze and work on specific problems in this area and to identify and formulate open questions.	
Content	The module covers advanced methods and applications of the theory of partial differential equations based on fundamental and important ways of thinking.	
Teaching and learning methods	The module comprises 3 hours per week lecture, 1 hour per week exercise and self-study. The lectures and the exercises will be held either in German or English. This will be specified by the lecturer at the beginning of each semester and announced in the usual manner.	
Prerequisites for participation	Knowledge in analysis and differential equations at the Bachelor's level is required. Literature (german and english): - Königsberger, K.: Analysis 1+2, Springer, - Werner, D.: Funktionalanalysis, Springer, - Evans, L. C.: Partial Differential Equations, AMS.	
Applicability	This module is one of 35 compulsory elective modules in the compulsory elective area M of the Master's degree program Mathematics, of which modules with a total of at least 66 credit points must be selected. Furthermore, this module is one of 34 compulsory elective modules in the compulsory elective area M of the Master's degree program Technomathematics, of which modules with a total of at least 42 credit points must be selected. In addition, this module is one of 31 compulsory elective modules in the compulsory elective area M of the Master's degree program Mathematics in Business and Economics, of which modules with a total of at least 24 credit points must be selected.	
Requirements for earning credit points	Credit points are earned after passing the module examination. The module examination consists of a non-public oral examination lasting 25 minutes as an individual examination. The language of the examination is German or English, at the student's choice.	
Credit points and grades	Participants can earn six credit points for this module. The module grade corresponds to the grade of the examined assessment.	
Module frequency	The module is offered at least every second academic year in the summer semester.	
Workload	The workload comprises a total of 180 hours.	
Module duration	The module comprises one semester.	

Module number	Module name	Responsible lecturer
Math-Ma-18	Dynamical systems – Basic concepts	Director of the Institute for Analysis id.analysis@tu-dresden.de
Qualification objectives	Students have a systematic understanding of the concepts of stability theory, a sound understanding of linearization techniques, a clear idea of bifurcation scenarios and their practical and theoretical relevance, and are able to independently analyze and solve mathematical problems from the theory of dynamical systems.	
Content	The module covers basic concepts of dynamical systems theory, linear and nonlinear theory, such as stability theory, bifurcation theory, and control theory.	
Teaching and learning methods	The module comprises 3 hours per week lecture, 1 hour per week exercise and self-study. The lectures and the exercises will be held either in German or English. This will be specified by the lecturer at the beginning of each semester and announced in the usual manner.	
Prerequisites for participation	Knowledge in ordinary differential equations at the Bachelor's level is required. Literature (german and english): - Lang, S.: Real and functional analysis, Springer, - Aulbach, B.: Gewöhnliche Differenzialgleichungen, Spektrum Akademischer Verlag, Kapitel 1 – 6.	
Applicability	This module is one of 35 compulsory elective modules in the compulsory elective area M of the Master’s degree program Mathematics, of which modules with a total of at least 66 credit points must be selected. Furthermore, this module is one of 34 compulsory elective modules in the compulsory elective area M of the Master’s degree program Technomathematics, of which modules with a total of at least 42 credit points must be selected. In addition, this module is one of 31 compulsory elective modules in the compulsory elective area M of the Master’s degree program Mathematics in Business and Economics, of which modules with a total of at least 24 credit points must be selected.	
Requirements for earning credit points	Credit points are earned after passing the module examination. The module examination consists of a non-public oral examination lasting 25 minutes as an individual examination. The language of the examination is German or English, at the student's choice.	
Credit points and grades	Participants can earn six credit points for this module. The module grade corresponds to the grade of the examined assessment.	
Module frequency	The module is offered at least once in four consecutive semesters.	
Workload	The workload comprises a total of 180 hours.	
Module duration	The module comprises one semester.	

Module number	Module name	Responsible lecturer
Math-Ma-19	Dynamical systems – Modern concepts and applications	Director of the Institute for Analysis id.analysis@tu-dresden.de
Qualification objectives	Students have a sound understanding of modern techniques from the field of dynamical systems and a solid competence to work independently on applied problems from the theory of dynamical systems.	
Content	The module covers advanced concepts of dynamical systems theory, such as non-autonomous dynamics, as well as applications in biology, fluid mechanics, or control theory.	
Teaching and learning methods	The module comprises 3 hours per week lecture, 1 hour per week exercise and self-study. The lectures and the exercises will be held either in German or English. This will be specified by the lecturer at the beginning of each semester and announced in the usual manner.	
Prerequisites for participation	Knowledge in ordinary differential equations at the Bachelor's level is required. Literature (german and english): - Lang, S.: Real and functional analysis, Springer, - Aulbach, B.: Gewöhnliche Differenzialgleichungen, Spektrum Akademischer Verlag, Kapitel 1 – 6.	
Applicability	This module is one of 35 compulsory elective modules in the compulsory elective area M of the Master's degree program Mathematics, of which modules with a total of at least 66 credit points must be selected. Furthermore, this module is one of 34 compulsory elective modules in the compulsory elective area M of the Master's degree program Technomathematics, of which modules with a total of at least 42 credit points must be selected. In addition, this module is one of 31 compulsory elective modules in the compulsory elective area M of the Master's degree program Mathematics in Business and Economics, of which modules with a total of at least 24 credit points must be selected.	
Requirements for earning credit points	Credit points are earned after passing the module examination. The module examination consists of a non-public oral examination lasting 25 minutes as an individual examination. The language of the examination is German or English, at the student's choice.	
Credit points and grades	Participants can earn six credit points for this module. The module grade corresponds to the grade of the examined assessment.	
Module frequency	The module is offered at least once in four consecutive semesters.	
Workload	The workload comprises a total of 180 hours.	
Module duration	The module comprises one semester.	

Module number	Module name	Responsible lecturer
Math-Ma-20	Probability with martingales	Director of the Institute for Mathematical Stochastics id.stochastik@tu-dresden.de
Qualification objectives	Students have acquired systematic knowledge and deeper understanding of martingales in discrete time and of their properties. They are familiar with the central limit theorem and its applications and with the construction of Brownian motion. Students understand elementary properties of Brownian motion and have developed several strategies for solving related problems.	
Content	The module covers martingales, in particular convergence, stopping techniques and inequalities, central limit theorem and construction of Brownian motion and basic distributional and sample path properties.	
Teaching and learning methods	The module comprises 3 hours per week lecture, 1 hour per week exercise and self-study. The lectures and the exercises will be held either in German or English. This will be specified by the lecturer at the beginning of each semester and announced in the usual manner.	
Prerequisites for participation	Knowledge in mathematical stochastics at the Bachelor's level is required. Literature (german and english): - Schilling, R.L.: Measures, Integrals and Martingales. Cambridge Univ. Press. 978-1-316-62024-3, - Schilling, R. L.: Maß und Integral, De Gruyter, - Schilling, R. L.: Wahrscheinlichkeit, De Gruyter, - Jacod, J. / Protter, P.: Probability Essentials, Springer.	
Applicability	This module is a compulsory module in the Master’s degree program Mathematics in Business and Economics. Furthermore, this module is one of 35 compulsory elective modules in the compulsory elective area M of the Master’s degree program Mathematics, of which modules with a total of at least 66 credit points must be selected. In addition, this module is one of 34 compulsory elective modules in the compulsory elective area M of the Master’s degree program Technomathematics, of which modules with a total of at least 42 credit points must be selected. The module is a prerequisite for participation in the modules Methods of financial and actuarial mathematics as well as Stochastic calculus.	
Requirements for earning credit points	Credit points are earned after passing the module examination. The module examination consists of a non-public oral examination lasting 25 minutes as an individual examination. The language of the examination is German or English, at the student's choice.	
Credit points and grades	Participants can earn six credit points for this module. The module grade corresponds to the grade of the examined assessment.	
Module frequency	The module is offered each winter semester.	
Workload	The workload comprises a total of 180 hours.	
Module duration	The module comprises one semester.	

Module number	Module name	Responsible lecturer
Math-Ma-21	Methods of financial and actuarial mathematics	Director of the Institute for Mathematical Stochastics id.stochastik@tu-dresden.de
Qualification objectives	Students are familiar with continuous-time models for financial and actuarial applications. In these models, they are able to price and hedge financial derivatives or to compute ruin probabilities and related quantities. They are able to give interpretations of their results in relation to their area of application	
Content	The module covers continuous-time modeling of financial markets, including stochastic differential equations and risk-neutral valuation of derivatives, or of insurance portfolios, including renewal processes, analytical and approximate methods of ruin theory.	
Teaching and learning methods	The module comprises 3 hours per week lecture, 1 hour per week exercise and self-study. The lectures and the exercises will be held either in German or English. This will be specified by the lecturer at the beginning of each semester and announced in the usual manner.	
Prerequisites for participation	Participants require skills acquired in the module Probability with martingales. Literature: - Schilling, R. L. / Partzsch, L.: Brownian Motion, De Gruyter, - Schilling, R. L.: Measure, Integral, Probability & Processes, independently published.	
Applicability	This module is a compulsory module in the Master's degree program Mathematics in Business and Economics. Furthermore, this module is one of 35 compulsory elective modules in the compulsory elective area M of the Master's degree program Mathematics, of which modules with a total of at least 66 credit points must be selected. In addition, this module is one of 34 compulsory elective modules in the compulsory elective area M of the Master's degree program Technomathematics, of which modules with a total of at least 42 credit points must be selected.	
Requirements for earning credit points	Credit points are earned after passing the module examination. The module examination consists of a non-public oral examination lasting 25 minutes as an individual examination. The language of the examination is German or English, at the student's choice.	
Credit points and grades	Participants can earn six credit points for this module. The module grade corresponds to the grade of the examined assessment.	
Module frequency	The module is offered each summer semester.	
Workload	The workload comprises a total of 180 hours.	
Module duration	The module comprises one semester.	

Module number	Module name	Responsible lecturer
Math-Ma-22	Stochastic calculus	Director of the Institute for Mathematical Stochastics id.stochastik@tu-dresden.de
Qualification objectives	Students have acquired systematic knowledge and deeper understanding of stochastic calculus, and have become familiar with the theory and applications of the Itô integral. They are able to apply stochastic integration to the theory of stochastic differential equations, they understand the theoretical basis of the Feynman-Kac and the Girsanov-Cameron-Martin formula and have developed strategies to solve related problems.	
Content	The module covers stochastic integration, Itô's formula, the theory of stochastic differential equations and their applications.	
Teaching and learning methods	The module comprises 3 hours per week lecture, 1 hour per week exercise and self-study. The lectures and the exercises will be held either in German or English. This will be specified by the lecturer at the beginning of each semester and announced in the usual manner.	
Prerequisites for participation	Participants require skills acquired in the module Probability with martingales. Literature: - Schilling, R. L. / Partzsch, L.: Brownian Motion, De Gruyter, - Schilling, R. L.: Measure, Integral, Probability & Processes, independently published.	
Applicability	This module is one of 35 compulsory elective modules in the compulsory elective area M of the Master's degree program Mathematics, of which modules with a total of at least 66 credit points must be selected. Furthermore, this module is one of 34 compulsory elective modules in the compulsory elective area M of the Master's degree program Technomathematics, of which modules with a total of at least 42 credit points must be selected. In addition, in the Master's degree program Mathematics in Business and Economics, this module is one of three compulsory elective modules in the compulsory elective area S, out of which one module must be selected, as well as one of 31 compulsory elective modules in the compulsory elective area M, of which modules with a total of at least 24 credit points must be selected. The module can only be selected once in the Master's degree program Mathematics in Business and Economics.	
Requirements for earning credit points	Credit points are earned after passing the module examination. The module examination consists of a non-public oral examination lasting 25 minutes as an individual examination. The language of the examination is German or English, at the student's choice.	
Credit points and grades	Participants can earn six credit points for this module. The module grade corresponds to the grade of the examined assessment.	
Module frequency	The module is offered at least once in four consecutive semesters.	
Workload	The workload comprises a total of 180 hours.	

Module duration	The module comprises one semester.

Module number	Module name	Responsible lecturer
Math-Ma-23	Stochastic processes	Director of the Institute for Mathematical Stochastics id.stochastik@tu-dresden.de
Qualification objectives	Students know how to construct stochastic processes, are familiar with elementary examples of stochastic processes, such as stationary, Gaussian, Lévy- or Markov-processes. They understand basic principles of the (stochastic) analysis of random processes and have developed concrete strategies to solve related problems.	
Content	The module covers the construction of stochastic processes, their path properties and distributional properties, methods for the analysis of stochastic processes.	
Teaching and learning methods	The module comprises 3 hours per week lecture, 1 hour per week exercise and self-study. The lectures and the exercises will be held either in German or English. This will be specified by the lecturer at the beginning of each semester and announced in the usual manner.	
Prerequisites for participation	Knowledge in mathematical stochastics at the Bachelor's level is required. Literature (german and english): - Schilling, R.L.: Measures, Integral, Probability & Processes. Independently published. 979-8-59910488-9, - Schilling, R. L.: Maß und Integral, De Gruyter, - Schilling, R. L.: Wahrscheinlichkeit, De Gruyter, - Jacod, J. / Protter, P.: Probability Essentials, Springer.	
Applicability	This module is one of 35 compulsory elective modules in the compulsory elective area M of the Master’s degree program Mathematics, of which modules with a total of at least 66 credit points must be selected. Furthermore, this module is one of 34 compulsory elective modules in the compulsory elective area M of the Master’s degree program Technomathematics, of which modules with a total of at least 42 credit points must be selected. In addition, in the Master’s degree program Mathematics in Business and Economics, this module is one of three compulsory elective modules in the compulsory elective area S, out of which one module must be selected, as well as one of 31 compulsory elective modules in the compulsory elective area M, of which modules with a total of at least 24 credit points must be selected. The module can only be selected once in the Master's degree program Mathematics in Business and Economics.	
Requirements for earning credit points	Credit points are earned after passing the module examination. The module examination consists of a non-public oral examination lasting 25 minutes as an individual examination. The language of the examination is German or English, at the student's choice.	
Credit points and grades	Participants can earn six credit points for this module. The module grade corresponds to the grade of the examined assessment.	
Module frequency	The module is offered at least once in four consecutive semesters.	

Workload	The workload comprises a total of 180 hours.
Module duration	The module comprises one semester.

Module number	Module name	Responsible lecturer
Math-Ma-24	Mathematical statistics	Director of the Institute for Mathematical Stochastics id.stochastik@tu-dresden.de
Qualification objectives	Students are able to derive functional limit theorems for empirical processes, are familiar with the basic principles of the theory of empirical processes and their applications in statistics. They have acquired a systematic understanding of irregular statistical experiments and are able to apply martingale methods.	
Content	The module covers weak convergence of probability measures on metric spaces, convergence criteria in special function spaces, functional limit theorems with applications in statistics, argmax-theorems and convex stochastic processes.	
Teaching and learning methods	The module comprises 3 hours per week lecture, 1 hour per week exercise and self-study. The lectures and the exercises will be held either in German or English. This will be specified by the lecturer at the beginning of each semester and announced in the usual manner.	
Prerequisites for participation	Knowledge in mathematical stochastics at the Bachelor's level is required. Literature (german and english): - Schilling, R.L.: Measures, Integral, Probability & Processes. Independently published. 979-8-59910488-9, - Schilling, R. L.: Maß und Integral, De Gruyter, - Schilling, R. L.: Wahrscheinlichkeit, De Gruyter, - Jacod, J. / Protter, P.: Probability Essentials, Springer.	
Applicability	This module is a compulsory module in the Master’s degree program Mathematics in Business and Economics. Furthermore, this module is one of 35 compulsory elective modules in the compulsory elective area M of the Master’s degree program Mathematics, of which modules with a total of at least 66 credit points must be selected. In addition, this module is one of 34 compulsory elective modules in the compulsory elective area M of the Master’s degree program Technomathematics, of which modules with a total of at least 42 credit points must be selected.	
Requirements for earning credit points	Credit points are earned after passing the module examination. The module examination consists of a non-public oral examination lasting 25 minutes as an individual examination. The language of the examination is German or English, at the student's choice.	
Credit points and grades	Participants can earn six credit points for this module. The module grade corresponds to the grade of the examined assessment.	
Module frequency	The module is offered each summer semester.	
Workload	The workload comprises a total of 180 hours.	
Module duration	The module comprises one semester.	

Module number	Module name	Responsible lecturer
Math-Ma-25	Statistical methods	Director of the Institute for Mathematical Stochastics id.stochastik@tu-dresden.de
Qualification objectives	Students understand basic concepts and methods of statistics. They have acquired systematic knowledge of selected statistical methods, are familiar with important concepts and results and are able to formulate precise definitions and proofs. They are able to apply different methods of estimation and prediction to statistical data and to interpret their results.	
Content	The module covers basic and advanced methods for estimation and prediction, such as linear models, statistics of extreme values, time series analysis, and statistical models in machine learning.	
Teaching and learning methods	The module comprises 3 hours per week lecture, 1 hour per week exercise and self-study. The lectures and the exercises will be held either in German or English. This will be specified by the lecturer at the beginning of each semester and announced in the usual manner.	
Prerequisites for participation	Knowledge in mathematical stochastics at the Bachelor's level is required. Literature (german and english): - Schilling, R.L.: Measures, Integral, Probability & Processes. Independently published. 979-8-59910488-9, - Schilling, R. L.: Maß und Integral, De Gruyter, - Schilling, R. L.: Wahrscheinlichkeit, De Gruyter, - Jacod, J. / Protter, P.: Probability Essentials, Springer.	
Applicability	This module is one of 35 compulsory elective modules in the compulsory elective area M of the Master’s degree program Mathematics, of which modules with a total of at least 66 credit points must be selected. Furthermore, this module is one of 34 compulsory elective modules in the compulsory elective area M of the Master’s degree program Technomathematics, of which modules with a total of at least 42 credit points must be selected. In addition, in the Master’s degree program Mathematics in Business and Economics, this module is one of three compulsory elective modules in the compulsory elective area S, out of which one module must be selected, as well as one of 31 compulsory elective modules in the compulsory elective area M, of which modules with a total of at least 24 credit points must be selected. The module can only be selected once in the Master's degree program Mathematics in Business and Economics.	
Requirements for earning credit points	Credit points are earned after passing the module examination. The module examination consists of a non-public oral examination lasting 25 minutes as an individual examination. The language of the examination is German or English, at the student's choice.	
Credit points and grades	Participants can earn six credit points for this module. The module grade corresponds to the grade of the examined assessment.	
Module frequency	The module is offered at least once in four consecutive semesters.	

Workload	The workload comprises a total of 180 hours.
Module duration	The module comprises one semester.

Module number	Module name	Responsible lecturer
Math-Ma-26	Continuous optimization	Director of the Institute for Numerical Mathematics id.numerik@tu-dresden.de
Qualification objectives	The students know the essential terms, their interaction and their importance for the treatment of continuous optimization problems, they understand basic and advanced algorithmic concepts and their convergence properties, and and they are able to independently analyze and model concrete optimization problems, to select suitable algorithms for them, and to evaluate them with respect to effort and accuracy.	
Content	The module covers necessary and sufficient optimality conditions including constraint qualifications, convexity notions and their importance for solving optimization problems, algorithmic concepts for solving optimization problems, and global and locally superlinear convergence properties of corresponding algorithms.	
Teaching and learning methods	The module comprises 3 hours per week lecture, 1 hour per week exercise and self-study. The lectures and the exercises will be held either in German or English. This will be specified by the lecturer at the beginning of each semester and announced in the usual manner.	
Prerequisites for participation	Knowledge in optimization at the Bachelor's level is required. Literature (german and english): - Jorge Nocedal und Stephen J. Wright: Numerical Optimization, Springer 2006, - Großmann, C. / Terno, J.: Numerik der Optimierung, Teubner, Kapitel 1-4 und 6.	
Applicability	This module is a compulsory module in the Master's degree program Mathematics in Business and Economics. Furthermore, this module is one of 35 compulsory elective modules in the compulsory elective area M of the Master's degree program Mathematics, of which modules with a total of at least 66 credit points must be selected. In addition, this module is one of 34 compulsory elective modules in the compulsory elective area M of the Master's degree program Technomathematics, of which modules with a total of at least 42 credit points must be selected.	
Requirements for earning credit points	Credit points are earned after passing the module examination. The module examination consists of a non-public oral examination lasting 25 minutes as an individual examination. The language of the examination is German or English, at the student's choice.	
Credit points and grades	Participants can earn six credit points for this module. The module grade corresponds to the grade of the examined assessment.	
Module frequency	The module is offered each winter semester.	
Workload	The workload comprises a total of 180 hours.	
Module duration	The module comprises one semester.	

Module number	Module name	Responsible lecturer
Math-Ma-27	Discrete optimization	Director of the Institute for Numerical Mathematics id.numerik@tu-dresden.de
Qualification objectives	Students know the essential concepts, their interaction and their importance for the solution of discrete optimization problems, understand basic algorithmic concepts, and and they are able to independently analyze and model concrete optimization problems as well as select suitable algorithms for them.	
Content	The module covers concepts and related theoretical tools for solving discrete optimization problems, in particular the branch-and-bound principle, as well as aspects of modeling and complexity. Integer linear optimization problems occupy a large space, including in particular the basics of polyhedra and integer polyhedra, as well as principles for generating cuts. Other topics are round trip problems and optimization problems on graphs and on matroids.	
Teaching and learning methods	The module comprises 3 hours per week lecture, 1 hour per week exercise and self-study. The lectures and the exercises will be held either in German or English. This will be specified by the lecturer at the beginning of each semester and announced in the usual manner.	
Prerequisites for participation	Knowledge in optimization at the Bachelor's level is required. Literature (german and english): - George Nemhauser, Laurence Wolsey: Integer and Combinatorial Optimization, Wiley 1999, - Großmann, C. / Terno, J.: Numerik der Optimierung, Teubner, Kapitel 1, 2, 4, 9 und 10.	
Applicability	This module is a compulsory module in the Master’s degree program Mathematics in Business and Economics. Furthermore, this module is one of 35 compulsory elective modules in the compulsory elective area M of the Master’s degree program Mathematics, of which modules with a total of at least 66 credit points must be selected. In addition, this module is one of 34 compulsory elective modules in the compulsory elective area M of the Master’s degree program Technomathematics, of which modules with a total of at least 42 credit points must be selected.	
Requirements for earning credit points	Credit points are earned after passing the module examination. The module examination consists of a non-public oral examination lasting 25 minutes as an individual examination. The language of the examination is German or English, at the student's choice.	
Credit points and grades	Participants can earn six credit points for this module. The module grade corresponds to the grade of the examined assessment.	
Module frequency	The module is offered each summer semester.	
Workload	The workload comprises a total of 180 hours.	
Module duration	The module comprises one semester.	

Module number	Module name	Responsible lecturer
Math-Ma-29	Numerical methods for partial differential equations – Advanced concepts	Director of the Institute for Numerical Mathematics id.numerik@tu-dresden.de
Qualification objectives	Students have a systematic understanding of basic models, are able to adapt discretization techniques to specific models, and have a clear idea of recent developments and current issues. They are able to analyze concrete problems independently and to solve them numerically with the provided techniques, and they know the perspectives and limits of the treated methods with respect to efficiency and accuracy.	
Content	The module covers advanced concepts in the analytical and numerical treatment of problems with partial differential equations, such as the analysis and numerics of model-adaptive discretization techniques, and the theory and numerics of optimal control problems.	
Teaching and learning methods	The module comprises 3 hours per week lecture, 1 hour per week exercise and self-study. The lectures and the exercises will be held either in German or English. This will be specified by the lecturer at the beginning of each semester and announced in the usual manner.	
Prerequisites for participation	Knowledge of the numerics of partial differential equations acquired in the module Numerical Methods for Partial Differential Equations – Basic Concepts is required.	
Applicability	This module is one of 35 compulsory elective modules in the compulsory elective area M of the Master's degree program Mathematics, of which modules with a total of at least 66 credit points must be selected. Furthermore, this module is one of 34 compulsory elective modules in the compulsory elective area M of the Master's degree program Technomathematics, of which modules with a total of at least 42 credit points must be selected. In addition, this module is one of 31 compulsory elective modules in the compulsory elective area M of the Master's degree program Mathematics in Business and Economics, of which modules with a total of at least 24 credit points must be selected.	
Requirements for earning credit points	Credit points are earned after passing the module examination. The module examination consists of a non-public oral examination lasting 25 minutes as an individual examination. The language of the examination is German or English, at the student's choice.	
Credit points and grades	Participants can earn six credit points for this module. The module grade corresponds to the grade of the examined assessment.	
Module frequency	The module is offered each summer semester.	
Workload	The workload comprises a total of 180 hours.	
Module duration	The module comprises one semester.	

Module number	Module name	Responsible lecturer
Math-Ma-30	Mathematical methods in continuum mechanics	Director of the Institute for Scientific Computing id.wir@tu-dresden.de
Qualification objectives	Students have a sound knowledge of the equations of continuum mechanics and their analytical properties. They are familiar with the mathematical methods used in continuum mechanics and are able to present and apply them. They have a solid competence to analyze and work on mathematical problems independently, to transfer them to new phenomena and to find solutions.	
Content	The module covers the continuum mechanical modeling of fluids and solids. Further topics are the derivation of models for solids and fluids, e.g. linear and nonlinear elasticity, plasticity, Stokes, Euler, Navier-Stokes, and their investigation by methods of partial differential equations and variational calculus. In addition, the module includes current concepts and problems, e.g. in the field of multiscale analysis.	
Teaching and learning methods	The module comprises 3 hours per week lecture, 1 hour per week exercise and self-study. The lectures and the exercises will be held either in German or English. This will be specified by the lecturer at the beginning of each semester and announced in the usual manner.	
Prerequisites for participation	Knowledge in functional analysis and partial differential equations at the Bachelor's level is required. Literature (german and english): - Alt, H. W.: Linear Functional Analysis - An Application-Oriented Introduction, Springer, - Alt, H. W.: Lineare Funktionalanalysis, Springer.	
Applicability	This module is one of 35 compulsory elective modules in the compulsory elective area M of the Master’s degree program Mathematics, of which modules with a total of at least 66 credit points must be selected. Furthermore, this module is one of 34 compulsory elective modules in the compulsory elective area M of the Master’s degree program Technomathematics, of which modules with a total of at least 42 credit points must be selected. In addition, this module is one of 31 compulsory elective modules in the compulsory elective area M of the Master’s degree program Mathematics in Business and Economics, of which modules with a total of at least 24 credit points must be selected.	
Requirements for earning credit points	Credit points are earned after passing the module examination. The module examination consists of a non-public oral examination lasting 25 minutes as an individual examination. The language of the examination is German or English, at the student's choice.	
Credit points and grades	Participants can earn six credit points for this module. The module grade corresponds to the grade of the examined assessment.	
Module frequency	The module is offered at least once in four consecutive semesters.	
Workload	The workload comprises a total of 180 hours.	

Module duration	The module comprises one semester.

Module number	Module name	Responsible lecturer
Math-Ma-32	Scientific computing – Advanced concepts	Director of the Institute for Scientific Computing id.wir@tu-dresden.de
Qualification objectives	The students have a systematic understanding of modeling concepts and know appropriate numerical methods and their theoretical foundations. They have basic experience in the algorithmic implementation of selected methods and their application to relevant problems.	
Content	The module covers aspects of mathematical modeling and theoretical and practical aspects of numerical methods.	
Teaching and learning methods	The module comprises 3 hours per week lecture, 1 hour per week exercise and self-study. The lectures and the exercises will be held either in German or English. This will be specified by the lecturer at the beginning of each semester and announced in the usual manner.	
Prerequisites for participation	Knowledge in modelling and simulation as well as in partial differential equations at the Bachelor's level is required. Literature (german and english): - Eck, C. / Garcke, H. / Knabner, P.:Mathematical Modeling, Springer, - Eck, C. / Garcke, H. / Knabner, P.: Mathematische Modellierung, Springer.	
Applicability	This module is one of 35 compulsory elective modules in the compulsory elective area M of the Master's degree program Mathematics, of which modules with a total of at least 66 credit points must be selected. Furthermore, this module is one of 34 compulsory elective modules in the compulsory elective area M of the Master's degree program Technomathematics, of which modules with a total of at least 42 credit points must be selected. In addition, this module is one of 31 compulsory elective modules in the compulsory elective area M of the Master's degree program Mathematics in Business and Economics, of which modules with a total of at least 24 credit points must be selected.	
Requirements for earning credit points	Credit points are earned after passing the module examination. For more than 20 registered students, the module examination consists of a written test lasting 90 minutes. For up to 20 registered students, the written test will be replaced by a non-public oral examination lasting 25 minutes as an individual examination. The type of examination will be announced in writing at the end of the registration period. The language of the examination corresponds to the language of teaching determined at the beginning of the semester.	
Credit points and grades	Participants can earn six credit points for this module. The module grade corresponds to the grade of the examined assessment.	
Module frequency	The module is offered at least once in four consecutive semesters.	
Workload	The workload comprises a total of 180 hours.	
Module duration	The module comprises one semester.	

Module number	Module name	Responsible lecturer
Math-Ma-33	Scientific programming – Advanced concepts	Director of the Institute for Scientific Computing id.wir@tu-dresden.de
Qualification objectives	Students have a systematic understanding of aspects of software development for the efficient implementation of numerical algorithms. They have experience in evaluating, using, and extending such software.	
Content	The module covers aspects of software development, such as programming on high-performance computers, object-oriented programming, or template-based programming.	
Teaching and learning methods	The module comprises 3 hours per week lecture, 1 hour per week exercise and self-study. The lectures and the exercises will be held either in German or English. This will be specified by the lecturer at the beginning of each semester and announced in the usual manner.	
Prerequisites for participation	Knowledge in modelling and simulation at the Bachelor's level is required. Literature (german and english): - Cormen, T. H. / Leiserson, C. E. / Rivest, R. L. / Stein, C.: Introduction to Algorithms, MIT Press (4th ed. 2022, 3rd ed. 2009), - Cormen, T. H. / Leiserson, C. E. / Rivest, R. L. / Stein, C.: Algorithmen - eine Einführung Introduction to Algorithms, Übersetzung Molitor, P. / Lippert, K. Oldenbourg Verlag, 2013, - Goldberg, D.: What Every Computer Scientist Should Know About Floating-Point Arithmetic, ACM Computing Surveys 23 (1), 1991.	
Applicability	This module is one of 35 compulsory elective modules in the compulsory elective area M of the Master's degree program Mathematics, of which modules with a total of at least 66 credit points must be selected. Furthermore, this module is one of 34 compulsory elective modules in the compulsory elective area M of the Master's degree program Technomathematics, of which modules with a total of at least 42 credit points must be selected. In addition, this module is one of 31 compulsory elective modules in the compulsory elective area M of the Master's degree program Mathematics in Business and Economics, of which modules with a total of at least 24 credit points must be selected.	
Requirements for earning credit points	Credit points are earned after passing the module examination. For more than 20 registered students, the module examination consists of a written test lasting 90 minutes. For up to 20 registered students, the written test will be replaced by a non-public oral examination lasting 25 minutes as an individual examination. The type of examination will be announced in writing at the end of the registration period. The language of the examination corresponds to the language of teaching determined at the beginning of the semester.	
Credit points and grades	Participants can earn six credit points for this module. The module grade corresponds to the grade of the examined assessment.	
Module frequency	The module is offered at least once in four consecutive semesters.	

Workload	The workload comprises a total of 180 hours.
Module duration	The module comprises one semester.

Module number	Module name	Responsible lecturer
Math-Ma-34	Models and methods of applied mathematics	Dean of Studies of the Master's study programmes in Mathematics studiendekan.math@tu-dresden.de
Qualification objectives	Students are able to familiarize themselves with the mathematical foundations of models and methods and to recognize prerequisites for the applicability of methods in general and in specific contexts. Students are able to analyze and evaluate the quality or efficiency of methods. With regard to applications, students know the possibilities and limitations of certain models and mathematical methods.	
Content	Depending on the student's choice, the module covers a special area of applied mathematics selected from the catalog „Models and methods of applied mathematics“, such as Analysis, Algebra, Differential equations, Discrete mathematics, Financial and economic mathematics, Geometry, Numerical mathematics, Modeling and simulation, Optimization, or Stochastics. It also includes connections to other areas of mathematics, engineering, or industry and business.	
Teaching and learning methods	The module comprises 3 hours per week lecture, 1 hour per week exercise and self-study. The mathematical specialization and the corresponding courses are to be chosen from the catalogue Models and methods of applied mathematics. This catalogue will be announced at the beginning of each semester in the usual manner. The lectures and the exercises will be held either in German or English. This will be specified by the lecturer at the beginning of each semester and announced in the usual manner.	
Prerequisites for participation	Knowledge in mathematics at the Bachelor's level is required.	
Applicability	This module is one of 35 compulsory elective modules in the compulsory elective area M of the Master’s degree program Mathematics, of which modules with a total of at least 66 credit points must be selected. Furthermore, this module is one of 34 compulsory elective modules in the compulsory elective area M of the Master’s degree program Technomathematics, of which modules with a total of at least 42 credit points must be selected. In addition, this module is one of 31 compulsory elective modules in the compulsory elective area M of the Master’s degree program Mathematics in Business and Economics, of which modules with a total of at least 24 credit points must be selected.	
Requirements for earning credit points	Credit points are earned after passing the module examination. The module examination consists of a complex assessment equating to 15 hours. The language of the examination is German or English, at the student's choice.	
Credit points and grades	Participants can earn six credit points for this module. The module grade corresponds to the grade of the examined assessment.	
Module frequency	The module is offered at least once per academic year.	
Workload	The workload comprises a total of 180 hours.	

Module duration	The module comprises one semester.

Module number	Module name	Responsible lecturer
Math-Ma-35	Models and methods of pure mathematics	Dean of Studies of the Master's study programmes in Mathematics studiendekan.math@tu-dresden.de
Qualification objectives	Students are able to familiarize themselves with the mathematical foundations of models, structures and methods and to recognize the prerequisites for the applicability of methods in general and in specific contexts. Students are able to analyze and evaluate models, structures and methods with regard to their possibilities, limitations and usefulness.	
Content	Depending on the student's choice, the module covers a special area of pure mathematics selected from the catalog „Models and methods of pure mathematics“, such as Analysis, Algebra, Differential equations, Discrete mathematics, Financial and economic mathematics, Geometry, Numerical mathematics, Modeling and simulation, Optimization, or Stochastics. This includes connections to other areas of mathematics or the sciences.	
Teaching and learning methods	The module comprises 3 hours per week lecture, 1 hour per week exercise and self-study. The mathematical specialization and the corresponding courses are to be chosen from the catalogue Models and methods of pure mathematics. This catalogue will be announced at the beginning of each semester in the usual manner. The lectures and the exercises will be held either in German or English. This will be specified by the lecturer at the beginning of each semester and announced in the usual manner.	
Prerequisites for participation	Knowledge in mathematics at the Bachelor's level is required.	
Applicability	This module is one of 35 compulsory elective modules in the compulsory elective area M of the Master’s degree program Mathematics, of which modules with a total of at least 66 credit points must be selected. Furthermore, this module is one of 34 compulsory elective modules in the compulsory elective area M of the Master’s degree program Technomathematics, of which modules with a total of at least 42 credit points must be selected. In addition, this module is one of 31 compulsory elective modules in the compulsory elective area M of the Master’s degree program Mathematics in Business and Economics, of which modules with a total of at least 24 credit points must be selected.	
Requirements for earning credit points	Credit points are earned after passing the module examination. The module examination consists of a complex assessment equating to 15 hours. The language of the examination is German or English, at the student's choice.	
Credit points and grades	Participants can earn six credit points for this module. The module grade corresponds to the grade of the examined assessment.	
Module frequency	The module is offered at least once per academic year.	
Workload	The workload comprises a total of 180 hours.	
Module duration	The module comprises one semester.	

Module number	Module name	Responsible lecturer
Math-Ma-MI	Mathematical Internship	Dean of Studies of the Master's study programmes in Mathematics studiendekan.math@tu-dresden.de
Qualification objectives	Students have insight into practical tasks, processes and frameworks related to mathematical activities. They are aware of possible career fields, have extended their existing knowledge in practice and can apply it. They can reflect on practical work experience and relate it to the knowledge acquired in the core area. Students have the ability to take on new tasks, navigate unfamiliar environments and fit into unfamiliar teams. Their communication and self-organization skills will be strengthened.	
Content	The module covers the practical application of acquired theoretical knowledge in mathematical fields of activity, where students gain their own experience in a professional environment and bring it into professional practice.	
Teaching and learning methods	The module comprises 160 hours (4 weeks) of internship and self-study.	
Prerequisites for participation	None.	
Applicability	This module is one of 34 compulsory elective modules in the compulsory elective area M of the Master's degree program Technomathematics, of which modules with a total of at least 42 credit points must be selected. Furthermore, this module is one of 31 compulsory elective modules in the compulsory elective area M of the Master's degree program Mathematics in Business and Economics, of which modules with a total of at least 24 credit points must be selected.	
Requirements for earning credit points	Credit points are earned after passing the module examination. The module examination consists of an ungraded portfolio equating to 10 hours. The language of the examination is German or English, at the student's choice.	
Credit points and grades	Participants can earn six credit points for this module. The module examination will be graded as either "pass" or "fail".	
Module frequency	The module is offered each semester.	
Workload	The workload comprises a total of 180 hours.	
Module duration	The module comprises one semester.	

Module number	Module name	Responsible lecturer
Math-Ma-RBI	Research and Business Internship	Dean of Studies of the Master's study programmes in Mathematics studiendekan.math@tu-dresden.de
Qualification objectives	Students have insight into practical tasks, processes and frameworks related to the application of mathematical topics. They are aware of possible areas of employment, have expanded their existing knowledge in a company or research institution and are able to apply it. They are able to reflect on their practical work experience and relate it to the knowledge they have acquired in the core area. Students have the ability to face new tasks and applications, to navigate in unfamiliar environments, and to fit into unfamiliar teams. Their communication and self-organization skills are strengthened.	
Content	The module covers the practical application of acquired knowledge in mathematical fields of activity, companies, enterprises, research institutions and similar institutions, where students gain their own experience in a professional non-university environment and bring it into professional practice.	
Teaching and learning methods	The module comprises 160 hours (4 weeks) of internship and self-study.	
Prerequisites for participation	None.	
Applicability	In the compulsory elective area N of the Master's program Technomathematics, in which modules with a total of at least 24 credit points are to be chosen, the module is one of eight compulsory elective modules in the specialization Electrical Engineering - Basic, one of eight compulsory elective modules in the specialization Electrical Engineering - Advanced, one of nine compulsory elective modules in the specialization Computer Science - Basic, one of ten compulsory elective modules in the specialization Computer Science - Advanced, one of six compulsory elective modules in the specialization Mechanical Engineering - Basic, one of eight compulsory elective modules in the specialization Mechanical Engineering - Advanced, one of eight compulsory elective modules in the specialization Physics - Basic and one of seven compulsory elective modules in the specialization Physics - Advanced. In the compulsory elective area N of the Master's program Mathematics in Business and Economics, in which modules of at least 24 credit points have to be chosen, the module is one of eleven compulsory elective modules in the specialization Business and Economics - Basic and one of 15 compulsory elective modules in the specialization Business and Economics - Advanced.	
Requirements for earning credit points	Credit points are earned after passing the module examination. The module examination consists of an ungraded portfolio equating to 10 hours. The language of the examination is German or English, at the student's choice.	
Credit points and grades	Participants can earn six credit points for this module. The module examination will be graded as either “pass” or “fail”.	
Module frequency	The module is offered each semester.	

Workload	The workload comprises a total of 180 hours.
Module duration	The module comprises one semester.

Module number	Module name	Responsible lecturer
Math-Ma-E01	Basics of Electrical Engineering	Prof. Ronald Tetzlaff ronald.tetzlaff@tu-dresden.de
Qualification objectives	Students have a basic knowledge of electrical engineering and electronics and master methods for solving electrical engineering problems with an emphasis on resistive circuits. They are able to describe linear and nonlinear two poles and to consider the temperature dependence of their parameters, to analyze systematically electrical DC circuits and to apply simplified analysis methods such as two pole theory, superposition theorem. They are able to calculate the power dissipation in circuits as well as to analyze and determine their thermal behaviour.	
Content	The module covers basic electrical quantities, resistive dipoles, current and voltage sources, methods of network analysis, and electrothermal analogies.	
Teaching and learning methods	The module comprises 2 hours per week lecture, 2 hours per week exercise and self-study. The lecture and the exercise will be held in German.	
Prerequisites for participation	None.	
Applicability	In the compulsory elective area N of the Master's program Mathematics, in which modules with a total of at least 18 credit points are to be chosen, the module is one of seven compulsory elective modules in the specialization Electrical Engineering – Basic. Furthermore, in the compulsory elective area N of the Master's program Technomathematics, in which modules with a total of at least 24 credit points have to be chosen, the module is one of eight compulsory elective modules in the specialization Electrical Engineering – Basic. The module cannot be chosen if it has already been taken in the Bachelor's program.	
Requirements for earning credit points	Credit points are earned after passing the module examination. The module examination consists of a written test lasting 150 minutes. The language of the examination is German.	
Credit points and grades	Participants can earn six credit points for this module. The module grade corresponds to the grade of the examined assessment.	
Module frequency	The module is offered each winter semester.	
Workload	The workload comprises a total of 180 hours.	
Module duration	The module comprises one semester.	

Module number	Module name	Responsible lecturer
Math-Ma-E02	Electrical and Magnetic Fields	Prof. Ronald Tetzlaff ronald.tetzlaff@tu-dresden.de
Qualification objectives	After completing this module, students understand basic concepts, know physical quantities, and apply methods for calculating basic electric and magnetic fields. They are able to calculate the stored field energy, force effects, and induction phenomena of magnetic fields. Basic principles and the elementary electronic components resistor, capacitor, inductor, and transformer are known.	
Content	The module covers electric flow fields, electrostatic fields and magnetic fields.	
Teaching and learning methods	The module comprises 4 hours per week lecture, 2 hours per week exercise and self-study. The lecture and the exercise will be held in German.	
Prerequisites for participation	Algebraic and analytical basics as well as basic knowledge of electrical engineering as taught in the module Basics of Electrical Engineering at the Bachelor's level of the Electrical Engineering program are required.	
Applicability	In the compulsory elective area N of the Master's program Mathematics, in which modules with a total of at least 18 credit points are to be chosen, the module is one of seven compulsory elective modules in the specialization Electrical Engineering – Basic. Furthermore, in the compulsory elective area N of the Master's program Technomathematics, in which modules with a total of at least 24 credit points have to be chosen, the module is one of eight compulsory elective modules in the specialization Electrical Engineering – Basic. The module cannot be chosen if it has already been taken in the Bachelor's program.	
Requirements for earning credit points	Credit points are earned after passing the module examination. The module examination consists of a written test lasting 150 minutes. The language of the examination is German.	
Credit points and grades	Participants can earn nine credit points for this module. The module grade corresponds to the grade of the examined assessment.	
Module frequency	The module is offered each summer semester.	
Workload	The workload comprises a total of 270 hours.	
Module duration	The module comprises one semester.	

Module number	Module name	Responsible lecturer
Math-Ma-E03	Dynamical Networks	Prof. Ronald Tetzlaff ronald.tetzlaff@tu-dresden.de
Qualification objectives	After completing this module, students are able to apply methods for analyzing linear dynamic circuits excited by periodic signals and to determine the transient behavior between stationary states. They are able to describe, to model and to analyze linear two-ports. They can determine transfer functions, analyze and graphically represent the network behavior for different frequencies, and determine basic filter structures. Phasor representations and Nyquist plots are mastered.	
Content	The module covers the calculation of linear dynamic networks and measurements on electronic circuits, including computer-controlled measurement techniques.	
Teaching and learning methods	The module comprises 2 hours per week lecture, 2 hours per week exercise and self-study. The lecture and the exercise will be held in German.	
Prerequisites for participation	Algebraic and analytical basics, knowledge of multidimensional differential and integral calculus, and basic knowledge of electrical engineering as taught in the module Basics of Electrical Engineering at the Bachelor's level of the Electrical Engineering program are required.	
Applicability	In the compulsory elective area N of the Master's program Mathematics, in which modules with a total of at least 18 credit points are to be chosen, the module is one of seven compulsory elective modules in the specialization Electrical Engineering – Basic. Furthermore, in the compulsory elective area N of the Master's program Technomathematics, in which modules with a total of at least 24 credit points have to be chosen, the module is one of eight compulsory elective modules in the specialization Electrical Engineering – Basic. The module cannot be chosen if it has already been taken in the Bachelor's program.	
Requirements for earning credit points	Credit points are earned after passing the module examination. The module examination consists of a written test lasting 150 minutes. The language of the examination is German.	
Credit points and grades	Participants can earn six credit points for this module. The module grade corresponds to the grade of the examined assessment.	
Module frequency	The module is offered each winter semester.	
Workload	The workload comprises a total of 180 hours.	
Module duration	The module comprises one semester.	

Module number	Module name	Responsible lecturer
Math-Ma-E04	Communications Engineering	Prof. Gerhard Fettweis gerhard.fettweis@tu-dresden.de
Qualification objectives	After completing this module, the students master the basic principles and the practical application of communications engineering. The students will be able to understand the basic signal processing in communications systems and to describe them mathematically. They are familiar with the transmission in baseband and band-pass area and know the basic analogue and digital modulation methods. They understand the impact of noise on the transmission quality for simple analogue and digital transmission scenarios.	
Content	The module covers signal theory, including sine waves, Dirac function, convolution and Fourier transform; linear time-invariant systems, including transfer function and impulse response; bandpass signals, including real and complex up and down mixing of signals and equivalent lowpass signal; analogue modulation, including modulation, demodulation and properties of AM, PM, FM; analogue-digital conversion, including sampling, signal reconstruction and quantization, sub- and oversampling; and digital modulation schemes, including modulation methods, matched-filter receiver and bit error probability).	
Teaching and learning methods	The module comprises 2 hours per week lecture, 1 hour per week exercise and self-study. The lecture and the exercise will be held in German.	
Prerequisites for participation	Algebraic and analytical basics as well as knowledge of multidimensional differential at the Bachelor's level of the Electrical Engineering program are required.	
Applicability	In the compulsory elective area N of the Master's program Mathematics, in which modules with a total of at least 18 credit points are to be chosen, the module is one of seven compulsory elective modules in the specialization Electrical Engineering – Basic. Furthermore, in the compulsory elective area N of the Master's program Technomathematics, in which modules with a total of at least 24 credit points have to be chosen, the module is one of eight compulsory elective modules in the specialization Electrical Engineering – Basic. The module cannot be chosen if it has already been taken in the Bachelor's program.	
Requirements for earning credit points	Credit points are earned after passing the module examination. The module examination consists of a written test lasting 120 minutes. The language of the examination is German.	
Credit points and grades	Participants can earn six credit points for this module. The module grade corresponds to the grade of the examined assessment.	
Module frequency	The module is offered each summer semester.	
Workload	The workload comprises a total of 180 hours.	
Module duration	The module comprises one semester.	

Module number	Module name	Responsible lecturer
Math-Ma-E05	Systems Theory	Prof. Rafael Schaefer rafael.schaefer@tu-dresden.de
Qualification objectives	Having successfully completed the module, the students are familiar with the regulative significance of the system concept in engineering. They master the application of signal transformations for the effective description of the system behaviour in the area of image. In particular, they are able to apply the approach of system theory to important areas of their own discipline, e.g. to the calculation of electrical networks in the case of non-sinusoidal or stochastic excitation and to the realization of systems with desired transfer behaviour in time-discrete form (digital filter).	
Content	The module deals with the fundamentals of systems theory with focus on digital systems, analogue time-continuous systems, analogue time-discrete systems and selected applications.	
Teaching and learning methods	The module comprises 4 hours per week lecture, 4 hours per week exercise and self-study. The lecture and the exercise will be held in German.	
Prerequisites for participation	Algebraic and analytical basics, knowledge of multidimensional differential and integral calculus, and basic knowledge of electrical engineering as taught in the module Basics of Electrical Engineering at the Bachelor's level of the Electrical Engineering program are required.	
Applicability	In the compulsory elective area N of the Master's program Mathematics, in which modules with a total of at least 18 credit points are to be chosen, the module is one of seven compulsory elective modules in the specialization Electrical Engineering – Basic. Furthermore, in the compulsory elective area N of the Master's program Technomathematics, in which modules with a total of at least 24 credit points have to be chosen, the module is one of eight compulsory elective modules in the specialization Electrical Engineering – Basic. The module cannot be chosen if it has already been taken in the Bachelor's program.	
Requirements for earning credit points	Credit points are earned after passing the module examination. The module examination consists of a written test lasting 120 minutes. The language of the examination is German.	
Credit points and grades	Participants can earn nine credit points for this module. The module grade corresponds to the grade of the examined assessment.	
Module frequency	The module will be offered each academic year, beginning in the winter semester.	
Workload	The workload comprises a total of 270 hours.	
Module duration	The module comprises two semester.	

Module number	Module name	Responsible lecturer
Math-Ma-E06	Electronic Systems Design	Prof. Jens Lienig jens.lienig@tu-dresden.de
Qualification objectives	Students completing this module obtain basic knowledge for the construction and development of electronic assembly groups and devices. They will have an understanding of engineering tasks as well as related requirements. Thus, the students will be enabled to follow engineering principles while developing and constructing such products under consideration of all relevant aspects.	
Content	The module focuses on constructional fundamentals with technical illustration and CAD, device design and device requirements, reliability of electronic systems, thermal dimensioning and electromagnetic compatibility.	
Teaching and learning methods	The module comprises 2 hours per week lecture, 2 hours per week exercise and self-study. The lecture and the exercise will be held in German.	
Prerequisites for participation	None.	
Applicability	In the compulsory elective area N of the Master's program Mathematics, in which modules with a total of at least 18 credit points are to be chosen, the module is one of seven compulsory elective modules in the specialization Electrical Engineering – Basic. Furthermore, in the compulsory elective area N of the Master's program Technomathematics, in which modules with a total of at least 24 credit points have to be chosen, the module is one of eight compulsory elective modules in the specialization Electrical Engineering – Basic. The module cannot be chosen if it has already been taken in the Bachelor's program.	
Requirements for earning credit points	Credit points are earned after passing the module examination. The module examination consists of a written test lasting 120 minutes. The language of the examination is German.	
Credit points and grades	Participants can earn six credit points for this module. The module grade corresponds to the grade of the examined assessment.	
Module frequency	The module is offered each summer semester.	
Workload	The workload comprises a total of 180 hours.	
Module duration	The module comprises one semester.	

Module number	Module name	Responsible lecturer
Math-Ma-E07	Circuit Design	Prof. Frank Ellinger frank.ellinger@tu-dresden.de
Qualification objectives	Students learn fundamental principles and practical realisations of analogue and digital circuits. They understand the properties of these circuits using different structures and the properties of the electronic devices. They can handle the methods of circuit analysis and they can dimension the circuits for specific applications.	
Content	This module gives an introduction to electronic circuits, such as basic analogue circuits, differential amplifiers, power amplifiers, operational amplifiers and its applications, power supply, basic digital circuits, combinational und sequential logic.	
Teaching and learning methods	The module comprises 4 hours per week lecture, 2 hours per week exercise and self-study. The lecture and the exercise will be held in German.	
Prerequisites for participation	Competencies in the calculation of electrical networks in direct current, for example Paul, S. / Paul, R.: Grundlagen der Elektrotechnik und Elektronik 1, Springer, as well as Grundlagen der Systemtheorie, e.g. Wunsch, G. / Schreiber, H.: Digitale Systeme, TUDpress and Wunsch, G. / Schreiber, H.: Analoge Systeme, TUDpress, at the Bachelor's level of the Electrical Engineering program are required.	
Applicability	In the compulsory elective area N of the Master's program Mathematics, in which modules with a total of at least 18 credit points are to be chosen, the module is one of seven compulsory elective modules in the specialization Electrical Engineering – Basic and one of seven compulsory elective modules in the specialization Electrical Engineering – Advanced. Furthermore, in the compulsory elective area N of the Master's program Technomathematics, in which modules with a total of at least 24 credit points have to be chosen, the module is one of eight compulsory elective modules in the specialization Electrical Engineering – Basic and one of eight compulsory elective modules in the specialization Electrical Engineering – Advanced. The module cannot be chosen if it has already been taken in the Bachelor's program.	
Requirements for earning credit points	Credit points are earned after passing the module examination. The module examination consists of a written test lasting 180 minutes. The language of the examination is German.	
Credit points and grades	Participants can earn nine credit points for this module. The module grade corresponds to the grade of the examined assessment.	
Module frequency	The module is offered each summer semester.	
Workload	The workload comprises a total of 270 hours.	
Module duration	The module comprises one semester.	

Module number	Module name	Responsible lecturer
Math-Ma-E08	Signal Theory	Prof. Peter Birkholz peter.birkholz@tu-dresden.de
Qualification objectives	The students master the fundamental principles and the practical application of methods of signal processing in the time domain and in the frequency domain. They are familiar with the relationship between the processing of continuous time and discrete time signals. They know the different forms of spectral analysis and are able to decide which forms are applicable under which conditions. They are able to analyze non-stationary signals, design digital filters, and determine temporal and spectral envelopes. The students are able to describe stochastic signals as realisations of stochastic processes. In particular, they understand how short time spectral analysis works and the specifics concerning its application. The students are able to describe stochastic signals as realisations of stochastic processes. They are capable of calculating the behaviour of deterministic and stochastic systems that are processing stochastic processes.	
Content	The module covers the analysis of continuous time and discrete time signals in the time and frequency domain. A second focus is the description of stochastic signals as realisations of stochastic processes and its processing by static and dynamic systems.	
Teaching and learning methods	The module comprises 4 hours per week lecture, 2 hours per week exercise and self-study. The lecture and the exercise will be held in German.	
Prerequisites for participation	Competences for the calculation of electrical networks using direct current, for example Paul, S. / Paul, R.: Grundlagen der Elektrotechnik und Elektronik 1, Springer, zur Berechnung einfacher elektrischer und magnetischer Felder, for exmple Paul, S. / Paul, R.: Grundlagen der Elektrotechnik und Elektronik 2, Springer Vieweg, zur Berechnung linearer dynamischer Netzwerke, for example Paul, R.: Elektrotechnik Grundlagenlehrbuch Band 2: Netzwerke, Springer, as well as zur Systemtheorie, for example Wunsch, G. / Schreiber, H.: Digitale Systeme, TUDpress and Wunsch, G. / Schreiber, H.: Analoge Systeme, TUD-press, at the Bachelor's level of the Electrical Engineering program are required.	
Applicability	In the compulsory elective area N of the Master's program Mathematics, in which modules with a total of at least 18 credit points are to be chosen, the module is one of seven compulsory elective modules in the specialization Electrical Engineering – Advanced. Furthermore, in the compulsory elective area N of the Master's program Technomathematics, in which modules with a total of at least 24 credit points have to be chosen, the module is one of eight compulsory elective modules in the specialization Electrical Engineering – Advanced. The module cannot be chosen if it has already been taken in the Bachelor's program.	
Requirements for earning credit points	Credit points are earned after passing the module examination. The module examination consists of two written test lasting 120 minutes each. The language of the examination is German in each case.	
Credit points and grades	Participants can earn nine credit points for this module. The module grade is calculated from the unweighted average grade of the examined assessments.	

Module frequency	The module is offered each winter semester.
Workload	The workload comprises a total of 270 hours.
Module duration	The module comprises one semester.

Module number	Module name	Responsible lecturer
Math-Ma-E09	Information Theory	Prof. Rafael Schaefer rafael.schaefer@tu-dresden.de
Qualification objectives	Students are able to master the basic principles of Information Theory. They are familiar with the calculation and the meaning of entropy as well as the mutual information for discrete and statistical random variables. Furthermore, students know the source coding and channel coding theorems and are able to apply the results from these coding theorems for a practical system design. They are able to construct source codes as well as channel codes and are further able to indicate procedures for decoding. Various performance metrics for the evaluation of the performance of information systems e.g. the ergodic capacity or the outage capacity are used and interpreted confidently.	
Content	The module covers basic information theoretic measures, source coding, channel coding, the coding theorem, and rate distortion theory.	
Teaching and learning methods	The module comprises 2 hours per week lecture, 2 hours per week exercise and self-study. The lecture and the exercise will be held in German.	
Prerequisites for participation	Competences in the basics of function theory, for example Freitag, E. / Busam, R.: Funktionentheorie, Springer, and zur Systemtheorie, for example Wunsch, G. / Schreiber, H.: Digitale Systeme, TUDpress as well as Wunsch, G. / Schreiber, H.: Analoge Systeme, TUDpress at the Bachelor's level of the Electrical Engineering program are required.	
Applicability	In the compulsory elective area N of the Master's program Mathematics, in which modules with a total of at least 18 credit points are to be chosen, the module is one of seven compulsory elective modules in the specialization Electrical Engineering – Advanced. Furthermore, in the compulsory elective area N of the Master's program Technomathematics, in which modules with a total of at least 24 credit points have to be chosen, the module is one of eight compulsory elective modules in the specialization Electrical Engineering – Advanced. The module cannot be chosen if it has already been taken in the Bachelor's program.	
Requirements for earning credit points	Credit points are earned after passing the module examination. The module examination consists of a written test lasting 120 minutes. The language of the examination is German.	
Credit points and grades	Participants can earn six credit points for this module. The module grade corresponds to the grade of the examined assessment.	
Module frequency	The module is offered each summer semester.	
Workload	The workload comprises a total of 180 hours.	
Module duration	The module comprises one semester.	

Module number	Module name	Responsible lecturer
Math-Ma-E10	Automation and Measurement Technology	Prof. Klaus Janschek klaus.janschek@tu-dresden.de
Qualification objectives	Having successfully completed the modules, the students understand fundamental behaviour description forms for technical systems. Further, they master the basic theoretical and computer-aided handling of linear, time-invariant and discrete-event behaviour models for the control of technical systems. They are able to design control algorithms for simple tasks. The students are familiar with the principles of analogue measuring procedures and are able to evaluate measurement results by using statistical methods. They are able to calculate and interpret random and systematic measuring uncertainties.	
Content	The module covers the basics of automation engineering wit the focus on behavioural description, control design in the frequency domain, digital control loops, industrial standard controllers, discrete-event control systems, elementary control concepts and automation technologies, the basics of measuring with the focus on measurement principles, SI units, analogue measurement technology such as fundamentals, measurement bridges, lock-in measurement technique, quadrature demodulation technique, measurement of transit times and distances, and statistical measurement data evaluation such as calculation of standard deviation and confidence intervals, propagation of the measurement uncertainty, setup of uncertainty budget for measurement.	
Teaching and learning methods	The module comprises 3 hours per week lecture, 2 hours per week exercise and self-study. The lecture and the exercise will be held in German.	
Prerequisites for participation	Basic scientific knowledge at the Bachelor's level of the Electrical Engineering program is required.	
Applicability	In the compulsory elective area N of the Master's program Mathematics, in which modules with a total of at least 18 credit points are to be chosen, the module is one of seven compulsory elective modules in the specialization Electrical Engineering – Advanced. Furthermore, in the compulsory elective area N of the Master's program Technomathematics, in which modules with a total of at least 24 credit points have to be chosen, the module is one of eight compulsory elective modules in the specialization Electrical Engineering – Advanced. The module cannot be chosen if it has already been taken in the Bachelor's program.	
Requirements for earning credit points	Credit points are earned after passing the module examination. The module examination consists of a written test lasting 210 minutes. The language of the examination is German.	
Credit points and grades	Participants can earn six credit points for this module. The module grade corresponds to the grade of the examined assessment.	
Module frequency	The module is offered each summer semester.	
Workload	The workload comprises a total of 180 hours.	

Module duration	The module comprises one semester.

Module number	Module name	Responsible lecturer
Math-Ma-E11	Basics Electromagnetic Theory	Prof. Hans Georg Krauthäuser hans_georg.krauthaeuser@tu-dresden.de
Qualification objectives	After completion of the module, the students have the ability to assess the causes and connections between most electromagnetic phenomena and are capable solving field problems with fundamental analytical methods. The students can establish relationships between the different disciplines in electrical engineering, the motivation and the scientific limits.	
Content	The module comprises the basics and methods of the classical electromagnetic field theory of electromagnetic interaction. Topics include axiomatic foundations, behavior at interfaces, electrostatics, electromagnetic fields, stationary electric flow fields, magnetostatics, and quasi-stationary fields.	
Teaching and learning methods	The module comprises 2 hours per week lecture, 2 hours per week exercise and self-study. The lecture and the exercise will be held in German.	
Prerequisites for participation	Algebraic and analytical basics, knowledge of multidimensional differential and integral calculus, function theory, partial differential equations and probability theory as well as the fundamentals of and magnetic fields at the Bachelor's level of the Electrical Engineering program are required.	
Applicability	In the compulsory elective area N of the Master's program Mathematics, in which modules with a total of at least 18 credit points are to be chosen, the module is one of seven compulsory elective modules in the specialization Electrical Engineering – Advanced. Furthermore, in the compulsory elective area N of the Master's program Technomathematics, in which modules with a total of at least 24 credit points have to be chosen, the module is one of eight compulsory elective modules in the specialization Electrical Engineering – Advanced. The module cannot be chosen if it has already been taken in the Bachelor's program. The module is a prerequisite for participation in the module Advanced Electromagnetic Theory.	
Requirements for earning credit points	Credit points are earned after passing the module examination. The module examination consists of a written test lasting 120 minutes. The language of the examination is German.	
Credit points and grades	Participants can earn six credit points for this module. The module grade corresponds to the grade of the examined assessment.	
Module frequency	The module is offered each winter semester.	
Workload	The workload comprises a total of 180 hours.	
Module duration	The module comprises one semester.	

Module number	Module name	Responsible lecturer
Math-Ma-E12	Advanced Electromagnetic Theory	Prof. Hans Georg Krauthäuser hans_georg.krauthaeuser@tu-dresden.de
Qualification objectives	After completion of the module, the students have the ability to assess the causes and connections between most electromagnetic phenomena and are capable solving field problems with fundamental analytical methods. The students can establish relationships between the different disciplines in electrical engineering, the motivation and the scientific limits.	
Content	The module covers the fundamentals of electromagnetic waves, including the homogeneous wave equation, harmonic plane waves, polarization of plane waves, wave packets, spherical waves, conducting media, waveguides, generation, reflection, and refraction.	
Teaching and learning methods	The module comprises 2 hours per week lecture, 2 hours per week exercise and self-study. The lecture and the exercise will be held in German.	
Prerequisites for participation	Algebraic and analytical basics, knowledge of multidimensional differential and integral calculus, function theory, partial differential equations and probability theory as well as the fundamentals of and magnetic fields at the Bachelor's level of the Electrical Engineering program are required. Furthermore, the competences to be acquired in the module Basics Electromagnetic Theory are assumed.	
Applicability	In the compulsory elective area N of the Master's program Mathematics, in which modules with a total of at least 18 credit points are to be chosen, the module is one of seven compulsory elective modules in the specialization Electrical Engineering – Advanced. Furthermore, in the compulsory elective area N of the Master's program Technomathematics, in which modules with a total of at least 24 credit points have to be chosen, the module is one of eight compulsory elective modules in the specialization Electrical Engineering – Advanced. The module cannot be chosen if it has already been taken in the Bachelor's program.	
Requirements for earning credit points	Credit points are earned after passing the module examination. The module examination consists of a written test lasting 120 minutes. The language of the examination is German.	
Credit points and grades	Participants can earn six credit points for this module. The module grade corresponds to the grade of the examined assessment.	
Module frequency	The module is offered each summer semester.	
Workload	The workload comprises a total of 180 hours.	
Module duration	The module comprises one semester.	

Module number	Module name	Responsible lecturer
Math-Ma-E13	Technologies and Components of Microelectronics	Prof. Michael Schröter michael.schroeter@tu-dresden.de
Qualification objectives	The students understanding the fundamental functioning and electrical features of the most important semiconductor electronic devices on basis of a simplified description of the physical potential ratio and transport mechanisms in semiconductors. They are able to discuss the most important characteristic lines and construct physical modell descriptions, including equivalent circuit diagrams, of semiconductor electronic devices for their application. The students are able to work with fundamental principles for the production and miniaturisation of devices and circuits as well as understand the modes of functioning of the individual technologies as well as their coaction resulting in simple process flows.	
Content	The module covers the physical fundamentals of electronic devices and the physical-technical fundamentals of their production by means of microtechnologies.	
Teaching and learning methods	The module comprises 5 hours per week lecture, 1 hour per week exercise and self-study. The lecture and the exercise will be held in German.	
Prerequisites for participation	Algebraic and analytical basics, knowledge of multidimensional differential and integral calculus, and basic knowledge of electrical engineering as taught in the module Basics of Electrical Engineering at the Bachelor's level of the Electrical Engineering program are required.	
Applicability	In the compulsory elective area N of the Master's program Mathematics, in which modules with a total of at least 18 credit points are to be chosen, the module is one of seven compulsory elective modules in the specialization Electrical Engineering – Advanced. Furthermore, in the compulsory elective area N of the Master's program Technomathematics, in which modules with a total of at least 24 credit points have to be chosen, the module is one of eight compulsory elective modules in the specialization Electrical Engineering – Advanced. The module cannot be chosen if it has already been taken in the Bachelor's program.	
Requirements for earning credit points	Credit points are earned after passing the module examination. The module examination consists of a written test lasting 210 minutes. The language of the examination is German.	
Credit points and grades	Participants can earn nine credit points for this module. The module grade corresponds to the grade of the examined assessment.	
Module frequency	The module is offered each winter semester.	
Workload	The workload comprises a total of 270 hours.	
Module duration	The module comprises one semester.	

Module number	Module name	Responsible lecturer
Math-Ma-C01	Programming and Robo-Lab	Prof. Christof Fetzer christof.fetzer@tu-dresden.de
Qualification objectives	Students will have insight into the structure and function of programming languages, possess programming skills and be able to apply them in practice. They are able to solve problems independently, to learn other programming languages independently and to transfer their skills to them. They are able to analyze and evaluate programming languages in order to choose the most appropriate language for solving different problems. They have the competence to solve complex tasks in a team.	
Content	The module covers the use and development of formal tools. This includes basics of computation, translation of program constructors, program transformations as well as verification of program properties.	
Teaching and learning methods	The module comprises 2 hours per week lecture, 1 hour per week exercise, 4 hours per week practical training and self-study. The lecture, the exercise and the practical training will be held in German.	
Prerequisites for participation	Participants require mathematical knowledge and algorithmic understanding at university entrance-level proficiency.	
Applicability	In the compulsory elective area N of the Master's program Mathematics, in which modules with a total of at least 18 credit points are to be chosen, the module is one of eight compulsory elective modules in the specialization Computer Science – Basic. Furthermore, in the compulsory elective area N of the Master's program Technomathematics, in which modules with a total of at least 24 credit points have to be chosen, the module is one of nine compulsory elective modules in the specialization Computer Science – Basic. The module cannot be chosen if it has already been taken in the Bachelor's program.	
Requirements for earning credit points	Credit points are earned after passing the module examination. The module examination consists of a written test lasting 90 minutes and a complex assessment equating to 80 hours. Both examinations must be passed. The language of the examination is German in each case.	
Credit points and grades	Participants can earn nine credit points for this module. The module grade is calculated from the weighted average grade of the examined assessments. The grade of the written test is weighted one times, the grade of the complex assessment two times.	
Module frequency	The module is offered each winter semester.	
Workload	The workload comprises a total of 270 hours.	
Module duration	The module comprises one semester.	

Module number	Module name	Responsible lecturer
Math-Ma-C02	Algorithms and Data Structures	Director of the Institute for Theoretical Computer Science heiko.vogler@tu-dresden.de
Qualification objectives	Students are able to apply imperative elements of programming. They know basic algorithms and can analyze their complexity.	
Content	The module covers the basics of imperative programming, including syntax diagrams, the extended Backus-Naur form, functions, modules, and data structures; algorithms for classical problems, such as sorting and search methods, as well as algorithms on trees and graphs; problem classes based on these, such as divide-and-conquer, dynamic programming, iteration versus recursion, and backtracking; and the runtime behavior of algorithms.	
Teaching and learning methods	The module comprises 2 hours per week lecture, 2 hours per week exercise and self-study. The lecture and the exercise will be held in German.	
Prerequisites for participation	Participants require knowledge of mathematics at university entrance-level proficiency.	
Applicability	In the compulsory elective area N of the Master's program Mathematics, in which modules with a total of at least 18 credit points are to be chosen, the module is one of eight compulsory elective modules in the specialization Computer Science – Basic. Furthermore, in the compulsory elective area N of the Master's program Technomathematics, in which modules with a total of at least 24 credit points have to be chosen, the module is one of nine compulsory elective modules in the specialization Computer Science – Basic. The module cannot be chosen if it has already been taken in the Bachelor's program.	
Requirements for earning credit points	Credit points are earned after passing the module examination. The module examination consists of a written test lasting 90 minutes. The language of the examination is German.	
Credit points and grades	Participants can earn six credit points for this module. The module grade corresponds to the grade of the examined assessment.	
Module frequency	The module is offered each summer semester.	
Workload	The workload comprises a total of 180 hours.	
Module duration	The module comprises one semester.	

Module number	Module name	Responsible lecturer
Math-Ma-C03	Software Technology	Prof. Uwe Aßmann uwe.assmann@tu-dresden.de
Qualification objectives	Students master the methods for developing software systems. They are able to apply a systematic engineering approach using the concepts of object orientation, using object-oriented modeling and programming languages in analysis, design and implementation.	
Content	The module covers the basics of object-oriented modeling languages such as the Unified Modeling Language (UML) and the reuse aspects in an object-oriented programming language such as Java, with special emphasis on the use of class libraries and design patterns. It also covers the fundamentals of object-oriented analysis, design, and architecture, as well as the fundamentals of project management, agile software development, and software quality assurance.	
Teaching and learning methods	The module comprises 2 hours per week lecture, 2 hours per week exercise and self-study. The lecture and the exercise will be held in German.	
Prerequisites for participation	Knowledge of programming class structures and procedures at the Bachelor's level of the Computer Science program is required.	
Applicability	In the compulsory elective area N of the Master's program Mathematics, in which modules with a total of at least 18 credit points are to be chosen, the module is one of eight compulsory elective modules in the specialization Computer Science – Basic. Furthermore, in the compulsory elective area N of the Master's program Technomathematics, in which modules with a total of at least 24 credit points have to be chosen, the module is one of nine compulsory elective modules in the specialization Computer Science – Basic. The module cannot be chosen if it has already been taken in the Bachelor's program.	
Requirements for earning credit points	Credit points are earned after passing the module examination. The module examination consists of a written test lasting 120 minutes. The language of the examination is German.	
Credit points and grades	Participants can earn six credit points for this module. The module grade corresponds to the grade of the examined assessment.	
Module frequency	The module is offered each summer semester.	
Workload	The workload comprises a total of 180 hours.	
Module duration	The module comprises one semester.	

Module number	Module name	Responsible lecturer
Math-Ma-C04	Computer Architecture	Prof. Akash Kumar akash.kumar@tu-dresden.de
Qualification objectives	Students have a basic knowledge of the structure and operation of information processing systems and the implementation of simple analog and digital circuits. Students have a balanced theoretical and methodological understanding of the structure and organization of computers and their basic components, including an understanding of complex computer systems, the application of parallelism and performance evaluation.	
Content	The module covers the design and analysis of simple analog and digital circuits, such as RC circuits, combinational circuits and flip-flops, sequential and automaton-controlled circuits, and von Neumann architecture. It also covers the design and function of the individual components of a computer structure, their organization and interaction. This includes the realization of switching networks and switching systems on the gate level, information representation, coding and processing, the instruction set as the link to the software up to the components of a computer such as control unit, arithmetic unit, registers and memory. The different types of parallelism, interconnection and evaluation of complex computer systems are also covered.	
Teaching and learning methods	The module comprises 3 hours per week lecture, 2 hours per week exercise and self-study. The lecture and the exercise will be held in German.	
Prerequisites for participation	Participants require mathematical knowledge at university entrance-level proficiency.	
Applicability	In the compulsory elective area N of the Master's program Mathematics, in which modules with a total of at least 18 credit points are to be chosen, the module is one of eight compulsory elective modules in the specialization Computer Science – Basic. Furthermore, in the compulsory elective area N of the Master's program Technomathematics, in which modules with a total of at least 24 credit points have to be chosen, the module is one of nine compulsory elective modules in the specialization Computer Science – Basic. The module cannot be chosen if it has already been taken in the Bachelor's program.	
Requirements for earning credit points	Credit points are earned after passing the module examination. The module examination consists of a written test lasting 120 minutes. The language of the examination is German.	
Credit points and grades	Participants can earn six credit points for this module. The module grade corresponds to the grade of the examined assessment.	
Module frequency	The module is offered each summer semester.	
Workload	The workload comprises a total of 180 hours.	
Module duration	The module comprises one semester.	

Module number	Module name	Responsible lecturer
Math-Ma-C05	Computer Architecture and Hardware Laboratory	Prof. Akash Kumar akash.kumar@tu-dresden.de
Qualification objectives	Students have a basic knowledge of the structure and operation of information processing systems and the implementation of simple analog and digital circuits. Students have a balanced theoretical and methodological understanding of the structure and organization of computers and their basic components, including the understanding of complex computer systems, the application of parallelism and performance evaluation. Students are able to apply the acquired theoretical knowledge practically, especially in the structure and operation of information processing systems and in the realization of simple analog and digital circuits.	
Content	The module covers the design and analysis of simple analog and digital circuits, such as RC circuits, combinational circuits and flip-flops, sequential and automaton-controlled circuits, and Von Neumann architecture. The module also covers the design and function of the individual components of a computer structure, their organization and interaction. This includes the realization of switching networks and switching systems at the gate level, information representation, coding and processing, the instruction set as the link to the software, up to the components of a computer such as control unit, arithmetic unit, registers and memory. The different types of parallelism, interconnection and evaluation of complex computer systems are also covered.	
Teaching and learning methods	The module comprises 3 hours per week lecture, 2 hours per week exercise, 2 hours per week practical training and self-study. The lecture, the exercise and the practical training will be held in German.	
Prerequisites for participation	Participants require mathematical knowledge at university entrance-level proficiency.	
Applicability	In the compulsory elective area N of the Master's program Mathematics, in which modules with a total of at least 18 credit points are to be chosen, the module is one of eight compulsory elective modules in the specialization Computer Science – Basic. Furthermore, in the compulsory elective area N of the Master's program Technomathematics, in which modules with a total of at least 24 credit points have to be chosen, the module is one of nine compulsory elective modules in the specialization Computer Science – Basic. The module cannot be chosen if it has already been taken in the Bachelor's program.	
Requirements for earning credit points	Credit points are earned after passing the module examination. The module examination consists of a written test lasting 120 minutes and an ungraded portfolio equating to 60 hours. Both examinations must be passed. The language of the examination is German in each case.	
Credit points and grades	Participants can earn nine credit points for this module. The module grade corresponds to the grade of the examined assessment.	
Module frequency	The module is offered each summer semester.	

Workload	The workload comprises a total of 270 hours.
Module duration	The module comprises one semester.

Module number	Module name	Responsible lecturer
Math-Ma-C06	Operating Systems	Chair of Operating Systems horst.schirmeier@tu-dresden.de
Qualification objectives	Students know the classical basic techniques of modern operating system design. They know the basics of hardware-oriented parallel programming and resource management. They recognize the interaction of certain hardware properties with system components. Furthermore, students are able to understand system architectures and to evaluate them with respect to functional and non-functional properties.	
Content	The module covers the basics of operating system design, the central system building blocks such as process, thread and memory, aspects of resource management and data storage. Other topics include theoretical knowledge of system properties and practical aspects of system-oriented and parallel programming on the hardware level, in particular the interaction of the operating system with the hardware and the applications.	
Teaching and learning methods	The module comprises 2 hours per week lecture, 2 hours per week exercise and self-study. The lecture and the exercise will be held in German.	
Prerequisites for participation	Knowledge of the structure and organization of computer architecture and imperative programming at the Bachelor's level of the Computer Science program is required.	
Applicability	In the compulsory elective area N of the Master's program Mathematics, in which modules with a total of at least 18 credit points are to be chosen, the module is one of eight compulsory elective modules in the specialization Computer Science – Basic. Furthermore, in the compulsory elective area N of the Master's program Technomathematics, in which modules with a total of at least 24 credit points have to be chosen, the module is one of nine compulsory elective modules in the specialization Computer Science – Basic. The module cannot be chosen if it has already been taken in the Bachelor's program.	
Requirements for earning credit points	Credit points are earned after passing the module examination. The module examination consists of a written test lasting 90 minutes. The language of the examination is German.	
Credit points and grades	Participants can earn six credit points for this module. The module grade corresponds to the grade of the examined assessment.	
Module frequency	The module is offered each winter semester.	
Workload	The workload comprises a total of 180 hours.	
Module duration	The module comprises one semester.	

Module number	Module name	Responsible lecturer
Math-Ma-C07	Security	Dr. Stefan Köpsell stefan.koepsell@tu-dresden.de
Qualification objectives	Students know the basics of information theory, where the concept of information is limited to the statistical aspect, and the basics of information security based on this. Students are able to define the concept of entropy and describe real sources quantitatively. Based on this, they know basic relationships between source entropy and source coding, as well as basics and code descriptions for error detection and error correction. Students are able to evaluate how compactly information can be represented with given statistical properties and how securely information can be transmitted or stored with coding capabilities. They have basic skills in performing a requirements analysis from a security point of view, i.e. they can identify protection goals to be implemented and perform attacker modeling. They are able to create and evaluate a basic security concept with regard to the protection goals of confidentiality and integrity. They understand the basic mechanisms of symmetric and asymmetric cryptographic algorithms. In addition to technical security measures, they are aware of the necessity and principles of legal and organizational security measures. They have basic knowledge in the field of data protection and can name requirements and mechanisms of action.	
Content	The module covers the basics of information theory, data security and data protection, the basics of describing real sources, code descriptions for error detection and error correction. Other topics include cryptographic methods in general and on selected examples, technical protection measures, legal basics, and organizational measures such as information security management and risk assessment. Data protection topics include requirements, measures, and organizational and legal aspects.	
Teaching and learning methods	The module comprises 2 hours per week lecture, 2 hours per week exercise and self-study. The lecture and the exercise will be held in German.	
Prerequisites for participation	Basic knowledge of probability, linear algebra, and algebraic structures at the Bachelor's level of the Computer Science program is required.	
Applicability	In the compulsory elective area N of the Master's program Mathematics, in which modules with a total of at least 18 credit points are to be chosen, the module is one of eight compulsory elective modules in the specialization Computer Science – Basic. Furthermore, in the compulsory elective area N of the Master's program Technomathematics, in which modules with a total of at least 24 credit points have to be chosen, the module is one of nine compulsory elective modules in the specialization Computer Science – Basic. The module cannot be chosen if it has already been taken in the Bachelor's program.	
Requirements for earning credit points	Credit points are earned after passing the module examination. The module examination consists of a written test lasting 90 minutes. The language of the examination is German.	
Credit points and grades	Participants can earn six credit points for this module. The module grade corresponds to the grade of the examined assessment.	

Module frequency	The module is offered each winter semester.
Workload	The workload comprises a total of 180 hours.
Module duration	The module comprises one semester.

Module number	Module name	Responsible lecturer
Math-Ma-C08	Formal Systems	Prof. Franz Baader franz.baader@tu-dresden.de
Qualification objectives	Students master the formal foundations of modeling information systems. They are familiar with different approaches to specifying syntax and can analyze and compare these approaches with respect to different structural properties. They understand the basics of logical modeling and logical reasoning as a basis for the specification of semantics.	
Content	Contents of the module are selected topics from the areas of formal languages, such as language classes of the Chomsky hierarchy and analysis of their formal properties, automata theory, such as finite automata, basement automata, and Turing machines, and logic, such as propositional logic, satisfiability, calculi of logical closure.	
Teaching and learning methods	The module comprises 4 hours per week lecture, 2 hours per week exercise and self-study. The lecture and the exercise will be held in German.	
Prerequisites for participation	Basic knowledge of mathematics, in particular discrete structures, analysis and linear algebra, at the Bachelor's level of the Computer Science program is required.	
Applicability	In the compulsory elective area N of the Master's program Mathematics, in which modules with a total of at least 18 credit points are to be chosen, the module is one of eight compulsory elective modules in the specialization Computer Science – Basic and one of nine compulsory elective modules in the specialization Computer Science – Advanced. Furthermore, in the compulsory elective area N of the Master's program Technomathematics, in which modules with a total of at least 24 credit points have to be chosen, the module is one of nine compulsory elective modules in the specialization Computer Science – Basic and one of ten compulsory elective modules in the specialization Computer Science – Advanced. The module cannot be chosen if it has already been taken in the Bachelor's program.	
Requirements for earning credit points	Credit points are earned after passing the module examination. The module examination consists of a written test lasting 90 minutes. The language of the examination is German.	
Credit points and grades	Participants can earn nine credit points for this module. The module grade corresponds to the grade of the examined assessment.	
Module frequency	The module is offered each winter semester.	
Workload	The workload comprises a total of 270 hours.	
Module duration	The module comprises one semester.	

Module number	Module name	Responsible lecturer
Math-Ma-C09	Artificial Intelligence	Prof. Björn Andres bjoern.andres@tu-dresden.de
Qualification objectives	Students master basic mathematical methods and artificial intelligence algorithms. They are competent in their specification, analysis, application and quantitative evaluation in relation to concrete data.	
Content	Contents of the module are - Local search algorithms for classification, especially by decision trees, - Local search algorithms for clustering, - Local search algorithms for ranking, - Methods for evaluating machine learning algorithms, - Methods for density estimation, - Knowledge representation, especially by Bayesian networks, - Foundations of deep learning.	
Teaching and learning methods	The module comprises 2 hours per week lecture, 2 hours per week exercise and self-study. The lecture and the exercise will be held in German.	
Prerequisites for participation	Basic knowledge of propositional and predicate logic, complexity theory, automata and algorithm theory, as well as knowledge of data structures and declarative programming languages at the Bachelor's level of the Computer Science program are required.	
Applicability	In the compulsory elective area N of the Master's program Mathematics, in which modules with a total of at least 18 credit points are to be chosen, the module is one of nine compulsory elective modules in the specialization Computer Science – Advanced. Furthermore, in the compulsory elective area N of the Master's program Technomathematics, in which modules with a total of at least 24 credit points have to be chosen, the module is one of ten compulsory elective modules in the specialization Computer Science – Advanced. The module cannot be chosen if it has already been taken in the Bachelor's program.	
Requirements for earning credit points	Credit points are earned after passing the module examination. The module examination consists of a written test lasting 90 minutes. The language of the examination is German.	
Credit points and grades	Participants can earn six credit points for this module. The module grade corresponds to the grade of the examined assessment.	
Module frequency	The module is offered each winter semester.	
Workload	The workload comprises a total of 180 hours.	
Module duration	The module comprises one semester.	

Module number	Module name	Responsible lecturer
Math-Ma-C10	Theoretical Computer Science and Logics	Prof. Markus Krötzsch markus.kroetzsch@tu-dresden.de
Qualification objectives	Students master the basics of representing and analyzing computations in computer science. They know important formal models of computation and understand their possibilities and limitations. They have the methodological foundations to investigate problems in terms of their computability and complexity. They are familiar with the foundations of predicate logic, related computational problems, and their complexity and computability. They have a basic understanding of the relationship between mathematical logic and computation.	
Content	The module covers selected topics from the areas of formal models of computation, such as Turing machines, WHILE and LOOP programs, and recursive functions; computability theory, including basic notions, typical undecidable problems, and uncomputable functions; complexity theory, including the resources TIME and SPACE; and reductions, basic complexity classes, such as P, NP, PSpace, and ExpTime, predicate logic, such as syntax, semantics, normal forms, unification, logical reasoning, and evaluation on finite interpretations, and the relation between computation and logic, such as decidability and complexity of logical reasoning, formal systems, and Gödel's incompleteness theorems.	
Teaching and learning methods	The module comprises 4 hours per week lecture, 2 hours per week exercise and self-study. The lecture and the exercise will be held in German.	
Prerequisites for participation	Basic knowledge of mathematics, in particular discrete structures, analysis and linear algebra, as well as of algorithms and data structures, programming and formal systems, at the Bachelor’s level of the Computer Science program is required.	
Applicability	In the compulsory elective area N of the Master's program Mathematics, in which modules with a total of at least 18 credit points are to be chosen, the module is one of nine compulsory elective modules in the specialization Computer Science – Advanced. Furthermore, in the compulsory elective area N of the Master's program Technomathematics, in which modules with a total of at least 24 credit points have to be chosen, the module is one of ten compulsory elective modules in the specialization Computer Science – Advanced. The module cannot be chosen if it has already been taken in the Bachelor's program.	
Requirements for earning credit points	Credit points are earned after passing the module examination. The module examination consists of a written test lasting 90 minutes. The language of the examination is German.	
Credit points and grades	Participants can earn nine credit points for this module. The module grade corresponds to the grade of the examined assessment.	
Module frequency	The module is offered each summer semester.	
Workload	The workload comprises a total of 270 hours.	

Module duration	The module comprises one semester.

Module number	Module name	Responsible lecturer
Math-Ma-C11	Computer Networks	Prof. Alexander Schill alexander.schill@tu-dresden.de
Qualification objectives	Students know the layered architecture of computer networks and understand the basic functionalities of data transmission, local area networks, data switching and transport, and computer network applications. They are able to evaluate, systematically select and appropriately combine alternative technologies, protocols and mechanisms for computer networks.	
Content	The module covers the basics of computer networks according to the systematics of the layer model for open communication systems. Further contents of the module are, starting from the basics of transmission technology, the principles of local networks, efficient and secure data transmission and the computer network applications based on it.	
Teaching and learning methods	The module comprises 2 hours per week lecture, 2 hours per week exercise and self-study. The lecture and the exercise will be held in German.	
Prerequisites for participation	Mathematical knowledge at university entrance-level proficiency, basic concepts, basic algorithms and architectural concepts of computer science at the Bachelor's level of the Computer Science program are required.	
Applicability	In the compulsory elective area N of the Master's program Mathematics, in which modules with a total of at least 18 credit points are to be chosen, the module is one of nine compulsory elective modules in the specialization Computer Science – Advanced. Furthermore, in the compulsory elective area N of the Master's program Technomathematics, in which modules with a total of at least 24 credit points have to be chosen, the module is one of ten compulsory elective modules in the specialization Computer Science – Advanced. The module cannot be chosen if it has already been taken in the Bachelor's program.	
Requirements for earning credit points	Credit points are earned after passing the module examination. The module examination consists of a written test lasting 90 minutes. The language of the examination is German.	
Credit points and grades	Participants can earn six credit points for this module. The module grade corresponds to the grade of the examined assessment.	
Module frequency	The module is offered each summer semester.	
Workload	The workload comprises a total of 180 hours.	
Module duration	The module comprises one semester.	

Module number	Module name	Responsible lecturer
Math-Ma-C12	Databases and Information Systems	Prof. Wolfgang Lehner wolfgang.lehner@tu-dresden.de
Qualification objectives	Students are able to cleanly structure a portion of the real world using entity-relationship data modeling (Personal and Social Competency) and relational data modeling and design theory (Methodological Competency). In addition, students are able to use tools to create a relational database while respecting semantic integrity constraints and query statements using Structured Query Language (SQL). In addition, students are able to correctly classify and understand selected system-oriented aspects in the implementation of database systems (technical competence). Students have an understanding of how database development is embedded as an elementary component in a higher-level software development process (overarching competence).	
Content	The module covers the basics of the scientific field of databases, including theoretical knowledge such as the entity-relationship model, the relational model and database design theory. It also covers the most important aspects of implementing database systems, including synchronization, restart and error handling, index structures, and query processing and optimization. The practical use of SQL is also part of the module.	
Teaching and learning methods	The module comprises 2 hours per week lecture, 2 hours per week exercise and self-study. The lecture and the exercise will be held in German.	
Prerequisites for participation	Mathematical knowledge at university entrance-level proficiency, basic concepts, basic algorithms and architectural concepts of computer science at the Bachelor's level of the Computer Science program are required.	
Applicability	In the compulsory elective area N of the Master's program Mathematics, in which modules with a total of at least 18 credit points are to be chosen, the module is one of nine compulsory elective modules in the specialization Computer Science – Advanced. Furthermore, in the compulsory elective area N of the Master's program Technomathematics, in which modules with a total of at least 24 credit points have to be chosen, the module is one of ten compulsory elective modules in the specialization Computer Science – Advanced. The module cannot be chosen if it has already been taken in the Bachelor's program.	
Requirements for earning credit points	Credit points are earned after passing the module examination. The module examination consists of a written test lasting 90 minutes. The language of the examination is German.	
Credit points and grades	Participants can earn six credit points for this module. The module grade corresponds to the grade of the examined assessment.	
Module frequency	The module is offered each summer semester.	
Workload	The workload comprises a total of 180 hours.	
Module duration	The module comprises one semester.	

Module number	Module name	Responsible lecturer
Math-Ma-C13	Software Technology Project	Prof. Uwe Aßmann uwe.assmann@tu-dresden.de
Qualification objectives	Students have practical engineering knowledge in the implementation of team-oriented software projects based on the division of labor. The students are able to analyze the requirements of a customer in cooperation with the customer and to design, implement, test and get accepted by the customer a software system based on the division of labor. In addition, students have personal and social skills in the areas of communication, project and time management, cooperation and teamwork.	
Content	The module covers a software project based on the division of labor. This includes the implementation of customer requirements, the creation of a requirement specification, a software design, small prototypes to familiarize with the frameworks or technologies to be used, an implementation and documentation. Other content includes quality assurance, such as creating a test suite and evaluating software analysis, and project management activities. This includes group meetings and their minutes, customer meetings, time tracking, reflection and control of the project status at well-defined milestones, and a final presentation to the customer.	
Teaching and learning methods	The module comprises 4 hours per week project and self-study. The project will be held in German.	
Prerequisites for participation	Knowledge of software technology, in particular methods for the development of large software systems, object orientation, the use of a modelling language such as the Unified Modelling Language (UML) in analysis, design and implementation, and programming in an object-oriented programming language such as Java, at the Bachelor's level of the Computer Science program is required.	
Applicability	In the compulsory elective area N of the Master's program Mathematics, in which modules with a total of at least 18 credit points are to be chosen, the module is one of nine compulsory elective modules in the specialization Computer Science – Advanced. Furthermore, in the compulsory elective area N of the Master's program Technomathematics, in which modules with a total of at least 24 credit points have to be chosen, the module is one of ten compulsory elective modules in the specialization Computer Science – Advanced. The module cannot be chosen if it has already been taken in the Bachelor's program.	
Requirements for earning credit points	Credit points are earned after passing the module examination. The module examination consists of a ungraded complex assessment equating to 100 hours. The language of the examination is German.	
Credit points and grades	Participants can earn six credit points for this module. The module examination will be graded as either "pass" or "fail".	
Module frequency	The module is offered each winter semester.	
Workload	The workload comprises a total of 180 hours.	

Module duration	The module comprises one semester.

Module number	Module name	Responsible lecturer
Math-Ma-C14	Machine Learning and Data Mining	Prof. Ivo Sbalzarini ivo.sbalzarini@tu-dresden.de
Qualification objectives	Upon completing the module, students master the basics and handling of forward problems and inverse problems in computer-aided science. They intuitively comprehend the meaning and definition of these two problem formulations, as well as the relationship with generative and discriminative approaches in Statistics. They know the theoretical connections between these two formulations, as given by the Theorem of Bayes and the Euler-Lagrange equations. For forward problems, students know what verification and validation mean, and can apply these in practice. For inverse problems, students are familiar with the basics of machine learning, in particular supervised and unsupervised approaches, as well as the concepts of overfitting and cross validation.	
Content	The module covers the mathematical formulation of forward and inverse problems, generative discriminative modelling approaches, Bayes theorem, Euler-Lagrange equations of optimisation, verification and validation of models and simulations, basics of machine learning, supervised learning, unsupervised learning, overfitting, cross validation, learning as an optimisation problem, basics of neural networks.	
Teaching and learning methods	The module comprises 2 hours per week lecture, 2 hours per week exercise and self-study. The lecture and the exercise will be held in English.	
Prerequisites for participation	Knowledge of sequential computer programming, algorithms and data structures, analysis of functions of one and several variables, linear algebra, especially vector and matrix calculation, as well as probability calculation and statistics at the Bachelor's level of the Computer Science program is required. The following literature is recommended for preparation: - Harel, D.: Algorithmics – the spirit of computing, Addison-Wesley, 2004, - Schildt, H.: C++ from the ground up, McGraw-Hill, 2003, - Abelson, H. / Sussman, G. J. / Sussman, J.: Structure and Interpretation of Computer Programs, MIT Press, 1985, - Cormen, T. H. / Leiserson, C. E. / Rivest, R. L. / Stein, C.: Introduction to Algorithms, 2nd Edition, MIT Press, 2001, - Lax, P. D. / Terrell, M. S.: Multivariable Calculus with Applications, Undergraduate Texts in Mathematics, Springer, 2018, - Hefferon, J.: Linear Algebra, https://joshua.smcvt.edu/linearalgebra/, 4th Edition, 2020.	
Applicability	In the compulsory elective area N of the Master's program Mathematics, in which modules with a total of at least 18 credit points are to be chosen, the module is one of nine compulsory elective modules in the specialization Computer Science – Advanced. Furthermore, in the compulsory elective area N of the Master's program Technomathematics, in which modules with a total of at least 24 credit points have to be chosen, the module is one of ten compulsory elective modules in the specialization Computer Science – Advanced. The module cannot be chosen if it has already been taken in the Bachelor's program.	

Requirements for earning credit points	Credit points are earned after passing the module examination. For more than 10 registered students, the module examination consists of a written test lasting 90 minutes. For up to 10 registered students, the written test will be replaced by a non-public oral examination lasting 30 minutes as an individual examination. The type of examination will be announced in writing at the end of the registration period. The language of the examination is English.
Credit points and grades	Participants can earn six credit points for this module. The module grade corresponds to the grade of the examined assessment.
Module frequency	The module is offered each winter semester.
Workload	The workload comprises a total of 180 hours.
Module duration	The module comprises one semester.

Module number	Module name	Responsible lecturer
Math-Ma-C15	Parallel Programming and High-Performance Computing	Prof. Wolfgang Nagel wolfgang.nagel@tu-dresden.de
Qualification objectives	Upon completing this module, the students will acquire the basics of parallel programming and high performance scientific computing.	
Content	The contents of the module include the design and architecture of numerical simulation codes, as well as computer programmes for data analysis. Furthermore, they include practical parts for the implementation of examples on existing HPC architectures in a high-level language with different parallelisation models such as e.g. MPI, multi-threading or CUDA.	
Teaching and learning methods	The module comprises 2 hours per week lecture, 2 hours per week exercise and self-study. The lecture and the exercise will be held in English.	
Prerequisites for participation	Knowledge in sequential computer programming, algorithms and data structures, analysis of functions of one and serveral variables, linear algebra, especially vector and matrix calculation, as well as probability calculation and statistics at the Bachelor's level of the Computer Science program is required. The following literature is recommended for preparation: - Harel, D.: Algorithmics – the spirit of computing, Addison-Wesley, 2004, - Schildt, H.: C++ from the ground up, McGraw-Hill, 2003, - Abelson, H. / Sussman, G. J. / Sussman, J.: Structure and Interpretation of Computer Programs, MIT Press, 1985, - Cormen, T. H. / Leiserson, C. E. / Rivest, R. L. / Stein, C.: Introduction to Algorithms, 2nd Edition, MIT Press, 2001, - Lax, P. D. / Terrell, M. S.: Multivariable Calculus with Applications, Undergraduate Texts in Mathematics, Springer, 2018, - Hefferon, J.: Linear Algebra, https://joshua.smcvt.edu/linearalgebra/, 4th Edition, 2020.	
Applicability	In the compulsory elective area N of the Master's program Mathematics, in which modules with a total of at least 18 credit points are to be chosen, the module is one of nine compulsory elective modules in the specialization Computer Science – Advanced. Furthermore, in the compulsory elective area N of the Master's program Technomathematics, in which modules with a total of at least 24 credit points have to be chosen, the module is one of ten compulsory elective modules in the specialization Computer Science – Advanced. The module cannot be chosen if it has already been taken in the Bachelor's program.	
Requirements for earning credit points	Credit points are earned after passing the module examination. For more than 10 registered students, the module examination consists of a written test lasting 90 minutes. For up to 10 registered students, the written test will be replaced by a non-public oral examination lasting 30 minutes as an individual examination. The type of examination will be announced in writing at the end of the registration period. The language of the examination is English.	
Credit points and grades	Participants can earn six credit points for this module. The module grade corresponds to the grade of the examined assessment.	

Module frequency	The module is offered each winter semester.
Workload	The workload comprises a total of 180 hours.
Module duration	The module comprises one semester.

Module number	Module name	Responsible lecturer
Math-Ma-C16	Data Visualization	Prof. Stefan Gumhold stefan.gumhold@tu-dresden.de
Qualification objectives	Upon completing this module, the students will acquire the basics and practices of scientific visualisation of measurement and experimental data, as well as simulation results. They know the basics of visual perception and their influence on the design of visualisations. Students can confidently specify data by dimension, feature types, and structure and select appropriate visual attributes for a given specification. They know the most important visualisation forms for 2-, 3- and multidimensional observation spaces, as well as for scalar, vectorial, tensor-valued and multidimensional features. They are able to select suitable techniques for the respective visualisation task. Students are familiar with basic presentation- and interaction techniques and can thoroughly implement them in an interactive visual analysis system. They know the most important visualisation frameworks, have gathered practical experience and are able to select these tasks appropriately.	
Content	The contents of the module are the basics of data visualisation, which deals with the mapping of data of different types on visual attributes, and builds on knowledge about the visual perception of humans.	
Teaching and learning methods	The module comprises 2 hours per week lecture, 2 hours per week exercise and self-study. The lecture and the exercise will be held in English.	
Prerequisites for participation	Knowledge in sequential computer programming, algorithms and data structures, analysis of functions of one and serveral variables, basic techniques of data analysis and linear algebra, especially vector and matrix calculation at the Bachelor's level of the Computer Science program is required. The following literature is recommended for preparation: - Harel, D.: Algorithmics – the spirit of computing, Addison-Wesley, 2004, - Schildt, H.: C++ from the ground up, McGraw-Hill, 2003, - Abelson, H. / Sussman, G. J. / Sussman, J.: Structure and Interpretation of Computer Programs, MIT Press, 1985, - Cormen, T. H. / Leiserson, C. E. / Rivest, R. L. / Stein, C.: Introduction to Algorithms, 2nd Edition, MIT Press, 2001, - Lax, P. D. / Terrell, M. S.: Multivariable Calculus with Applications, Undergraduate Texts in Mathematics, Springer, 2018, - Hefferon, J.: Linear Algebra, https://joshua.smcvt.edu/linearalgebra/, 4th Edition, 2020.	
Applicability	In the compulsory elective area N of the Master's program Mathematics, in which modules with a total of at least 18 credit points are to be chosen, the module is one of nine compulsory elective modules in the specialization Computer Science – Advanced. Furthermore, in the compulsory elective area N of the Master's program Technomathematics, in which modules with a total of at least 24 credit points have to be chosen, the module is one of ten compulsory elective modules in the specialization Computer Science – Advanced. The module cannot be chosen if it has already been taken in the Bachelor's program.	

Requirements for earning credit points	Credit points are earned after passing the module examination. For more than 10 registered students, the module examination consists of a written test lasting 90 minutes. For up to 10 registered students, the written test will be replaced by a non-public oral examination lasting 30 minutes as an individual examination. The type of examination will be announced in writing at the end of the registration period. The language of the examination is English.
Credit points and grades	Participants can earn six credit points for this module. The module grade corresponds to the grade of the examined assessment.
Module frequency	The module is offered each winter semester.
Workload	The workload comprises a total of 180 hours.
Module duration	The module comprises one semester.

Module number	Module name	Responsible lecturer
Math-Ma-M01	Technical Mechanics – Statics	Prof. Markus Kästner studiendokumente.mw@tu-dresden.de
Qualification objectives	The students know the basic laws of statics and can apply them to the analysis of the load-bearing behaviour of simple components and constructions. They are able to determine static and geometric properties of bodies and cross-sections.	
Content	The module covers the physical model of the rigid body, the loads force and moment, free body diagrams, the location of centers of gravity, moments of area of first and second order as well as the analysis of the equilibrium of plane and three-dimensional load-bearing structures using the basic laws of statics to calculate reaction forces and moments in bearings and structural members. Other topics are bearing and cutting reactions and friction problems.	
Teaching and learning methods	The module comprises 2 hours per week lecture, 2 hours per week exercise and self-study. The lecture and the exercise will be held in German.	
Prerequisites for participation	Knowledge of mathematics at A-level (basic course) is required.	
Applicability	In the compulsory elective area N of the Master's program Mathematics, in which modules with a total of at least 18 credit points are to be chosen, the module is one of five compulsory elective modules in the specialization Mechanical Engineering – Basic. Furthermore, in the compulsory elective area N of the Master's program Technomathematics, in which modules with a total of at least 24 credit points have to be chosen, the module is one of six compulsory elective modules in the specialization Mechanical Engineering – Basic. The module cannot be chosen if it has already been taken in the Bachelor's program.	
Requirements for earning credit points	Credit points are earned after passing the module examination. The module examination consists of a written test lasting 120 minutes. Bonus performance for the written examination is a performance status check equating to 10 hours. The language of the examination is German.	
Credit points and grades	Participants can earn six credit points for this module. The module grade corresponds to the grade of the examined assessment.	
Module frequency	The module is offered each winter semester.	
Workload	The workload comprises a total of 180 hours.	
Module duration	The module comprises one semester.	

Module number	Module name	Responsible lecturer
Math-Ma-M02	Technical Mechanics – Theory of Strength of Materials	Prof. Thomas Wallmersperger thomas.wallmersperger@tu-dresden.de
Qualification objectives	The students know the relationships between loads, material properties and stresses of components. They are proficient in simple calculation methods for dimensioning, strength verification and load-bearing capacity assessment of components and structures. They understand the continuum mechanical basics of modern computer programmes for stress and deformation analysis.	
Content	The module covers the basic problems of strength theory. Contents of the module are tensile, compressive and shear stresses including elementary dimensioning concepts, general stress and distortion states in linear-elastic materials with temperature influence, stresses and deformations in torsion of prismatic bars, beam bending, shear force, strength hypotheses, influence numbers and Castigliano's theorem, elastostatic stability, rotationally symmetrical stress states in thin-walled vessels, circular discs and plates as well as in thick-walled circular cylinders, simple notch and crack problems, inelastic loading, summary of the basic equations of linear elasticity theory.	
Teaching and learning methods	The module comprises 4 hours per week lecture, 3 hours per week exercise and self-study. The lecture and the exercise will be held in German.	
Prerequisites for participation	Fundamentals of engineering mechanics, as taught in the module Technical Mechanics – Statics, as well as fundamentals of mathematics, in particular integral and differential calculus, at the Bachelor’s level of the Mechanical Engineering program are required.	
Applicability	In the compulsory elective area N of the Master's program Mathematics, in which modules with a total of at least 18 credit points are to be chosen, the module is one of five compulsory elective modules in the specialization Mechanical Engineering – Basic. Furthermore, in the compulsory elective area N of the Master's program Technomathematics, in which modules with a total of at least 24 credit points have to be chosen, the module is one of six compulsory elective modules in the specialization Mechanical Engineering – Basic. The module cannot be chosen if it has already been taken in the Bachelor's program.	
Requirements for earning credit points	Credit points are earned after passing the module examination. The module examination consists of a written test lasting 180 minutes. Bonus performance for the written examination is a performance status check equating to 10 hours. The language of the examination is German.	
Credit points and grades	Participants can earn nine credit points for this module. The module grade corresponds to the grade of the examined assessment.	
Module frequency	The module will be offered each academic year, beginning in the summer semester.	
Workload	The workload comprises a total of 270 hours.	
Module duration	The module comprises two semester.	

Module number	Module name	Responsible lecturer
Math-Ma-M03	Technical Mechanics – Kinematics and Kinetics	Prof. Michael Beitelschmidt michael.beitelschmidt@tu-dresden.de
Qualification objectives	The students master elementary kinematics as well as the basic laws of kinetics, they are familiar with problem-solving thinking and can apply the knowledge they have acquired to calculate the relationships between body movements and the associated loads. They are able to analyse and solve simple kinematic and kinetic problems for components and constructions.	
Content	Contents of the module are the kinematics of the point, rigid bodies and systems of rigid bodies as a prerequisite for kinetic analyses. For the kinetic calculation of translational movements of rigid bodies, the basic laws of statics are extended by taking into account body mass and translational acceleration while observing the principle of intersection. The investigation of arbitrary rigid body movements is based on the postulates of momentum and angular momentum balance as independent basic laws of kinetics. The evaluation of these laws concerns plane motions, kinetic sectional reactions, oscillations with different degrees of freedom, impact processes, the derivation of the Lagrange equations of the second kind and spatial rotor motions as well as the formulation of the elastokinetic initial boundary value problem as the basis of modern computer programs.	
Teaching and learning methods	The module comprises 3 hours per week lecture, 2 hours per week exercise and self-study. The lecture and the exercise will be held in German.	
Prerequisites for participation	Fundamentals of engineering mechanics, as taught in the modules Technical Mechanics – Statics and Technical Mechanics – Theory of Strength of Materials, at the Bachelor's level of the Mechanical Engineering program are required.	
Applicability	In the compulsory elective area N of the Master's program Mathematics, in which modules with a total of at least 18 credit points are to be chosen, the module is one of five compulsory elective modules in the specialization Mechanical Engineering – Basic. Furthermore, in the compulsory elective area N of the Master's program Technomathematics, in which modules with a total of at least 24 credit points have to be chosen, the module is one of six compulsory elective modules in the specialization Mechanical Engineering – Basic. The module cannot be chosen if it has already been taken in the Bachelor's program.	
Requirements for earning credit points	Credit points are earned after passing the module examination. The module examination consists of a written test lasting 150 minutes. The language of the examination is German.	
Credit points and grades	Participants can earn six credit points for this module. The module grade corresponds to the grade of the examined assessment.	
Module frequency	The module is offered each summer semester.	
Workload	The workload comprises a total of 180 hours.	
Module duration	The module comprises one semester.	

Module number	Module name	Responsible lecturer
Math-Ma-M04	Design Theory	Prof. Kristin Paetzold-Byhain kristin.paetzold@tu-dresden.de
Qualification objectives	The students master basic knowledge and skills required for the creation of constructive designs and their documentation. After completing the module, the students have basic constructional knowledge and design skills. They are able to understand basic geometric and technical elements and to prepare and read technical documentation based on these. In addition, you have the ability to think holistically in terms of design and to design mechanical engineering components in a way that is suitable for function and production.	
Content	Contents of the module are basic relationships between geometric objects, basics of making and understanding technical documentation such as drawings and parts lists, replacement construction, design of machine parts suitable for production, design of machine parts suitable for function and stress.	
Teaching and learning methods	The module comprises 4 hours per week lecture, 4 hours per week exercise, 2 hours per week tutorial and self-study. The lecture, the exercise and the tutorial will be held in German.	
Prerequisites for participation	Knowledge of mathematics at A-level (basic course) is required.	
Applicability	In the compulsory elective area N of the Master's program Mathematics, in which modules with a total of at least 18 credit points are to be chosen, the module is one of five compulsory elective modules in the specialization Mechanical Engineering – Basic. Furthermore, in the compulsory elective area N of the Master's program Technomathematics, in which modules with a total of at least 24 credit points have to be chosen, the module is one of six compulsory elective modules in the specialization Mechanical Engineering – Basic. The module cannot be chosen if it has already been taken in the Bachelor's program.	
Requirements for earning credit points	Credit points are earned after passing the module examination. The module examination consists of a written test lasting 150 minutes. The language of the examination is German.	
Credit points and grades	Participants can earn nine credit points for this module. The module grade corresponds to the grade of the examined assessment.	
Module frequency	The module will be offered each academic year, beginning in the winter semester.	
Workload	The workload comprises a total of 270 hours.	
Module duration	The module comprises two semester.	

Module number	Module name	Responsible lecturer
Math-Ma-M05	Fundamentals of Fluid Mechanics	Prof. Jochen Fröhlich jochen.froehlich@tu-dresden.de
Qualification objectives	The students have a basic understanding of the mechanics of liquids and gases in laminar and turbulent flow. They are able to analyse and quantitatively describe simple technical flow configurations.	
Content	Contents are the specific properties of fluids, static situations, kinematics of fluids and the derivation and application of the conservation laws in differential and integral form, basic similarity numbers and one-dimensional theory for compressible and incompressible fluids, without and with losses. Further contents are the techniques for the exact calculation of laminar flows and the description of turbulent flows with exemplary technical applications.	
Teaching and learning methods	The module comprises 2 hours per week lecture, 2 hours per week exercise, 1 hour tutorial and self-study. The lecture, the exercise and the tutorial will be held in German.	
Prerequisites for participation	Participants require basic knowledge of mathematics in the fields of algebra and calculus at university entrance-level proficiency.	
Applicability	In the compulsory elective area N of the Master's program Mathematics, in which modules with a total of at least 18 credit points are to be chosen, the module is one of five compulsory elective modules in the specialization Mechanical Engineering – Basic and one of seven compulsory elective modules in the specialization Mechanical Engineering – Advanced. Furthermore, in the compulsory elective area N of the Master's program Technomathematics, in which modules with a total of at least 24 credit points have to be chosen, the module is one of six compulsory elective modules in the specialization Mechanical Engineering – Basic and one of eight compulsory elective modules in the specialization Mechanical Engineering – Advanced. The module cannot be chosen if it has already been taken in the Bachelor's program.	
Requirements for earning credit points	Credit points are earned after passing the module examination. The module examination consists of a written test lasting 150 minutes. The language of the examination is German.	
Credit points and grades	Participants can earn six credit points for this module. The module grade corresponds to the grade of the examined assessment.	
Module frequency	The module is offered each summer semester.	
Workload	The workload comprises a total of 180 hours.	
Module duration	The module comprises one semester.	

Module number	Module name	Responsible lecturer
Math-Ma-M06	Continuum Mechanics and Multi-functional Structures	Prof. Thomas Wallmersperger thomas.wallmersperger@tu-dresden.de
Qualification objectives	The students master the basics of physical modelling as well as the mathematical description of the movement of deformable bodies under the influence of mechanical and thermal loads. They have knowledge and skills for the description and calculation of active structures, know different active materials and the calculation and application of multifunctional structures.	
Content	In the focus on continuum mechanics, the module covers the kinematics of arbitrary motions, the basic balance equations as well as the formulation of nonlinear material laws, in particular the specialisation of these basic equations to problems of solid and fluid mechanics. In the focus on multifunctional structures, the module covers adaptive systems, active actuator and sensor materials e.g. piezoelectric ceramics, electro- and magnetostrictives, shape memory alloys as well as electroactive polymers, the modelling and discretisation of actuators and the control of an adaptive structure.	
Teaching and learning methods	The module comprises 4 hours per week lecture, 2 hours per week exercise and self-study. The lecture and the exercise will be held in German.	
Prerequisites for participation	Fundamentals of engineering mechanics and advanced competencies in mathematics at the Bachelor's level of the Mechanical Engineering program are required. Literature: For example Balke, H.: Technische Mechanik – Statik, Festigkeitslehre, Kinetik, Springer is suitable for preparation.	
Applicability	In the compulsory elective area N of the Master's program Mathematics, in which modules with a total of at least 18 credit points are to be chosen, the module is one of seven compulsory elective modules in the specialization Mechanical Engineering – Advanced. Furthermore, in the compulsory elective area N of the Master's program Technomathematics, in which modules with a total of at least 24 credit points have to be chosen, the module is one of eight compulsory elective modules in the specialization Mechanical Engineering – Advanced. The module cannot be chosen if it has already been taken in the Bachelor's program.	
Requirements for earning credit points	Credit points are earned after passing the module examination. The module examination consists of a written test lasting 120 minutes and a non-public oral examination lasting 30 minutes as an individual examination. The language of the examination is German in each case.	
Credit points and grades	Participants can earn nine credit points for this module. The module grade is calculated from the unweighted average grade of the examined assessments.	
Module frequency	The module is offered each summer semester.	
Workload	The workload comprises a total of 270 hours.	

Module duration	The module comprises one semester.

Module number	Module name	Responsible lecturer
Math-Ma-M07	Analytical Methods of Solid Mechanics	Prof. Markus Kästner markus.kaestner@tu-dresden.de
Qualification objectives	The students master basic mathematical methods of solid mechanics. They have knowledge of the calculus of variations, tensor calculus and stability analysis.	
Content	The module includes an introduction to the basics of tensor calculus, such as transformation algebra and analysis, as well as to one- and multidimensional variational problems of one or more functions. It also covers the basic features of stability theory and the application of mathematical methods based on problems in solid mechanics. These include, for example, work and variation problems in elasticity theory as well as branching and stability analysis of static conservative discrete systems.	
Teaching and learning methods	The module comprises 2 hours per week lecture, 2 hours per week exercise and self-study. The lecture and the exercise will be held in German.	
Prerequisites for participation	Fundamentals of engineering mechanics at the Bachelor's level of the Mechanical Engineering program are required. Literature: For example Balke, H.: Technische Mechanik – Statik, Festigkeitslehre, Kinetik, Springer is suitable for preparation.	
Applicability	In the compulsory elective area N of the Master's program Mathematics, in which modules with a total of at least 18 credit points are to be chosen, the module is one of seven compulsory elective modules in the specialization Mechanical Engineering – Advanced. Furthermore, in the compulsory elective area N of the Master's program Technomathematics, in which modules with a total of at least 24 credit points have to be chosen, the module is one of eight compulsory elective modules in the specialization Mechanical Engineering – Advanced. The module cannot be chosen if it has already been taken in the Bachelor's program.	
Requirements for earning credit points	Credit points are earned after passing the module examination. The module examination consists of a non-public oral examination lasting 30 minutes as an individual examination. The language of the examination is German.	
Credit points and grades	Participants can earn six credit points for this module. The module grade corresponds to the grade of the examined assessment.	
Module frequency	The module is offered each winter semester.	
Workload	The workload comprises a total of 180 hours.	
Module duration	The module comprises one semester.	

Module number	Module name	Responsible lecturer
Math-Ma-M08	Elastic Structures and Technical Fluid Mechanics	Prof. Thomas Wallmersperger thomas.wallmersperger@tu-dresden.de
Qualification objectives	Students will be able to calculate the elastic behaviour of structures under the influence of mechanical and thermal load as well as break down complex flows into elementary flows and model these mathematically and physically.	
Content	The module covers static problems of solid bodies with infinitesimal distortions and linear material behaviour in Cartesian coordinates and polar coordinates as well as the analytical solution of special boundary value problems within the framework of disk and torsion problems. As practice-relevant elementary flows, vortex flows with the help of the vorticity, the vortex theorems and the theorem of Bio-Savart, potential flows with the complex potential, the singularity method and circulation are contents of the module. The module also includes the derivation of boundary layer equations and the solution with methods of similarity mechanics as well as simple programming for the connection to practical application.	
Teaching and learning methods	The module comprises 4 hours per week lecture, 2 hours per week exercise, 1 hour practical training and self-study. The lecture, the exercise and the practical training will be held in German.	
Prerequisites for participation	Basic knowledge of fluid mechanics, technical thermodynamics and strength of materials as taught in the modules Fundamentals of Fluid Mechanics, Technical Mechanics – Statics and Technical Mechanics – Theory of Strength of Materials are required, as well as advanced competencies in mathematics at the Bachelor's level of the Mechanical Engineering program.	
Applicability	In the compulsory elective area N of the Master's program Mathematics, in which modules with a total of at least 18 credit points are to be chosen, the module is one of seven compulsory elective modules in the specialization Mechanical Engineering – Advanced. Furthermore, in the compulsory elective area N of the Master's program Technomathematics, in which modules with a total of at least 24 credit points have to be chosen, the module is one of eight compulsory elective modules in the specialization Mechanical Engineering – Advanced. The module cannot be chosen if it has already been taken in the Bachelor's program.	
Requirements for earning credit points	Credit points are earned after passing the module examination. The module examination consists of a written test lasting 120 minutes and a non-public oral examination lasting 30 minutes as an individual examination. The language of the examination is German in each case.	
Credit points and grades	Participants can earn nine credit points for this module. The module grade is calculated from the unweighted average grade of the examined assessments.	
Module frequency	The module is offered each winter semester.	
Workload	The workload comprises a total of 270 hours.	

Module duration	The module comprises one semester.

Module number	Module name	Responsible lecturer
Math-Ma-M09	Numerical Methods and Structural Durability	Prof. Markus Kästner markus.kaestner@tu-dresden.de
Qualification objectives	The students master the basics of numerical modelling of components to determine stresses. They have basic knowledge of assessing stresses in classic structural and modern lightweight materials.	
Content	The module covers established simulation methods for the approximate solution of boundary value problems, basics of algebraisation, discretisation and the numerical properties of the finite element and the boundary element method for solid mechanics problems, in particular the description and determination of stresses in materials and components, the service life estimation according to the nominal stress concept and other elastic concepts as well as the proof of operational or fatigue strength.	
Teaching and learning methods	The module comprises 4 hours per week lecture, 2 hours per week exercise, 1 hour practical training and self-study. The lecture, the exercise and the practical training will be held in German.	
Prerequisites for participation	Fundamentals of engineering mechanics, as taught in the modules Technical Mechanics – Statics and Technical Mechanics – Theory of Strength of Materials, at the Bachelor's level of the Mechanical Engineering program are required.	
Applicability	In the compulsory elective area N of the Master's program Mathematics, in which modules with a total of at least 18 credit points are to be chosen, the module is one of seven compulsory elective modules in the specialization Mechanical Engineering – Advanced. Furthermore, in the compulsory elective area N of the Master's program Technomathematics, in which modules with a total of at least 24 credit points have to be chosen, the module is one of eight compulsory elective modules in the specialization Mechanical Engineering – Advanced. The module cannot be chosen if it has already been taken in the Bachelor's program.	
Requirements for earning credit points	Credit points are earned after passing the module examination. The module examination consists of a written test lasting 120 minutes and a non-public oral examination lasting 30 minutes as an individual examination. The language of the examination is German in each case.	
Credit points and grades	Participants can earn nine credit points for this module. The module grade is calculated from the unweighted average grade of the examined assessments.	
Module frequency	The module is offered each winter semester.	
Workload	The workload comprises a total of 270 hours.	
Module duration	The module comprises one semester.	

Module number	Module name	Responsible lecturer
Math-Ma-M10	System Dynamics and Structural Vibrations	Prof. Michael Beitelschmidt michael.beitelschmidt@tu-dresden.de
Qualification objectives	The students have basic knowledge of system dynamics and are able to describe the dynamics of mechanical systems and systems of other physical domains and to calculate and identify their behaviour. They also have the competence to understand, calculate and evaluate vibration phenomena with higher complexity and to apply solution methods to vibration behaviour.	
Content	Contents of the module are the basics of system dynamics and structural vibrations. In the focus on system dynamics, the module includes the basic procedures of theoretical modelling, identification of dynamic systems and parameter estimation of generalised problems, differential equation systems, system characteristic functions in the time and frequency domain as well as the methods of system description and system investigation. The focus on vibration theory includes the fundamentals and methods for vibration analysis, in particular procedures and methods for the calculation of linear and non-linear mechanical, discrete and continuous vibration systems, solution methods for non-linear oscillators as well as linear, one-dimensional continua and the exact or approximate solution of the wave equation.	
Teaching and learning methods	The module comprises 4 hours per week lecture, 2 hours per week exercise and self-study. The lecture and the exercise will be held in German.	
Prerequisites for participation	Basic competencies in strength of materials, kinematics and kinetics, statics, as well as advanced competencies in mathematics at the Bachelor's level of the Mechanical Engineering program are required.	
Applicability	In the compulsory elective area N of the Master's program Mathematics, in which modules with a total of at least 18 credit points are to be chosen, the module is one of seven compulsory elective modules in the specialization Mechanical Engineering – Advanced. Furthermore, in the compulsory elective area N of the Master's program Technomathematics, in which modules with a total of at least 24 credit points have to be chosen, the module is one of eight compulsory elective modules in the specialization Mechanical Engineering – Advanced. The module cannot be chosen if it has already been taken in the Bachelor's program.	
Requirements for earning credit points	Credit points are earned after passing the module examination. The module examination consists of a written test lasting 180 minutes. The language of the examination is German.	
Credit points and grades	Participants can earn nine credit points for this module. The module grade corresponds to the grade of the examined assessment.	
Module frequency	The module is offered each winter semester.	
Workload	The workload comprises a total of 270 hours.	
Module duration	The module comprises one semester.	

Module number	Module name	Responsible lecturer
Math-Ma-M11	Data Processing and Experimental Model Analysis	Prof. Michael Beitelschmidt michael.beitelschmidt@tu-dresden.de
Qualification objectives	The students master current methods of processing measured values for vibration analysis and technical diagnostics. They are able to apply the taught analysis and evaluation methods in order to correctly assess and interpret the vibration behaviour in a specific case. The students are familiar with the metrological recording of structural vibrations and the processing of the measurement signals. They are also able to experimentally determine the modal parameters of elastic structures with the help of modal analysis.	
Content	The module covers the methods of measured value processing and technical diagnostics as well as experimental modal analysis. Measurement value processing includes the methods of measurement data acquisition and measurement data processing as well as procedures for signal and model-based diagnostics, in particular the basics of sensor technology and measurement technology, the conception of a measurement chain, methods of digital signal analysis in the time and frequency range such as aliasing, Gibbs phenomenon and FFT, window functions, time-frequency analysis, such as Campbell diagrams, waterfall diagrams and wavelets, mechanical vibration models and machine diagnostics. The focus on experimental modal analysis includes the fundamentals and applications of experimental modal analysis. This includes the methods for vibration excitation and vibration measurement, signal analysis and processing. Other topics include frequency response, transfer function and their modal decomposition, modal theory as well as the determination of modal parameters and methods for mode identification and comparison.	
Teaching and learning methods	The module comprises 3 hours per week lecture, 2 hours per week exercise, 1 hour practical training and self-study. The lecture, the exercise and the practical training will be held in German.	
Prerequisites for participation	Basic competencies in kinematics and kinetics and advanced competencies in mathematics at the Bachelor's level of the Mechanical Engineering program are required.	
Applicability	In the compulsory elective area N of the Master's program Mathematics, in which modules with a total of at least 18 credit points are to be chosen, the module is one of seven compulsory elective modules in the specialization Mechanical Engineering – Advanced. Furthermore, in the compulsory elective area N of the Master's program Technomathematics, in which modules with a total of at least 24 credit points have to be chosen, the module is one of eight compulsory elective modules in the specialization Mechanical Engineering – Advanced. The module cannot be chosen if it has already been taken in the Bachelor's program.	
Requirements for earning credit points	Credit points are earned after passing the module examination. The module examination consists of a written test lasting 180 minutes. The language of the examination is German.	

Credit points and grades	Participants can earn nine credit points for this module. The module grade corresponds to the grade of the examined assessment.
Module frequency	The module is offered each summer semester.
Workload	The workload comprises a total of 270 hours.
Module duration	The module comprises one semester.

Module number	Module name	Responsible lecturer
Math-Ma-P01	Experimental Physics – Mechanics and Thermodynamics	Dean of Studies of the Faculty of Physics studiendekan.physik@tu-dresden.de
Qualification objectives	Students are able to independently understand fundamental physical processes and relationships in mechanics and thermodynamics for idealized case studies, to describe them analytically and quantitatively, and to interpret them in a descriptive way. Students are able to apply this knowledge to a wide range of phenomena.	
Content	The module covers mechanics, including kinematics and dynamics of the point mass and rigid body, special relativity, mechanical properties of solids, liquids, and gases, as well as mechanical oscillations and waves, and thermodynamics, including the laws of thermodynamics, cyclic processes, thermal properties of solids, liquids, and gases, changes of state and phase diagrams, and heat conduction.	
Teaching and learning methods	The module comprises 4 hours per week lecture, 2 hours per week exercise and self-study. The lecture and the exercise will be held in German.	
Prerequisites for participation	None.	
Applicability	In the compulsory elective area N of the Master's program Mathematics, in which modules with a total of at least 18 credit points are to be chosen, the module is one of seven compulsory elective modules in the specialization Physics – Basic. Furthermore, in the compulsory elective area N of the Master's program Technomathematics, in which modules with a total of at least 24 credit points have to be chosen, the module is one of eight compulsory elective modules in the specialization Physics – Basic. The module cannot be chosen if it has already been taken in the Bachelor's program.	
Requirements for earning credit points	Credit points are earned after passing the module examination. The module examination consists of a written test lasting 180 minutes. The language of the examination is German.	
Credit points and grades	Participants can earn nine credit points for this module. The module grade corresponds to the grade of the examined assessment.	
Module frequency	The module is offered each winter semester.	
Workload	The workload comprises a total of 270 hours.	
Module duration	The module comprises one semester.	

Module number	Module name	Responsible lecturer
Math-Ma-P02	Experimental Physics – Electromagnetism and Optics	Dean of Studies of the Faculty of Physics studiendekan.physik@tu-dresden.de
Qualification objectives	Students are able to independently understand fundamental physical processes and relationships in electrodynamics and optics for idealized case studies, to describe them analytically and quantitatively, and to interpret them clearly. Students are able to apply this knowledge to a wide range of phenomena.	
Content	The module covers electrostatics and magnetostatics, electrodynamics including currents and fields in matter, time-varying fields, electromagnetic oscillations and waves, Maxwell's equations and their relativistic description, and optics including geometrical optics, reflection, refraction, lenses, optical instruments, and photometry.	
Teaching and learning methods	The module comprises 4 hours per week lecture, 2 hours per week exercise and self-study. The lecture and the exercise will be held in German.	
Prerequisites for participation	Competencies in experimental physics in the areas of mechanics and thermodynamics at the Bachelor’s level of the Physics program are required.	
Applicability	In the compulsory elective area N of the Master's program Mathematics, in which modules with a total of at least 18 credit points are to be chosen, the module is one of seven compulsory elective modules in the specialization Physics – Basic. Furthermore, in the compulsory elective area N of the Master's program Technomathematics, in which modules with a total of at least 24 credit points have to be chosen, the module is one of eight compulsory elective modules in the specialization Physics – Basic. The module cannot be chosen if it has already been taken in the Bachelor's program.	
Requirements for earning credit points	Credit points are earned after passing the module examination. The module examination consists of a written test lasting 180 minutes. The language of the examination is German.	
Credit points and grades	Participants can earn nine credit points for this module. The module grade corresponds to the grade of the examined assessment.	
Module frequency	The module is offered each summer semester.	
Workload	The workload comprises a total of 270 hours.	
Module duration	The module comprises one semester.	

Module number	Module name	Responsible lecturer
Math-Ma-P03	Experimental Physics – Waves and Quanta	Dean of Studies of the Faculty of Physics studiendekan.physik@tu-dresden.de
Qualification objectives	Students are able to independently understand basic physical processes and relationships in the description and treatment of waves and quanta for idealized case studies, to describe them analytically and quantitatively, and to interpret them in a descriptive way. Students are able to apply this knowledge to a wide range of phenomena.	
Content	The module covers wave optics, such as coherence, interference, and diffraction; applications, such as the resolution of optical instruments and interferometers; and light quanta. This includes the photo effect and Compton effect, applications such as photodiodes, solar energy, and X-ray tubes, and the interaction of photons with matter. Other topics include the mathematical description of waves and wave packets by Fourier series and integrals, including Heisenberg's uncertainty principle, and matter waves from de Broglie's hypothesis to the first proofs by Thomson and Davisson/Germer, and wave mechanics after Schrödinger, with simple applications to potential step and potential well, tunneling effect, bound states, zero-point energy, and molecular vibrations.	
Teaching and learning methods	The module comprises 4 hours per week lecture, 2 hours per week exercise and self-study. The lecture and the exercise will be held either in German or English. This will be specified by the lecturer at the beginning of each semester and announced in the usual manner.	
Prerequisites for participation	Competences in experimental physics in the areas of mechanics, heat, electromagnetism and optics at the Bachelor’s level of the Physics program are required.	
Applicability	In the compulsory elective area N of the Master's program Mathematics, in which modules with a total of at least 18 credit points are to be chosen, the module is one of seven compulsory elective modules in the specialization Physics – Basic and one of six compulsory elective modules in the specialization Physics – Advanced. Furthermore, in the compulsory elective area N of the Master's program Technomathematics, in which modules with a total of at least 24 credit points have to be chosen, the module is one of eight compulsory elective modules in the specialization Physics – Basic and one of seven compulsory elective modules in the specialization Physics – Advanced. The module cannot be chosen if it has already been taken in the Bachelor's program.	
Requirements for earning credit points	Credit points are earned after passing the module examination. The module examination consists of a written test lasting 180 minutes. The language of the examination is German.	
Credit points and grades	Participants can earn nine credit points for this module. The module grade corresponds to the grade of the examined assessment.	
Module frequency	The module is offered each winter semester.	

Workload	The workload comprises a total of 270 hours.
Module duration	The module comprises one semester.

Module number	Module name	Responsible lecturer
Math-Ma-P04	Computational Methods of Physics	Director of the Institute for Theoretical Physics itp@tu-dresden.de
Qualification objectives	Students gain insight into the systematic way of thinking and formal description of physical theories. They master the basic computational methods of physics. Students are able to apply this knowledge mathematically to a wide range of problems.	
Content	The module covers mathematical calculation and solution methods of vector algebra, differential and integral calculus for functions of one and more variables, vector analysis, in particular coordinate transformations, the Nabla operator and integral theorems, and ordinary and partial differential equations.	
Teaching and learning methods	The module comprises 4 hours per week lecture, 2 hours per week exercise and self-study. The lecture and the exercise will be held in German.	
Prerequisites for participation	None.	
Applicability	In the compulsory elective area N of the Master's program Mathematics, in which modules with a total of at least 18 credit points are to be chosen, the module is one of seven compulsory elective modules in the specialization Physics – Basic. Furthermore, in the compulsory elective area N of the Master's program Technomathematics, in which modules with a total of at least 24 credit points have to be chosen, the module is one of eight compulsory elective modules in the specialization Physics – Basic. The module cannot be chosen if it has already been taken in the Bachelor's program.	
Requirements for earning credit points	Credit points are earned after passing the module examination. The module examination consists of a written test lasting 180 minutes. The language of the examination is German.	
Credit points and grades	Participants can earn six credit points for this module. The module grade corresponds to the grade of the examined assessment.	
Module frequency	The module is offered each winter semester.	
Workload	The workload comprises a total of 180 hours.	
Module duration	The module comprises one semester.	

Module number	Module name	Responsible lecturer
Math-Ma-P05	Theoretical Mechanics	Director of the Institute for Theoretical Physics itp@tu-dresden.de
Qualification objectives	Students know and understand the systematic way of thinking and formal description of mechanics. They understand the models of theoretical physics of single mass points and are able to process the problems of mechanics analytically. Students are able to apply this knowledge and mathematical methods to a wide range of problems in mechanics.	
Content	The module covers the kinematics of the point mass, Newton's equation of motion, conservation laws, central force problem, two- and multi-body problem, nonlinear dynamics, Galilean and Lorentz transformations, special relativity, covariant formulation, equivalent formulations of theoretical mechanics such as Lagrange I+II, Hamilton and Poisson brackets, as well as symmetries of rigid bodies and gyroscopes.	
Teaching and learning methods	The module comprises 4 hours per week lecture, 2 hours per week exercise and self-study. The lecture and the exercise will be held in German.	
Prerequisites for participation	Competences in computational methods of physics at the Bachelor’s level of the Physics program are required.	
Applicability	In the compulsory elective area N of the Master's program Mathematics, in which modules with a total of at least 18 credit points are to be chosen, the module is one of seven compulsory elective modules in the specialization Physics – Basic. Furthermore, in the compulsory elective area N of the Master's program Technomathematics, in which modules with a total of at least 24 credit points have to be chosen, the module is one of eight compulsory elective modules in the specialization Physics – Basic. The module cannot be chosen if it has already been taken in the Bachelor's program.	
Requirements for earning credit points	Credit points are earned after passing the module examination. The module examination consists of a written test lasting 180 minutes. The language of the examination is German.	
Credit points and grades	Participants can earn nine credit points for this module. The module grade corresponds to the grade of the examined assessment.	
Module frequency	The module is offered each summer semester.	
Workload	The workload comprises a total of 270 hours.	
Module duration	The module comprises one semester.	

Module number	Module name	Responsible lecturer
Math-Ma-P06	Theoretical Electrodynamics	Director of the Institute for Theoretical Physics itp@tu-dresden.de
Qualification objectives	Students know and understand the systematic way of thinking and formal description of electrodynamics. They are able to capture physical processes and relationships with the help of Maxwell's equations and to describe them analytically and quantitatively. Students are able to apply the acquired knowledge to a wide range of electromagnetic phenomena. They have general skills for problem solving and analytical thinking.	
Content	The module covers the basic equations of electrodynamics, electrostatics, magnetostatics, electromagnetic waves, fields of time-dependent charge and current distributions, covariant formulation, and electromagnetic fields in media.	
Teaching and learning methods	The module comprises 4 hours per week lecture, 2 hours per week exercise and self-study. The lecture and the exercise will be held either in German or English. This will be specified by the lecturer at the beginning of each semester and announced in the usual manner.	
Prerequisites for participation	Competencies in experimental physics in the areas of mechanics, thermodynamics, electrodynamics and optics, for example Demtröder, W.: Experimentalphysik 1-2, Springer Spektrum at the Bachelor's level of the Physics program are required.	
Applicability	In the compulsory elective area N of the Master's program Mathematics, in which modules with a total of at least 18 credit points are to be chosen, the module is one of seven compulsory elective modules in the specialization Physics – Basic and one of six compulsory elective modules in the specialization Physics – Advanced. Furthermore, in the compulsory elective area N of the Master's program Technomathematics, in which modules with a total of at least 24 credit points have to be chosen, the module is one of eight compulsory elective modules in the specialization Physics – Basic and one of seven compulsory elective modules in the specialization Physics – Advanced. The module cannot be chosen if it has already been taken in the Bachelor's program.	
Requirements for earning credit points	Credit points are earned after passing the module examination. The module examination consists of a written test lasting 180 minutes. The language of the examination is German.	
Credit points and grades	Participants can earn nine credit points for this module. The module grade corresponds to the grade of the examined assessment.	
Module frequency	The module is offered each winter semester.	
Workload	The workload comprises a total of 270 hours.	
Module duration	The module comprises one semester.	

Module number	Module name	Responsible lecturer
Math-Ma-P07	Introductory Lab Course and Basic Lab Course – Mechanics and Heat	Director of the Physics Lab physikpraktikum@tu-dresden.de
Qualification objectives	Students are able to apply their theoretical and experimental knowledge in practice. They master basic experimental skills in the fields of mechanics and thermodynamics, are familiar with important measuring instruments and measurement techniques, and have knowledge of the scientific treatment of measurement uncertainties. They are able to work in a team, to develop solutions together and to critically analyze measurement results. They also have oral and written communication skills. They are able to use computer and programming techniques for statistical evaluation and presentation of measurement results.	
Content	The module covers basic concepts of statistical data analysis, computer and programming techniques with emphasis on the evaluation and presentation of physical measurement results. The module also includes basic experiments in mechanics, such as mechanical vibrations, hydrodynamics, and elastic properties, and thermodynamics, such as heat capacities, changes of state, latent heat, and gases.	
Teaching and learning methods	The module comprises 3 hours per week lecture, 2 hours per week exercise, 6 hours per week practical training and self-study. The lecture, the exercise and the practical training will be held in German.	
Prerequisites for participation	None.	
Applicability	In the compulsory elective area N of the Master's program Mathematics, in which modules with a total of at least 18 credit points are to be chosen, the module is one of seven compulsory elective modules in the specialization Physics – Basic. Furthermore, in the compulsory elective area N of the Master's program Technomathematics, in which modules with a total of at least 24 credit points have to be chosen, the module is one of eight compulsory elective modules in the specialization Physics – Basic. The module cannot be chosen if it has already been taken in the Bachelor's program.	
Requirements for earning credit points	Credit points are earned after passing the module examination. The module examination consists of a portfolio equating to 30 hours. The language of the examination is German.	
Credit points and grades	Participants can earn nine credit points for this module. The module grade corresponds to the grade of the examined assessment.	
Module frequency	The module will be offered each academic year, beginning in the winter semester.	
Workload	The workload comprises a total of 270 hours.	
Module duration	The module comprises two semester.	

Module number	Module name	Responsible lecturer
Math-Ma-P08	Basics of Quantum Theory	Director of the Institute for Theoretical Physics itp@tu-dresden.de
Qualification objectives	Students know and understand the systematic way of thinking and the formal description of quantum mechanics. They are able to derive fundamental quantum effects from the postulates of quantum theory and to describe them analytically and quantitatively. Students are able to apply the acquired knowledge to a wide range of quantum physical phenomena. They are capable of general problem solving and have enhanced analytical thinking skills.	
Content	The module covers the quantum mechanical state, quantum mechanical operators, measured values of observables, Hilbert space, the Schrödinger equation, time evolution, stationary solutions, one-dimensional problems, the harmonic oscillator, as well as the angular momentum operators, the hydrogen atom, and spin. Other topics include the measurement process in quantum theory and approximation methods, such as time-independent and time-dependent perturbation calculus, variational methods, and the Wentzel-Kramers-Brillouin approximation.	
Teaching and learning methods	The module comprises 4 hours per week lecture, 2 hours per week exercise and self-study. The lecture and the exercise will be held either in German or English. This will be specified by the lecturer at the beginning of each semester and announced in the usual manner.	
Prerequisites for participation	Competencies in theoretical mechanics, for example Fließbach, T.: Mechanik: Lehrbuch zur Theoretischen Physik I, Spektrum Akademischer Verlag, at the Bachelor's level of the Physics program are required.	
Applicability	In the compulsory elective area N of the Master's program Mathematics, in which modules with a total of at least 18 credit points are to be chosen, the module is one of six compulsory elective modules in the specialization Physics – Advanced. Furthermore, in the compulsory elective area N of the Master's program Technomathematics, in which modules with a total of at least 24 credit points have to be chosen, the module is one of seven compulsory elective modules in the specialization Physics – Advanced. The module cannot be chosen if it has already been taken in the Bachelor's program.	
Requirements for earning credit points	Credit points are earned after passing the module examination. The module examination consists of a written test lasting 180 minutes. The language of the examination is German.	
Credit points and grades	Participants can earn nine credit points for this module. The module grade corresponds to the grade of the examined assessment.	
Module frequency	The module is offered each summer semester.	
Workload	The workload comprises a total of 270 hours.	
Module duration	The module comprises one semester.	

Module number	Module name	Responsible lecturer
Math-Ma-P09	Particle and Nuclear Physics	Director of the Institute for Nuclear and Particle Physics iktp@tu-dresden.de
Qualification objectives	Students are able to trace questions about the origin and structure of the matter that surrounds us back to questions about the fundamental building blocks and their interactions. They know the methods and detection devices of experimental research in particle and nuclear physics. They understand the great similarities in the description of all interactions and can trace them back to a common fundamental principle and are able to analyze their significance for cosmological questions.	
Content	The module covers the design and interpretation essential experiments for testing or discovering the characteristic properties of interactions and elementary particles, and the discussion and phenomenology of the Standard Model using Feynman diagrams. The module also covers the basics of symmetry principles and Lagrange densities for understanding the fundamental vertices of all interactions relevant to elementary particles, properties of nuclei based on the physics of their constituents, models for describing the binding of nucleons in nuclei and the resulting consequences of the stability and decay of nuclei, and further applications of particle and nuclear physics such as the energy production from nuclear reactions.	
Teaching and learning methods	The module comprises 4 hours per week lecture, 2 hours per week exercise and self-study. The lecture and the exercise will be held either in German or English. This will be specified by the lecturer at the beginning of each semester and announced in the usual manner.	
Prerequisites for participation	Competencies in experimental physics in the areas of mechanics, thermodynamics, electrodynamics, optics, waves, and quantum physics, for example Demtröder, W.: Experimentalphysik 1-3, Springer Spektrum, and zur Theoretischen Mechanik, for example Fließbach, T.: Mechanik: Lehrbuch zur Theoretischen Physik I, Spektrum Akademischer Verlag at the Bachelor's level of the Physics program are required.	
Applicability	In the compulsory elective area N of the Master's program Mathematics, in which modules with a total of at least 18 credit points are to be chosen, the module is one of six compulsory elective modules in the specialization Physics – Advanced. Furthermore, in the compulsory elective area N of the Master's program Technomathematics, in which modules with a total of at least 24 credit points have to be chosen, the module is one of seven compulsory elective modules in the specialization Physics – Advanced. The module cannot be chosen if it has already been taken in the Bachelor's program.	
Requirements for earning credit points	Credit points are earned after passing the module examination. The module examination consists of a written test lasting 180 minutes. The language of the examination is German.	
Credit points and grades	Participants can earn nine credit points for this module. The module grade corresponds to the grade of the examined assessment.	

Module frequency	The module is offered each winter semester.
Workload	The workload comprises a total of 270 hours.
Module duration	The module comprises one semester.

Module number	Module name	Responsible lecturer
Math-Ma-P10	Solid-State Physics	Director of the Institute for Solid State and Materials Physics ifmp@mailbox.tu-dresden.de
Qualification objectives	Students master basic terminology, models, experimental methods, and theoretical concepts describing condensed matter. They know the fundamental phenomena that characterize the behavior of condensed matter and understand technological applications. Students are able to apply their knowledge to a wide range of phenomena.	
Content	The module covers the structure of crystalline and amorphous solids, such as bonding types, structure, structure determination and defects; lattice dynamics, such as lattice vibrations, dispersion curves, densities of states and anharmonic properties; conduction electrons, Fermi gas and band model, transport properties of electrons and behaviour in magnetic fields; and semiconductors, such as intrinsic and doped semiconductors, simple devices and heterostructures. Other topics include magnetism, such as dia-, para- and ferromagnetism, dielectric and optical properties based on local fields and the dielectric function, as well as collective excitations and superconductivity, such as their basic properties, Cooper pairs and the macroscopic wave function.	
Teaching and learning methods	The module comprises 4 hours per week lecture, 2 hours per week exercise and self-study. The lecture and the exercise will be held either in German or English. This will be specified by the lecturer at the beginning of each semester and announced in the usual manner.	
Prerequisites for participation	Competencies in experimental physics in the areas of mechanics, thermodynamics, electrodynamics, optics, waves, and quantum physics, for example Demtröder, W.: Experimentalphysik 1-3, Springer Spektrum, and zur Theoretischen Mechanik, for example Fließbach, T.: Mechanik: Lehrbuch zur Theoretischen Physik I, Spektrum Akademischer Verlag at the Bachelor's level of the Physics program are required.	
Applicability	In the compulsory elective area N of the Master's program Mathematics, in which modules with a total of at least 18 credit points are to be chosen, the module is one of six compulsory elective modules in the specialization Physics – Advanced. Furthermore, in the compulsory elective area N of the Master's program Technomathematics, in which modules with a total of at least 24 credit points have to be chosen, the module is one of seven compulsory elective modules in the specialization Physics – Advanced. The module cannot be chosen if it has already been taken in the Bachelor's program.	
Requirements for earning credit points	Credit points are earned after passing the module examination. The module examination consists of a written test lasting 180 minutes. The language of the examination is German.	
Credit points and grades	Participants can earn nine credit points for this module. The module grade corresponds to the grade of the examined assessment.	
Module frequency	The module is offered each winter semester.	

Workload	The workload comprises a total of 270 hours.
Module duration	The module comprises one semester.

Module number	Module name	Responsible lecturer
Math-Ma-P11	Basic Lab Course – Electromagnetism, Optics	Director of the Physics Lab physikpraktikum@tu-dresden.de
Qualification objectives	Students are able to apply their theoretical and experimental knowledge practically. They will have basic experimental skills in electrodynamics and optics. They also have some experience of independent laboratory work. They are able to statistically evaluate the measured data and to scientifically document their experimental procedures and results. They are capable of working scientifically in a team, working independently and collaboratively on tasks and finding solutions. In addition, they can critically analyse measurement results and have strengthened their oral and written expression skills.	
Content	The module covers basic experiments in electrodynamics, such as electric or magnetic fields, induction and circuits, and optics, such as optical imaging, interferometry, polarisation and diffraction.	
Teaching and learning methods	The module comprises 5 hours per week practical training and self-study. The practical training will be held either in German or English. This will be specified by the lecturer at the beginning of each semester and announced in the usual manner.	
Prerequisites for participation	Competences in experimental physics in the fields of mechanics and heat at the Bachelor's level of the Physics program are required.	
Applicability	In the compulsory elective area N of the Master's program Mathematics, in which modules with a total of at least 18 credit points are to be chosen, the module is one of six compulsory elective modules in the specialization Physics – Advanced. Furthermore, in the compulsory elective area N of the Master's program Technomathematics, in which modules with a total of at least 24 credit points have to be chosen, the module is one of seven compulsory elective modules in the specialization Physics – Advanced. The module cannot be chosen if it has already been taken in the Bachelor's program.	
Requirements for earning credit points	Credit points are earned after passing the module examination. The module examination consists of a portfolio equating to 25 hours. The language of the examination is German.	
Credit points and grades	Participants can earn six credit points for this module. The module grade corresponds to the grade of the examined assessment.	
Module frequency	The module is offered each winter semester.	
Workload	The workload comprises a total of 180 hours.	
Module duration	The module comprises one semester.	

Annex 2:

Study schedule (for full-time students) – Starting in the winter semester [1]

with type and scope of courses given in hrs/week as well as required work, the type, scope and format of which can be found in the module descriptions

Module number	Module name	1st Semester	2nd Semester	3rd Semester (M)	4th Semester	CP
		L/E/S/T/P/Pr	L/E/S/T/P/Pr	L/E/S/T/P/Pr	L/E/S/T/P/Pr	
Compulsory Field						
Math-Ma-28	Numerical methods for partial differential equations – Basic concepts	3/1/0/0/0/0 Ex				6
Math-Ma-31	Finite element methods – Theory, implementation and applications	3/1/0/0/0/0 Ex				6
Math-Ma-MS	Modelling seminar		0/0/4/0/0/6 Ex			7
Math-Ma-RP	Research project			0/0/0/0/0/4 Ex		4
Math-Ma-SL	Scientific literature – Research topics				0/0/2/0/0/0 Ex	4
					Final thesis	27
Elective Compulsory Field [2]						
Elective Compulsory Field M [3]						
Math-Ma-01	Algebraic structures		3/1/0/0/0/0 Ex			6
Math-Ma-02	Model theory	3/1/0/0/0/0 Ex				6
Math-Ma-03	Discrete structures		3/1/0/0/0/0 Ex			6
Math-Ma-04	Algebra and number theory	3/1/0/0/0/0 Ex				6
Math-Ma-05	Group theory		3/1/0/0/0/0 Ex			6
Math-Ma-06	Commutative algebra	3/1/0/0/0/0 Ex				6
Math-Ma-07	Noncommutative geometry		3/1/0/0/0/0 Ex			6
Math-Ma-08	Algebraic topology			3/1/0/0/0/0 Ex		6
Math-Ma-09	Groups and geometry		3/1/0/0/0/0 Ex			6
Math-Ma-10	Algebraic methods in geometry			3/1/0/0/0/0 Ex		6
Math-Ma-11	Real algebra		3/1/0/0/0/0 Ex			6
Math-Ma-12	Functional analysis		3/1/0/0/0/0 Ex			6
Math-Ma-13	Methods of functional analysis			3/1/0/0/0/0 Ex		6

Module number	Module name	1st Semester	2nd Semester	3rd Semester (M)	4th Semester	CP
		L/E/S/T/P/Pr	L/E/S/T/P/Pr	L/E/S/T/P/Pr	L/E/S/T/P/Pr	
Math-Ma-14	Nonlinear analysis	3/1/0/0/0/0 Ex				6
Math-Ma-15	Methods of analysis		3/1/0/0/0/0 Ex			6
Math-Ma-16	Partial differential equations	3/1/0/0/0/0 Ex				6
Math-Ma-17	Methods for partial differential equations		3/1/0/0/0/0 Ex			6
Math-Ma-18	Dynamical systems – Basic concepts	3/1/0/0/0/0 Ex				6
Math-Ma-19	Dynamical systems – Modern concepts and applications			3/1/0/0/0/0 Ex		6
Math-Ma-20	Probability with martingales	3/1/0/0/0/0 Ex				6
Math-Ma-21	Methods of financial and actuarial mathematics		3/1/0/0/0/0 Ex			6
Math-Ma-22	Stochastic calculus		3/1/0/0/0/0 Ex			6
Math-Ma-23	Stochastic processes		3/1/0/0/0/0 Ex			6
Math-Ma-24	Mathematical statistics		3/1/0/0/0/0 Ex			6
Math-Ma-25	Statistical methods	3/1/0/0/0/0 Ex				6
Math-Ma-26	Continuous optimization	3/1/0/0/0/0 Ex				6
Math-Ma-27	Discrete optimization		3/1/0/0/0/0 Ex			6
Math-Ma-29	Numerical methods for partial differential equations – Advanced concepts		3/1/0/0/0/0 Ex			6
Math-Ma-30	Mathematical methods in continuum mechanics			3/1/0/0/0/0 Ex		6
Math-Ma-32	Scientific computing – Advanced concepts		3/1/0/0/0/0 Ex			6
Math-Ma-33	Scientific programming – Advanced concepts		3/1/0/0/0/0 Ex			6
Math-Ma-34	Models and methods of applied mathematics			3/1/0/0/0/0 Ex		6
Math-Ma-35	Models and methods of pure mathematics		3/1/0/0/0/0 Ex			6
Math-Ma-MI	Mathematical Internship			4 weeks Internship		6

Module number	Module name	1st Semester	2nd Semester	3rd Semester (M)	4th Semester	CP
		L/E/S/T/P/Pr	L/E/S/T/P/Pr	L/E/S/T/P/Pr	L/E/S/T/P/Pr	
Elective Compulsory Field N[4]						
Specialization Electrical Engineering – Basic[5]						
Math-Ma-E01	Basics of Electrical Engineering	2/2/0/0/0/0 Ex				6
Math-Ma-E02	Electrical and Magnetic Fields		4/2/0/0/0/0 Ex			9
Math-Ma-E03	Dynamical Networks			2/2/0/0/0/0 Ex		6
Math-Ma-E04	Communications Engineering		2/1/0/0/0/0 Ex			6
Math-Ma-E05	Systems Theory	2/2/0/0/0/0	2/2/0/0/0/0 Ex			9
Math-Ma-E06	Electronic Systems Design		2/2/0/0/0/0 Ex			6
Math-Ma-E07	Circuit Design		4/2/0/0/0/0 Ex			9
Math-Ma-RBI	Research and Business Internship			4 weeks Internship		6
Specialization Electrical Engineering – Advanced[5]						
Math-Ma-E07	Circuit Design		4/2/0/0/0/0 Ex			9
Math-Ma-E08	Signal Theory	4/2/0/0/0/0 2xEx				9
Math-Ma-E09	Information Theory		2/2/0/0/0/0 Ex			6
Math-Ma-E10	Automation and Measure-ment Technology		3/2/0/0/0/0 Ex			6
Math-Ma-E11	Basics Electromagnetic Theory	2/2/0/0/0/0 Ex				6
Math-Ma-E12	Advanced Electromagnetic Theory		2/2/0/0/0/0 Ex			6
Math-Ma-E13	Technologies and Compo-nents of Microelectronics	5/1/0/0/0/0 Ex				9
Math-Ma-RBI	Research and Business Internship			4 weeks Internship		6
Specialization Computer Science – Basic[5]						
Math-Ma-C01	Programming and Robo-Lab	2/1/0/0/4/0 2xEx				9
Math-Ma-C02	Algorithms and Data Structures		2/2/0/0/0/0 Ex			6
Math-Ma-C03	Software Technology		2/2/0/0/0/0 Ex			6
Math-Ma-C04	Computer Architecture		3/2/0/0/0/0 Ex			6
Math-Ma-C05	Computer Architecture and Hardware Laboratory		3/2/0/0/2/0 2xEx			9

Module number	Module name	1st Semester	2nd Semester	3rd Semester (M)	4th Semester	CP
		L/E/S/T/P/Pr	L/E/S/T/P/Pr	L/E/S/T/P/Pr	L/E/S/T/P/Pr	
Math-Ma-C06	Operating Systems			2/2/0/0/0/0 Ex		6
Math-Ma-C07	Security			2/2/0/0/0/0 Ex		6
Math-Ma-C08	Formal Systems			4/2/0/0/0/0 Ex		9
Math-Ma-RBI	Research and Business Internship			4 weeks Internship		6
Specialization Computer Science – Advanced[5]						
Math-Ma-C08	Formal Systems	4/2/0/0/0/0 Ex				9
Math-Ma-C09	Artificial Intelligence	2/2/0/0/0/0 Ex				6
Math-Ma-C10	Theoretical Computer Science and Logics		4/2/0/0/0/0 Ex			9
Math-Ma-C11	Computer Networks		2/2/0/0/0/0 Ex			6
Math-Ma-C12	Databases and Information Systems		2/2/0/0/0/0 Ex			6
Math-Ma-C13	Software Technology Project			0/0/0/0/0/4 Ex		6
Math-Ma-C14	Machine Learning and Data Mining			2/2/0/0/0/0 Ex		6
Math-Ma-C15	Parallel Programming and High-Performance Computing			2/2/0/0/0/0 Ex		6
Math-Ma-C16	Data Visualization			2/2/0/0/0/0 Ex		6
Math-Ma-RBI	Research and Business Internship			4 weeks Internship		6
Specialization Mechanical Engineering – Basic[5]						
Math-Ma-M01	Technical Mechanics – Statics	2/2/0/0/0/0 Ex				6
Math-Ma-M02	Technical Mechanics – Theory of Strength of Materials		2/2/0/0/0/0	2/1/0/0/0/0 Ex		9
Math-Ma-M03	Technical Mechanics – Kinematics and Kinetics		3/2/0/0/0/0 Ex			6
Math-Ma-M04	Design Theory	2/2/0/1/0/0	2/2/0/1/0/0 Ex			9
Math-Ma-M05	Fundamentals of Fluid Mechanics		2/2/0/1/0/0 Ex			6
Math-Ma-RBI	Research and Business Internship			4 weeks Internship		6
Specialization Mechanical Engineering – Advanced[5]						
Math-Ma-M05	Fundamentals of Fluid Mechanics		2/2/0/1/0/0 Ex			6
Math-Ma-M06	Continuum Mechanics and Multifunctional Structures		4/2/0/0/0/0 2xEx			9

Module number	Module name	1st Semester	2nd Semester	3rd Semester (M)	4th Semester	CP
		L/E/S/T/P/Pr	L/E/S/T/P/Pr	L/E/S/T/P/Pr	L/E/S/T/P/Pr	
Math-Ma-M07	Analytical Methods of Solid Mechanics			2/2/0/0/0/0 Ex		6
Math-Ma-M08	Elastic Structures and Technical Fluid Mechanics			4/2/0/0/1/0 2xEx		9
Math-Ma-M09	Numerical Methods and Structural Durability			4/2/0/0/1/0 2xEx		9
Math-Ma-M10	System Dynamics and Structural Vibrations			4/2/0/0/0/0 Ex		9
Math-Ma-M11	Data Processing and Experimental Model Analysis		3/2/0/0/1/0 Ex			9
Math-Ma-RBI	Research and Business Internship			4 weeks Internship		6
Specialization Physics – Basic[5]						
Math-Ma-P01	Experimental Physics – Mechanics and Thermodynamics	4/2/0/0/0/0 Ex				9
Math-Ma-P02	Experimental Physics – Electromagnetism and Optics		4/2/0/0/0/0 Ex			9
Math-Ma-P03	Experimental Physics – Waves and Quanta			4/2/0/0/0/0 Ex		9
Math-Ma-P04	Computational Methods of Physics	4/2/0/0/0/0 Ex				6
Math-Ma-P05	Theoretical Mechanics		4/2/0/0/0/0 Ex			9
Math-Ma-P06	Theoretical Electrodynamics			4/2/0/0/0/0 Ex		9
Math-Ma-P07	Introductory Lab Course and Basic Lab Course – Mechanics and Heat	2/2/0/0/1/0	1/0/0/0/5/0 Ex			9
Math-Ma-RBI	Research and Business Internship			4 weeks Internship		6
Specialization Physics – Advanced[5]						
Math-Ma-P03	Experimental Physics – Waves and Quanta	4/2/0/0/0/0 Ex				9
Math-Ma-P06	Theoretical Electrodynamics	4/2/0/0/0/0 Ex				9
Math-Ma-P08	Basics of Quantum Theory		4/2/0/0/0/0 Ex			9
Math-Ma-P09	Particle and Nuclear Physics			4/2/0/0/0/0 Ex		9
Math-Ma-P10	Solid-State Physics			4/2/0/0/0/0 Ex		9
Math-Ma-P11	Basic Lab Course – Electromagnetism, Optics			0/0/0/0/5/0 Ex		6
Math-Ma-RBI	Research and Business Internship			4 weeks Internship		6
CP		**30**	**31**	**28**	**31**	**120**

[1] The study schedule refers to the beginning of the winter semester. If the study program is started in the summer semester, corresponding prerequisites must be taken into account when selecting the elective modules.
[2] Modules amounting to a least 66 credits must be selected.
[3] From the elective compulsory field M, seven modules amounting to a least 42 credits must be selected.
[4] One specialization must be selected from the elective area N.
[5] From a specialization, three to four modules amounting to a least 24 credits must be selected.

M	Mobility window according to § 6 para. 1 sentence 3 Study Regulations
CP	Credit Points
L	Lecture
E	Exercise
S	Seminar
T	Tutorial
P	Practical training
Pr	Project
Ex	Examination(s)

Annex 3:

Example of how to structure part-time studies – Starting in the winter semester

This description represents a possible schedule of studies in part-time studies; it is possible to deviate from this schedule.

Module number	Module name	1st Semester	2nd Semester	3rd Semester	4th Semester	5th Semester	6th Semester	7th Semester	CP
		L/E/S/T/P/Pr	L/E/S/T/P/Pr	L/E/S/T/P/Pr	L/E/S/T/P/Pr	L/E/S/T/P/Pr	L/E/S/T/P/Pr	L/E/S/T/P/Pr	
Compulsory Field									
Math-Ma-28	Numerical methods for partial differential equations – Basic concepts	3/1/0/0/0/0 Ex							6
Math-Ma-31	Finite element methods – Theory, implementation and applications	3/1/0/0/0/0 Ex							6
Math-Ma-MS	Modelling seminar				0/0/4/0/0/6 Ex				7
Math-Ma-RP	Research project					0/0/0/0/0/4 Ex			4
Math-Ma-SL	Scientific literature – Research topics							0/0/2/0/0/0 Ex	4
								Final thesis	27
Elective Compulsory Field – in the total amount of at least 66 credit points									
Elective Compulsory Field M – in the total amount of at least 42 credit points									
	Compulsory Elective Module 1*	3/1/0/0/0/0 Ex							6
	Compulsory Elective Module 2*		3/1/0/0/0/0 Ex						6
	Compulsory Elective Module 3*		3/1/0/0/0/0 Ex						6
	Compulsory Elective Module 4*			3/1/0/0/0/0 Ex					6
	Compulsory Elective Module 5*			3/1/0/0/0/0 Ex					6
	Compulsory Elective Module 6*					3/1/0/0/0/0 Ex			6
	Compulsory Elective Module 7*						3/1/0/0/0/0 Ex		6
Elective Compulsory Field N – in the total amount of at least 24 credit points									
	Compulsory Elective Module 1*			*/*/*/*/*/* Ex*					6
	Compulsory Elective Module 2*				*/*/*/*/*/* Ex*				6
	Compulsory Elective Module 3*					*/*/*/*/*/* Ex*			6
	Compulsory Elective Module 4*						*/*/*/*/*/* Ex*		6
CP		18	12	18	13	16	12	31	120

* depending on choice made by the student

CP Credit Points

Ex Examination(s)

L Lecture

E Exercise

S Seminar

T Tutorial

P Practical training

Pr Project