Appendix B: Module catalogue

for the study programme Applied Mathematics (B.Sc.)

Analysis					**ANA**
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1003	450 h	15	1st sem.	Annual (Winter)	2 sem.

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	8	SCH	120	h	180	h
	Sem. lessons	30 students	0	SCH	0	h	0	h
	Exercise	20 students	4	SCH	60	h	90	h
	Practical or seminar	15 students	0	SCH	0	h	0	h
	Supervised self-study	60 students	0	SCH	0	h	0	h

2	Learning outcomes/competences:	
	The students know the basic concepts of calculus. They can name and represent these terms. They can apply the knowledge to problems, calculate and state solutions. They can independently identify, formulate, and analyse problems and present solutions.	
3	Contents:	
	• Point sets and properties of point sets • Real sequences and series, related terms of convergence • Real functions of one variable, their continuity, differentiability and integrability • Functions of several variables (scalar and vector fields) and their continuity, differentiability and integrability (double and triple integrals) • Function sequences and series, interchange theorems, power and Taylor series • Basics of vector analysis, operators • Curves and curve integrals	
4	Forms of teaching:	
	Lecture with exercises	
5	Participation requirements:	
	Formal:	None
	Content:	Modules: 1161 Mathematical Foundations;
6	Forms of assessment:	
	Term paper, written examination, combined examination, project work, oral examination or examination accompanying the course	
7	Prerequisite for the award of credit points:	
	Module examination pass	
8	Application of the module (in the following study programmes)	
	Applied Mathematics (B.Sc.)	
9	Importance of the grade for the final grade:	
	according to BRPO	
10	Module coordinator:	
	Prof. Dr. rer. nat. Jörg Horst	
11	Other information:	
	Literature will be announced at the beginning of the course. Teaching content is summarised in a script accompanying the lecture.	

12	Language: German

Bachelor Thesis					**BA**
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1294	360 h	12	7th sem.	each semester	12 weeks

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	0	SCH	0	h	0	h
	Sem. lessons	30 students	0	SCH	0	h	0	h
	Exercise	20 students	0	SCH	0	h	0	h
	Practical or seminar	15 students	0	SCH	0	h	0	h
	Supervised self-study	60 students	0	SCH	0	h	360	h

2	Learning outcomes/competences:	
	With the bachelor thesis, the candidate has shown that he/she can complete a practice-oriented task from his/her special subject area within a specified period of time, both in terms of subject-related details as well as in terms of working independently on interdisciplinary contexts according to scientific methods.	
3	Contents:	
	The bachelor thesis is usually an independent investigation with a mathematical-technical, mathematical-business administration or mathematical-information technology task and a detailed description and explanation of its solution. In professionally suitable cases, it can also be a written term paper with subject-literary content.	
4	Forms of teaching:	
5	Participation requirements:	
	Formal:	see Section 27 RPO-BA
	Content:	
6	Forms of assessment:	
7	Prerequisite for the award of credit points:	
8	Application of the module (in the following study programmes)	
	Applied Mathematics (B.Sc.)	
9	Importance of the grade for the final grade:	
	according to BRPO	
10	Module coordinator:	
	Prof. Dr. phil. Bernhard Bachmann	
11	Other information:	
12	Language:	
	German	

Databases					**DB**
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1298	150 h	5	4th or 6th sem.		1 sem.

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	0	SCH	0	h	0	h
	Sem. lessons	30 students	4	SCH	60	h	90	h
	Exercise	20 students	0	SCH	0	h	0	h
	Practical or seminar	15 students	0	SCH	0	h	0	h
	Supervised self-study	60 students	0	SCH	0	h	0	h

2	Learning outcomes/competences:	
	The students know the essential terms from the field of databases. They are in a position to model applications, to present these in the form of an entity-relationship diagram and implement it in a database system using the SQL language.	
3	Contents:	
	• Basic concepts, redundancy, data independence • Database management systems, database administrators • Database models, relational databases • Relational algebra, normal forms, logical database description, data integrity • Database design, conceptual and logical design • Entity relationship models and diagrams • Programming practical internship: Introduction to the database language SQL, data definition language, data manipulation language, query language. Example projects	
4	Forms of teaching:	
	Sem. lessons and practical programming course	
5	Participation requirements:	
	Formal:	
	Content:	Modules: 1098 Principles of Computer Science
6	Forms of assessment:	
	Term paper, written examination, combination examination, course assessment, performance examination, project work, oral examination or examination accompanying the course	
7	Prerequisite for the award of credit points:	
	Module examination pass	
8	Application of the module (in the following study programmes)	
	Applied Mathematics (B.Sc.)	
9	Importance of the grade for the final grade:	
	according to BRPO or SPO if ungraded elective subject	
10	Module coordinator:	
	Dr. math. Elke Koppenrade	
11	Other information:	
	Literature will be announced at the beginning of the course. Teaching content is summarised in a script accompanying the lecture.	

12	Language: German

Differential Equations					**DGL**
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1043	360 h	12	3rd sem.	Annual (Winter)	2 sem.

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	0	SCH	0	h	0	h
	Sem. lessons	30 students	8	SCH	120	h	240	h
	Exercise	20 students	0	SCH	0	h	0	h
	Practical or seminar	15 students	0	SCH	0	h	0	h
	Supervised self-study	60 students	0	SCH	0	h	0	h

2	Learning outcomes/competences:	
	Students possess theoretical and practical competences in dealing with analytically solvable ordinary differential equations and systems of differential equations. They are able to make qualitative assessments about existence and uniqueness propositions and the correctness of the assignment.	
3	Contents:	
	• Methods for solving explicit and implicit first-order ordinary differential equations • Banach fixed point theorem • General existence theorem • Higher order linear differential equations and first order systems with constant coefficients	
4	Forms of teaching:	
	Sem. lessons	
5	Participation requirements:	
	Formal:	
	Content:	Modules: 1003 Analysis 1139 Linear Algebra
6	Forms of assessment:	
	Term paper, written examination, combined examination, project work, oral examination or examination accompanying the course	
7	Prerequisite for the award of credit points:	
	Module examination pass	
8	Application of the module (in the following study programmes)	
	Applied Mathematics (B.Sc.)	
9	Importance of the grade for the final grade:	
	according to BRPO	
10	Module coordinator:	
	Prof. Dr. rer. nat. Jörg Horst	
11	Other information:	
	Literature will be announced at the beginning of the course. Teaching content is summarised in a script accompanying the lecture.	
12	Language:	
	German	

Digital Signal Processing					**DSIG**
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1044	150 h	5	4th or 6th sem.		1 sem.

1	Course:	Planned group sizes	Scope		actual contact time / classroom teaching		Self-study	
	Lecture	60 students	0	SCH	0	h	0	h
	Sem. lessons	30 students	4	SCH	60	h	90	h
	Exercise	20 students	0	SCH	0	h	0	h
	Practical or seminar	15 students	0	SCH	0	h	0	h
	Supervised self-study	60 students	0	SCH	0	h	0	h

2	Learning outcomes/competences:	
	The students have basic knowledge of modelling continuous processes on digital computers and know the problems of the sampling theorem. They will be able to use the Discrete Fourier Transform (DFT) in comparison to the continuous spectral analysis for linear dynamic systems to understand the approximation problem.	
3	Contents:	
	• Signal and information, classification of signals • Fourier transform and linear differential equations, DFT, discretisation of signals • Sampling theorem, reconstructability of the continuous signal • DFT and linear discrete systems, impulse response / frequency response • Fast Fourier Transform • Various algorithms • Brief outlook on digital filtering and window functions.	
4	Forms of teaching:	
	Sem. lessons.	
5	Participation requirements:	
	Formal:	Modules: 1043 Differential Equations
	Content:	Modules: 1043 Differential Equations
6	Forms of assessment:	
	Term paper, written examination, combined examination, course assessment, project work, oral examination or examination during the course	
7	Prerequisite for the award of credit points:	
	Module examination pass	
8	Application of the module (in the following study programmes)	
	Applied Mathematics (B.Sc.)	
9	Importance of the grade for the final grade:	
	according to BRPO or SPO if ungraded elective subject	
10	Module coordinator:	
	Prof. Dr. rer. nat. Jörg Horst	
11	Other information:	
	Literature will be announced at the beginning of the course.	
12	Language:	
	German	

Discrete Mathematics					**DM**
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1046	240 h	8	5th sem.	Annual (Winter)	1 sem.

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	0	SCH	0	h	0	h
	Sem. lessons	30 students	4	SCH	60	h	180	h
	Exercise	20 students	0	SCH	0	h	0	h
	Practical or seminar	15 students	0	SCH	0	h	0	h
	Supervised self-study	60 students	0	SCH	0	h	0	h

2 Learning outcomes/competences:

The students know the essential basic concepts and the corresponding fields of application of graph theory, formulate relevant real-world problems (case studies) into discrete graph models and solve them using suitable graph algorithms.

3 Contents:

- Basic concepts of graph theory
- Determination of spanning trees and shortest paths in graphs and digraphs
- Maximum flow and minimum cost circulation flow problems in networks
- Bipartite graphs
- Matchings
- Eulerian and Hamiltonian problems
- Planar graphs and colouring problems

4 Forms of teaching:

Sem. lessons with active exercise components

5 Participation requirements:

Formal:	
Content:	

6 Forms of assessment:

Written examination, combination examination or oral examination

7 Prerequisite for the award of credit points:

Module examination pass

8 Application of the module (in the following study programmes)

Applied Mathematics (B.Sc.)

9 Importance of the grade for the final grade:

according to BRPO

10 Module coordinator:

Prof. Dr. Jonas Ide

11 Other information:

Literature will be announced at the beginning of the course.
Teaching content is summarised in a script accompanying the lecture.

12 Language:

German

Financial Mathematics and Investment Management					**FMI**
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1092	240 h	8	5th or 6th sem.		1 sem.

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	0	SCH	0	h	0	h
	Sem. lessons	30 students	4	SCH	60	h	180	h
	Exercise	20 students	0	SCH	0	h	0	h
	Practical or seminar	15 students	0	SCH	0	h	0	h
	Supervised self-study	60 students	0	SCH	0	h	0	h

2	Learning outcomes/competences:	
	The students know basic mathematical models and methods of financial mathematics and can apply them to typical tasks in investment management.	
3	Contents:	
	Stochastic modelling of interest rates and asset prices Portfolio optimisation Mechanics and valuation of derivative financial instruments (futures, options, swaps, hybrid securities)	
4	Forms of teaching:	
	Sem. lessons with active exercises and smaller projects	
5	Participation requirements:	
	Formal:	
	Content:	Previous knowledge from the elective subject "Basic Principles of Financial and Actuarial Mathematics" (1100) is not a prerequisite, but useful; maths skills of the first two years, e.g., modules: 1003 Analysis; 1043 Differential Equations; 1099 Principles of Business Administration and Business Mathematics; 1139 Linear Algebra; 1140 Linear Optimisation; 1186 Numerical Mathematics; 1251 Stochastics
6	Forms of assessment:	
	Term paper, written examination, combined examination, project work, oral examination or examination accompanying the course	
7	Prerequisite for the award of credit points:	
	Module examination pass	
8	Application of the module (in the following study programmes)	
	Applied Mathematics (B.Sc.)	
9	Importance of the grade for the final grade:	
	according to BRPO	
10	Module coordinator:	
	Prof. Dr. rer. nat. Claudia Cottin	
11	Other information:	
	Literature will be announced at the beginning of the course.	

	The course material is summarised in a script that accompanies the course.
12	Language: German

Gender and Diversity: Success Factors for Companies					**GUD**
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
3135	150 h	5	5th sem.	Annual (Winter)	1 sem.

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	SCH	30	h	45	h
	Sem. lessons	30 students	2	SCH	30	h	45	h
	Exercise	20 students	0	SCH	0	h	0	h
	Practical or seminar	15 students	0	SCH	0	h	0	h
	Supervised self-study	60 students	0	SCH	0	h	0	h

2 Learning outcomes/competences:

The students …

- know the terms, history and differences of gender/gender mainstreaming and diversity/diversity management.
- know legal principles in the context of gender and diversity (e.g. EU Anti-Discrimination Directive, General Act on Equal Treatment)
- are sensitised to human heterogeneity in the corporate context.
- independently recognise stereotyping and can develop ideas for possible changes in the business environment.
- are able to independently collect relevant information on established concepts such as gender mainstreaming and diversity management and assess their relevance for professional practice.
  are familiar with selected theories and approaches in the current discourse on diversity management and, building on this, can develop conceptual ideas for the implementation of holistic diversity management in a corporate context.

3 Contents:

- Definitions of terms and delimitation of gender and diversity
- Concepts and approaches to equal opportunities (e.g. diversity management, gender mainstreaming)
- Legal bases and political influences (e.g. EU Anti-Discrimination Directive, General Act on Equal Treatment [AGG])
- Subjective and societal values, attitudes and prejudices in the context of diversity
- Possible approaches for taking diversity characteristics (e.g. gender and age) into account in selected areas of business (marketing, product development, human resources)
- Concept for the sustainable introduction of holistic diversity management
- Case studies and application examples from business practice

4 Forms of teaching:

Lecture, Sem. lessons, presentation, group work, presentation of seminar paper

5 Participation requirements:

Formal:	
Content:	None

6	Forms of assessment: Term paper, written examination or oral examination
7	Prerequisite for the award of credit points: Module examination pass
8	Application of the module (in the following study programmes) Applied Mathematics (B.Sc.), Apparative Biotechnology (B.Sc.), Electrical Engineering (B.Eng.), Computer Engineering (B.Eng.), Mechanical Engineering (B.Eng.), Mechatronics (B.Sc.), Renewable Energies (B.Eng.) and Industrial Engineering and Management (B.Sc.)
9	Importance of the grade for the final grade: according to BRPO
10	Module coordinator: Prof. Dr.-Ing. Andrea Kaimann
11	Other information: Literature will be announced at the beginning of the course.
12	Language: German

Principles of Data Science					GDS
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer:	Duration:
1402	240	8	5. sem. or 6. sem.		1 sem.

1	Course:	Planned group sizes:	Scope:		Actual contact time/classroom teaching		Self-study	
	Lecture	60 students		SCH		h		h
	Sem. lessons	30 students	4	SCH	60	h	160	h
	Exercise	20 students		SCH		h		h
	Practical or seminar	15 students	0	SCH	0	h	0	h
	Supervised self-study	60 students		SCH		h		h

2 Learning outcomes/competences:

The students

- are able to explain the basic concepts of scientific thinking presented, know about the differences between chance and causality,
- are able to explain, apply and implement the fundamentals of non-linear regression and the basic principles of simulation-based inference such as resampling, bootstrap distribution, shuffling, permutation distribution, p-value,
- know algorithms from the field of machine learning and deep learning and use concrete examples to put them into practice, know what is understood by a structural causal model and by a directed acyclic graph and can apply them to given data sets.

3 Contents:

- Principles of quantitative data analysis (scientific basics, basic concepts, data collection, data preparation)
- Exploratory data analysis (analysis of categorical and numerical data, correlation between numerical variables)
- Classification (logistic regression, non-linear regression)
- Resampling procedure (bootstrapping)
- Principles of machine learning and deep learning (supervised learning, unsupervised learning, reinforcement learning)
- Algorithms from the field of data science/machine learning (principal components analysis, cluster analysis) Causal modelling

4 Forms of teaching:

Sem. lessons

5 Participation requirements:

Formal:	
Content:	Modules: 1003 Analysis; 1139 Linear Algebra;

6 Form of assessment:

Term paper, written examination, combination examination, project work, oral examination or examination accompanying the course

7 Prerequisite for the award of credit points:

Module examination pass

8 Application of the module (in the following study programmes):

Applied Mathematics (B.Sc.)

9	Importance of the grade for the final grade: according to BRPO
10	Module coordinator: Prof. Dr. rer. nat. Jörg Horst
11	Other information:
12	Language: German

Principles of Computer Science					**INF**
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1098	240 h	8	1st sem.	Annual (Winter)	2 sem.

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	0	SCH	0	h	0	h
	Sem. lessons	30 students	4	SCH	60	h	40	h
	Exercise	20 students	0	SCH	0	h	0	h
	Practical or seminar	15 students	4	SCH	60	h	80	h
	Supervised self-study	60 students	0	SCH	0	h	0	h

2 Learning outcomes/competences:

Students know the basic concepts of computer science.
They are able to identify the components of a PC and describe their principle functions.
They are able to solve practical exercises using a general programming language.
This comprises:

- structuring the task in terms of procedural/modular programming.
- creating a specification for all procedures/functions.
- designing and implementing the modules in a general programming language.
- systematic testing based on the specification and, if necessary, resolving occurring errors.

They are able to handle a professional software engineering environment.
Students know the job opportunities of mathematicians in the field of computer science.

3 Contents:

- Introduction: Computer science definition, computer classification
- Principles: Basic structure of a computer (von Neumann architecture), programming languages, compilers, interpreters, linkers
- Information presentation: Characters, coding, number systems, place value systems, conversion between bases, arithmetic, number representation in the computer
- Algorithm: Definition, representation methods, structuring, complexity, recursion, sorting, search
- Programming: Quality criteria, program testing and debugging
- Elementary data structures: Arrays, linear lists, binary trees, associative arrays
- Programming language: Simple and composite data types, references, input/output, expressions, operators, control structures, functions and methods
- Application of the development environment and debugger.

Introduction to the professional field of mathematicians in computer science.

4 Forms of teaching:

Sem. lessons, programming practical

5 Participation requirements:

Formal:	
Content:	

6	Forms of assessment: Term paper, written examination, combined examination, project work, oral examination or examination accompanying the course
7	Prerequisite for the award of credit points: Module examination pass
8	Application of the module (in the following study programmes) Applied Mathematics (B.Sc.)
9	Importance of the grade for the final grade: according to BRPO
10	Module coordinator: Dipl.-Ing. Jens Schönbohm
11	Other information: Literature will be announced at the beginning of the course. The course material is summarised in a script accompanying the lecture.
12	Language: German

Principles of Business Administration and Business Mathematics					**BWWM**
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1099	240 h	8	1st sem.	Annual (Winter)	2 sem.

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	0	SCH	0	h	0	h
	Sem. lessons	30 students	8	SCH	120	h	120	h
	Exercise	20 students	0	SCH	0	h	0	h
	Practical or seminar	15 students	0	SCH	0	h	0	h
	Supervised self-study	60 students	0	SCH	0	h	0	h

2 Learning outcomes/competences:

(1) Subject-specific:
The students have an overview of the structure and organisation of companies and typical economic processes as well as typical mathematical models of economics. Furthermore, they possess basic skills in modelling and application of quantitative methods in the optimisation of economic structures and processes
(2) Interdisciplinary:
Students competently apply basic research, presentation and documentation techniques.
The students know the occupational areas of mathematicians in economic fields.

3 Contents:

Business basics:
Introduction:
Role of the enterprise in the economic process.
Operational objectives.
Economic principle
Overview of the framework of business operations (business organisation, forms of business, investment and financing, etc.)
Process of service production and utilisation (procurement, production, sales):
Basic terms and models
Managerial Accounting:
Basics of accounting, cost accounting and controlling
Business Mathematics Basics (in the context of the above-business administration basics):
Quantitative methods for planning and decision support in companies
Investment appraisal and elementary financial mathematics
Introduction to the professional field of mathematicians in economic fields.

4 Forms of teaching:

Sem. lessons with exercises and project work

5 Participation requirements:

Formal:	
Content:	

6 Forms of assessment:

Term paper, written examination, combined examination, project work, oral examination or examination accompanying the course

7 Prerequisite for the award of credit points:

Module examination pass

8	Application of the module (in the following study programmes) Applied Mathematics (B.Sc.)
9	Importance of the grade for the final grade: according to BRPO
10	Module coordinator: Prof. Dr. rer. nat. Claudia Cottin
11	Other information: Literature will be announced at the beginning of the course. Accompanying material will be provided (e.g. short script and calculation examples using Excel)
12	Language: German

Principles of Financial and Actuarial Mathematics					**GFVM**
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1100	240 h	8	5th or 6th sem.		1 sem.

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	0	SCH	0	h	0	h
	Sem. lessons	30 students	4	SCH	60	h	180	h
	Exercise	20 students	0	SCH	0	h	0	h
	Practical or seminar	15 students	0	SCH	0	h	0	h
	Supervised self-study	60 students	0	SCH	0	h	0	h

2	Learning outcomes/competences:	
	The students know basic mathematical models and methods of financial and actuarial mathematics and can use them to solve practical problems.	
3	Contents:	
	• Mathematical description of financial and insurance products through cash flow models • Basic mathematical principles and models for the valuation of certain as well as risky cash flows • Exemplary applications of the basic principles and models in the analysis and valuation of fixed-interest securities, derivative financial instruments, building society savings contracts as well as insurance products	
4	Forms of teaching:	
	Sem. lessons with exercises and small projects	
5	Participation requirements:	
	Formal:	
	Content:	Basic knowledge of business administration approximately to the extent of the courses in the first two semesters. Knowledge in mathematics approximately to the extent of the first 4 semesters; e.g. modules: 1003 Analysis; 1099 Principles of Business Administration and Business Mathematics; 1043 Differential Equations; 1139 Linear Algebra; 1140 Linear Optimisation; 1186 Numerical Mathematics; 1251 Stochastics
6	Forms of assessment:	
	Term paper, written examination, combined examination, project work, oral examination or examination accompanying the course	
7	Prerequisite for the award of credit points:	
	Module examination pass	
8	Application of the module (in the following study programmes)	
	Applied Mathematics (B.Sc.)	
9	Importance of the grade for the final grade:	
	according to BRPO	
10	Module coordinator:	
	Prof. Dr. rer. nat. Claudia Cottin	

11	Other information: Literature will be announced at the beginning of the course. The course material is summarised in a script that accompanies the course.
12	Language: German

Interpolation and Approximation					**IUA**
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1117	240 h	8	5th or 6th sem.		1 sem.

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	0	SCH	0	h	0	h
	Sem. lessons	30 students	4	SCH	60	h	180	h
	Exercise	20 students	0	SCH	0	h	0	h
	Practical or seminar	15 students	0	SCH	0	h	0	h
	Supervised self-study	60 students	0	SCH	0	h	0	h

2	Learning outcomes/competences:	
	Students are familiar with the basic objectives and the most important methods of interpolation and approximation of functions and can solve practical problems with these methods. They are able to estimate and interpret approximation errors and implement function interpolation/approximation.	
3	Contents:	
	• Polynomial interpolation: Existence and uniqueness • Lagrange, Hermite and Newton interpolation methods • Error estimation in polynomial interpolation • Discrete and continuous Gaussian approximation • Linear, square and cubic splines. B-Splines • Bezier curves and applications. De Casteljau's algorithm • Approximation by rational functions. Pade approximant	
4	Forms of teaching:	
	Sem. lessons	
5	Participation requirements:	
	Formal:	
	Content:	Modules: 1003 Analysis; 1139 Linear Algebra; 1186 Numerical Mathematics
6	Forms of assessment:	
	Term paper, written examination, combined examination, project work, oral examination or examination accompanying the course	
7	Prerequisite for the award of credit points:	
	Module examination pass	
8	Application of the module (in the following study programmes)	
	Applied Mathematics (B.Sc.)	
9	Importance of the grade for the final grade:	
	according to BRPO	
10	Module coordinator:	
	Prof. Dr. rer. nat. Svetozara Petrova	
11	Other information:	
	Literature will be announced at the beginning of the course. Teaching content is summarised in a script accompanying the lecture.	
12	Language:	
	German	

Colloquium					**KOL**
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1290	90 h	3	6th or 7th sem.	each semester	

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	0	SCH	0	h	90	h
	Sem. lessons	30 students	0	SCH	0	h	0	h
	Exercise	20 students	0	SCH	0	h	0	h
	Practical or seminar	15 students	0	SCH	0	h	0	h
	Supervised self-study	60 students	0	SCH	0	h	0	h

2	Learning outcomes/competences:	
	The colloquium is to be assessed as an independent examination. It serves to determine whether the candidate is able to orally present the scientific topic of the bachelor thesis, its subject-related foundations, its interdisciplinary connections and its non-subject-related references and justify them independently as well as assess their significance for practice.	
3	Contents:	
	- Content of the thesis according to the topic - Disputation on the procedure in the preparation of the thesis and the questions that arose in the context of the thesis	
4	Forms of teaching:	
	Oral examination for the bachelor thesis	
5	Participation requirements:	
	Formal:	None
	Content:	Treatment of the bachelor thesis
6	Forms of assessment:	
	Oral examination	
7	Prerequisite for the award of credit points:	
8	Application of the module (in the following study programmes)	
	Applied Mathematics (B.Sc.), Apparative Biotechnology (B.Sc.), Electrical Engineering (B.Eng.), Computer Engineering (B.Eng.), Mechanical Engineering (B.Eng.), Mechatronics (B.Sc.), Renewable Energies (B.Eng.) and Industrial Engineering and Management (B.Sc.)	
9	Importance of the grade for the final grade:	
	according to BRPO	
10	Module coordinator:	
	N.N.	
11	Other information:	
	Literature will be announced at the beginning of the course.	
12	Language:	
	German	

Complex Analysis					**KANA**
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1122	240 h	8	5th or 6th sem.		1 sem.

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	0	SCH	0	h	0	h
	Sem. lessons	30 students	4	SCH	60	h	180	h
	Exercise	20 students	0	SCH	0	h	0	h
	Practical or seminar	15 students	0	SCH	0	h	0	h
	Supervised self-study	60 students	0	SCH	0	h	0	h

2	Learning outcomes/competences:	
	The students master the handling of complex numbers. They understand the interpretation of complex functions and their differentiability and integrability and can apply them to concrete problems.	
3	Contents:	
	• Complex numbers • Möbius transformations • Complex differentiable functions • Integral theorems • Inverse functions • Residual theory	
4	Forms of teaching:	
	Sem. lessons	
5	Participation requirements:	
	Formal:	
	Content:	Modules: 1003 Analysis
6	Forms of assessment:	
	Term paper, written examination, combined examination, project work, oral examination or examination accompanying the course	
7	Prerequisite for the award of credit points:	
	Module examination pass	
8	Application of the module (in the following study programmes)	
	Applied Mathematics (B.Sc.)	
9	Importance of the grade for the final grade:	
	according to BRPO	
10	Module coordinator:	
	Prof. Dr. phil. Bernhard Bachmann	
11	Other information:	
	Literature will be announced at the beginning of the course.	
12	Language:	
	German	

Cryptography					**KRY**
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1133	240 h	8	5th or 6th sem.		1 sem.

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	0	SCH	0	h	0	h
	Sem. lessons	30 students	4	SCH	60	h	180	h
	Exercise	20 students	0	SCH	0	h	0	h
	Practical or seminar	15 students	0	SCH	0	h	0	h
	Supervised self-study	60 students	0	SCH	0	h	0	h

2	Learning outcomes/competences:	
	The students know the basic principles, in particular the public key procedures, of cryptography. They are able to understand and implement practical algorithms from number theory.	
3	Contents:	
	• Basic properties of the Z and Z/(n) rings • Prime number tests and factorisation methods • Simple cryptosystems for encryption • Public key cryptosystems • Cryptographic applications of discrete logarithms • Cryptographic applications of discrete quadratic equations • Cryptographic hash functions • Digital signatures	
4	Forms of teaching:	
	Sem. lessons	
5	Participation requirements:	
	Formal:	
	Content:	Modules: 1003 Analysis; 1139 Linear Algebra
6	Forms of assessment:	
	Term paper, written exam, combination exam, course assessment, performance examination, project work, oral examination or course-related examination	
7	Prerequisite for the award of credit points:	
	Module examination pass	
8	Application of the module (in the following study programmes)	
	Applied Mathematics (B.Sc.)	
9	Importance of the grade for the final grade:	
	according to BRPO	
10	Module coordinator:	
	Prof. Dr. phil. Bernhard Bachmann	
11	Other information:	
	Literature will be announced at the beginning of the course. Teaching content is summarised in a script accompanying the lecture.	
12	Language:	
	German	

Linear Algebra					**LA**
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1139	450 h	15	1st sem.	Annual (Winter)	2 sem.

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	8	SCH	120	h	180	h
	Sem. lessons	30 students	0	SCH	0	h	0	h
	Exercise	20 students	4	SCH	60	h	90	h
	Practical or seminar	15 students	0	SCH	0	h	0	h
	Supervised self-study	60 students	0	SCH	0	h	0	h

2	Learning outcomes/competences:	
	Students have an overview of matrix theory and solution methods for systems of linear equations as a fundamental part of linear algebra	
3	Contents:	
	• Groups, rings and bodies • Matrices and systems of linear equations • Vector spaces and affine space • Affine and linear mappings • Determinants, eigenvalues and eigenvectors • Similarity transformations and Jordan normal form • Euclidean space and the scalar product	
4	Forms of teaching:	
	Lecture with exercises	
5	Participation requirements:	
	Formal:	
	Content:	Modules: 1161 Mathematical Foundations
6	Forms of assessment:	
	Term paper, written examination, combined examination, project work, oral examination or examination accompanying the course	
7	Prerequisite for the award of credit points:	
	Module examination pass	
8	Application of the module (in the following study programmes)	
	Applied Mathematics (B.Sc.)	
9	Importance of the grade for the final grade:	
	according to BRPO	
10	Module coordinator:	
	Prof. Dr. rer. nat. Svetozara Petrova	
11	Other information:	
	Literature will be announced at the beginning of the course. Teaching content is summarised in a script accompanying the lecture.	
12	Language:	
	German	

Linear Optimisation					**LOPT**
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1140	150 h	5	4th sem.	Annual(Winter)	1 sem.

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	0	SCH	0	h	0	h
	Sem. lessons	30 students	4	SCH	60	h	90	h
	Exercise	20 students	0	SCH	0	h	0	h
	Practical or seminar	15 students	0	SCH	0	h	0	h
	Supervised self-study	60 students	0	SCH	0	h	0	h

2	Learning outcomes/competences:	
	The students can formulate practical problems as linear optimisation tasks and solve them with the support of analytical or numerical methods.	
3	Contents:	
	• Modelling linear optimisation problems • Linear inequality and equation systems and convex polyhedral • Bases, basic and non-basic subset, basic solutions, permissibility, change of basis, infinite case • Simplex and two-phase simplex methods • Degeneracy and redundancy • Duality theory and dual simplex • Sensitivity analysis • Interior-point method • Linear transport problems	
4	Forms of teaching:	
	Sem. lessons	
5	Participation requirements:	
	Formal:	
	Content:	Modules: 1003 Analysis; 1139 Linear Algebra
6	Forms of assessment:	
	Term paper, written examination, combined examination, course assessment, project work, oral examination or examination during the course	
7	Prerequisite for the award of credit points:	
	Module examination pass	
8	Application of the module (in the following study programmes)	
	Applied Mathematics (B.Sc.)	
9	Importance of the grade for the final grade:	
	according to BRPO	
10	Module coordinator:	
	Prof. Dr. rer. nat. Svetozara Petrova	
11	Other information:	
	Literature will be announced at the beginning of the course. Teaching content is summarised in a script accompanying the lecture.	
12	Language:	
	German	

Logistics					**LOG**
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1141	150 h	5	4th or 6th sem.		1 sem.

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	0	SCH	0	h	90	h
	Sem. lessons	30 students	4	SCH	60	h	0	h
	Exercise	20 students	0	SCH	0	h	0	h
	Practical or seminar	15 students	0	SCH	0	h	0	h
	Supervised self-study	60 students	0	SCH	0	h	0	h

2	Learning outcomes/competences:	
	Students analyse and model concrete problems from different areas of operational logistics (location planning, material logistics, batch size planning, machine allocation planning, distribution logistics) and solve them with the help of suitable procedures.	
3	Contents:	
	• Basic principles of operational location planning (facility location) • Basic principles of material procurement and provision as well as stock-keeping planning • Machine allocation planning, scheduling • Transport and routing problems, vehicle routing The corresponding (optimisation) models and solution methods are presented for selected problem characteristics of these different logistics areas. Associated case studies are worked on in small project groups (problem analysis, modelling, solution finding).	
4	Forms of teaching:	
	Sem. lessons with active exercise components	
5	Participation requirements:	
	Formal:	
	Content:	
6	Forms of assessment:	
	Term paper, written examination, combination examination, project work or oral examination	
7	Prerequisite for the award of credit points:	
	Module examination pass	
8	Application of the module (in the following study programmes)	
	Applied Mathematics (B.Sc.)	
9	Importance of the grade for the final grade:	
	according to BRPO or SPO if ungraded elective subject	
10	Module coordinator:	
	Prof. Dr. Jonas Ide	
11	Other information:	
	Literature will be announced at the beginning of the course. Teaching content is summarised in a script accompanying the lecture.	
12	Language:	
	German	

Mathematical Foundations					**MGL**
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1161	150 h	5	1st sem.	Annual (Winter)	1 sem.

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	3	SCH	45	h	67.5	h
	Sem. lessons	30 students	0	SCH	0	h	0	h
	Exercise	20 students	1	SCH	15	h	22.5	h
	Practical or seminar	15 students	0	SCH	0	h	0	h
	Supervised self-study	60 students	0	SCH	0	h	0	h

2	Learning outcomes/competences: The students master elementary proof techniques and logical reasoning in mathematics and are able to apply mathematical techniques to basic mathematics.
3	Contents: • Elementary logic, sets, relations, mappings and functions • Axiomatic structure of number systems including complex numbers • Elementary proof techniques • Equations and inequalities • Analytic geometry in 2 and 3 dimensions
4	Forms of teaching: Lecture with exercises
5	Participation requirements: Formal: Content:
6	Forms of assessment: Term paper, written examination, combined examination, project work, oral examination or examination accompanying the course
7	Prerequisite for the award of credit points: Module examination pass
8	Application of the module (in the following study programmes) Applied Mathematics (B.Sc.)
9	Importance of the grade for the final grade: according to BRPO
10	Module coordinator: Dr. math. Elke Koppenrade
11	Other information: Literature will be announced at the beginning of the course. Teaching content is summarised in a script accompanying the lecture.
12	Language: German

Mathematical Modelling of Processes Relevant to Practice									**MMPP**
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1301	240 h	8	4th sem.		1 sem.

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	0	SCH	0	h	0	h
	Sem. lessons	30 students	4	SCH	60	h	180	h
	Exercise	20 students	0	SCH	0	h	0	h
	Practical or seminar	15 students	0	SCH	0	h	0	h
	Supervised self-study	60 students	0	SCH	0	h	0	h

2	Learning outcomes/competences:	
	Students are familiar with the basic concepts of mathematical modelling and the modelling cycle. They are able to independently model exemplary application problems from the natural sciences and the economy. To this end, they know various model formalisms and can create simple models independently with the help of suitable software. In addition, they acquire the ability to analyse the models created by means of computer simulation.	
3	Contents:	
	- Methodology of mathematical modelling - Statistical models - Linear models - Nonlinear models - Discrete time models - Business process models	
4	Forms of teaching:	
	Sem. lessons	
5	Participation requirements:	
	Formal:	None
	Content:	Knowledge of mathematics approximately equivalent to the first 4 semesters. Basic knowledge of programming with MATLAB Approximately the scope of the course Software Lab 2
6	Forms of assessment:	
	Term paper, written examination, combination examination, project work or oral examination	
7	Prerequisite for the award of credit points:	
	Module examination pass	
8	Application of the module (in the following study programmes)	
	Applied Mathematics (B.Sc.)	
9	Importance of the grade for the final grade:	
	according to BRPO	
10	Module coordinator:	
	Prof. Dr. Jonas Ide	
11	Other information:	
	Literature will be announced at the beginning of the course.	
12	Language:	
	German	

Mathematical Proseminar					**PSEM**
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1162	180 h	6	5th sem.	Annual (Winter)	1 sem.

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	0	SCH	0	h	0	h
	Sem. lessons	30 students	0	SCH	0	h	0	h
	Exercise	20 students	0	SCH	0	h	0	h
	Practical or seminar	15 students	4	SCH	60	h	120	h
	Supervised self-study	60 students	0	SCH	0	h	0	h

2	Learning outcomes/competences:	
	Students have improved their skills in the written and oral presentation of subject-related topics by working on a given topic related to mathematics, summarising it in writing, and presenting it in a lecture of approximately one hour.	
3	Contents:	
	Selected topics with mathematical reference	
4	Forms of teaching:	
	Independent written composition and presentation of a given topic with subsequent discussion	
5	Participation requirements:	
	Formal:	
	Content:	Modules: 1003 Analysis; 1099 Principles of Business Administration and Business Mathematics; 1043 Differential Equations; 1098 Principles of Computer Science; 1139 Linear Algebra; 1140 Linear Optimisation; 1186 Numerical Mathematics; 1188 Object-Oriented Programming; 1203 Principles of Physics and Engineering; 1251 Stochastics; 1246 Software Lab 1; 1247 Software Lab 2
6	Forms of assessment:	
	Course assessment or examination accompanying the course	
7	Prerequisite for the award of credit points:	
	Module examination pass	
8	Application of the module (in the following study programmes)	
	Applied Mathematics (B.Sc.)	
9	Importance of the grade for the final grade:	
	according to BRPO or SPO if ungraded elective subject	
10	Module coordinator:	
	Prof. Dr. phil. Bernhard Bachmann	
11	Other information:	
	Literature will be announced at the beginning of the course.	

12	Language: German

Mathematical Seminar					**SEM**
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1163	180 h	6	6th sem.	Annual (Summer)	1 semester

1	Course:	Planned group sizes	Scope		actual contact time / classroom teaching		Self-study	
	Lecture	60 students	0	SCH	0	h	0	h
	Sem. lessons	30 students	0	SCH	0	h	0	h
	Exercise	20 students	0	SCH	0	h	0	h
	Practical or seminar	15 students	4	SCH	60	h	120	h
	Supervised self-study	60 students	0	SCH	0	h	0	h

2	Learning outcomes/competences:	
	Students are able to present mathematical topics in writing and orally.	
3	Contents:	
	Selected mathematical topics	
4	Forms of teaching:	
	Independent written composition and presentation of a given topic with subsequent discussion	
5	Participation requirements:	
	Formal:	Modules: 1162 Mathematical Proseminar;
	Content:	Modules: 1003 Analysis; 1099 Principles of Business Administration and Business Mathematics; 1043 Differential Equations; 1098 Principles of Computer Science; 1139 Linear Algebra; 1140 Linear Optimisation; 1186 Numerical Mathematics; 1188 Object-Oriented Programming; 1203 Principles of Physics and Engineering; 1251 Stochastics; 1246 Software Lab 1; 1247 Software Lab 2
6	Forms of assessment:	
	in-class examination	
7	Prerequisite for the award of credit points:	
	Module examination pass	
8	Application of the module (in the following study programmes)	
	Applied Mathematics (B.Sc.)	
9	Importance of the grade for the final grade:	
	according to BRPO	
10	Module coordinator:	
	Prof. Dr. phil. Bernhard Bachmann	
11	Other information:	
	Literature will be announced at the beginning of the course.	
12	Language:	
	German	

Modelling and Simulation					**MUS**
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1175	150 h	5	4th or 6th sem.		1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	0	SCH	0	h	90	h
	Sem. lessons	30 students	4	SCH	60	h	0	h
	Exercise	20 students	0	SCH	0	h	0	h
	Practical or seminar	15 students	0	SCH	0	h	0	h
	Supervised self-study	60 students	0	SCH	0	h	0	h

2	Learning outcomes/competences: The students possess the competence for the synthesis and analysis of mathematical model equations of dynamic systems. Since two problem areas are linked in the course, they know the answers to the following questions: 1. How do I arrive at a model for a time-varying system and what scope should it have? 2. How can I analyse a modelled system with the help of simulation?
3	Contents: General part: Models and model classes, direct and inverse model building, parametric and non-parametric modelling, tracking problem and parameter identification, Terms: Identifiability, controllability, observability, identification of linear dynamic systems with Gateaux gradient methods. Practical part: Laplace transform and representation of differential equations in Matlab / Simulink, simulation of multi-variable models, analysis of simulated measurement data, for example with the identification software Elaris.
4	Forms of teaching: Sem. lessons
5	Participation requirements: Formal: Content: Modules: 1043 Differential Equations
6	Forms of assessment: Term paper, written examination, combined examination, course assessment, project work, oral examination or examination during the course
7	Prerequisite for the award of credit points: Module examination pass
8	Application of the module (in the following study programmes) Applied Mathematics (B.Sc.)
9	Importance of the grade for the final grade: according to BRPO or SPO if ungraded elective subject
10	Module coordinator: Prof. Dr. rer. nat. Jörg Horst
11	Other information: Literature will be announced at the beginning of the course.

12	Language: German

Nonlinear Optimisation					**NLOPT**
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1182	180 h	6	5th sem.	Annual (Winter)	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	0	SCH	0	h	0	h
	Sem. lessons	30 students	4	SCH	60	h	120	h
	Exercise	20 students	0	SCH	0	h	0	h
	Practical or seminar	15 students	0	SCH	0	h	0	h
	Supervised self-study	60 students	0	SCH	0	h	0	h

2	Learning outcomes/competences:	
	Students can formulate practical model statements as non-linear optimisation tasks and solve them using analytical or numerical methods.	
3	Contents:	
	• Unconstrained nonlinear optimization • Structure of a descent procedure. Selection of the step length • Gradient decent and conjugate gradient method • Quasi-Newton algorithm. Update procedures • Constrained nonlinear optimisation • Lagrange multipliers and duality theory: Karush-Kuhn-Tucker conditions • Numerical methods for solving nonlinear optimisation problems • Applications in practice (case studies).	
4	Forms of teaching:	
	Sem. lessons with active exercise components	
5	Participation requirements:	
	Formal:	
	Content:	Modules: 1003 Analysis; 1139 Linear Algebra; 1186 Numerical Mathematics
6	Forms of assessment:	
	Term paper, written examination, combined examination, project work, oral examination or examination accompanying the course	
7	Prerequisite for the award of credit points:	
	Module examination pass	
8	Application of the module (in the following study programmes)	
	Applied Mathematics (B.Sc.)	
9	Importance of the grade for the final grade:	
	according to BRPO	
10	Module coordinator:	
	Prof. Dr. rer. nat. Svetozara Petrova	
11	Other information:	
	Literature will be announced at the beginning of the course. Teaching content is summarised in a script accompanying the lecture.	
12	Language:	
	German	

Numerics of Ordinary Differential Equations					**NDGL**
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1183	240 h	8	5th or 6th sem.		1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	0	SCH	0	h	0	h
	Sem. lessons	30 students	4	SCH	60	h	180	h
	Exercise	20 students	0	SCH	0	h	0	h
	Practical or seminar	15 students	0	SCH	0	h	0	h
	Supervised self-study	60 students	0	SCH	0	h	0	h

2 Learning outcomes/competences:

The students know the most important methods for solving ordinary differential equations and their possible applications.
They can analyse initial and boundary value problems of ordinary differential equations with regard to numerical solvability and error behaviour, and select appropriate procedures.

3 Contents:

Initial value problems:
One-step method, extrapolation method, multi-step method, predictor-corrector method. Stiff differential equations. Consistency, convergence, stability terms.
Boundary value problems:
Shooting method, multi-target method, difference method, variation method.

4 Forms of teaching:

Sem. lessons

5 Participation requirements:

Formal:	
Content:	Knowledge of the contents of the modules Analysis (1003), Linear Algebra (1139), Numerical Mathematics (1186) and Differential Equations (1043) Modules: 1003 Analysis; 1043 Differential Equations; 1139 Linear Algebra; 1186 Numerical Mathematics

6 Forms of assessment:

Term paper, written examination, combined examination, project work, oral examination or examination accompanying the course

7 Prerequisite for the award of credit points:

Module examination pass

8 Application of the module (in the following study programmes)

Applied Mathematics (B.Sc.)

9 Importance of the grade for the final grade:

according to BRPO

10 Module coordinator:

Prof. Dr. phil. Bernhard Bachmann

11 Other information:

Literature will be announced at the beginning of the course.

	Teaching content is summarised in a script accompanying the lecture.
12	Language: German

Numerical Methods for Large Sparse Systems of Equations					**SPM**
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1184	240 h	8	5th or 6th sem.		1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	0	SCH	0	h	0	h
	Sem. lessons	30 students	4	SCH	60	h	180	h
	Exercise	20 students	0	SCH	0	h	0	h
	Practical or seminar	15 students	0	SCH	0	h	0	h
	Supervised self-study	60 students	0	SCH	0	h	0	h

2 Learning outcomes/competences:

Students are familiar with the most important properties and storage formats for sparse matrices. They have an overview of fast iterative methods for sparse linear systems and implement well-known solution techniques (e.g. finite difference and finite element method) for specific applications.

3 Contents:

- Graphs and sparse matrices
- Adjacency and incidence matrix, cliques, permutation
- Irreducible matrix and properties of underlying graph
- Storage formats of sparse vectors and matrices
- Triangular, tridiagonal, block, band, Hessenberg, skyline matrices
- Band and envelope methods. The Cuthill-McKee algorithm
- Gauss elimination (Fill-in; incomplete LU factorization)
- Iterative solvers (preconditioning, convergence)
- Applications of solvers for ordinary differential equations

4 Forms of teaching:

Sem. lessons

5 Participation requirements:

Formal:	
Content:	Modules: 1139 Linear Algebra

6 Forms of assessment:

Term paper, written examination, combined examination, project work, oral examination or examination accompanying the course

7 Prerequisite for the award of credit points:

Module examination pass

8 Application of the module (in the following study programmes)

Applied Mathematics (B.Sc.)

9 Importance of the grade for the final grade:

according to BRPO

10 Module coordinator:

Prof. Dr. rer. nat. Svetozara Petrova

11 Other information:

Literature will be announced at the beginning of the course.

12	Language: German

Numerics of Partial Differential Equations					**NPDGL**
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1185	240 h	8	5th or 6th sem.		1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	0	SCH	0	h	0	h
	Sem. lessons	30 students	4	SCH	60	h	180	h
	Exercise	20 students	0	SCH	0	h	0	h
	Practical or seminar	15 students	0	SCH	0	h	0	h
	Supervised self-study	60 students	0	SCH	0	h	0	h

2	Learning outcomes/competences:	
	The students understand the most important numerical methods for solving partial differential equations. They know the different types (elliptic, hyperbolic and parabolic) of partial differential equations and can analyse them with regard to numerical solvability and error behaviour as well as select suitable procedures.	
3	Contents:	
	• Types of partial differential equations • Application of partial differential equations • Finite difference method • Finite elements method • Finite volume method • Characteristics procedure	
4	Forms of teaching:	
	Sem. lessons	
5	Participation requirements:	
	Formal:	
	Content:	Knowledge of the contents of the modules Analysis (1003), Linear Algebra (1139), Numerical Mathematics (1186) and Differential Equations (1043) Modules: 1003 Analysis; 1043 Differential Equations; 1139 Linear Algebra; 1186 Numerical Mathematics
6	Forms of assessment:	
	Term paper, written examination, combined examination, project work, oral examination or examination accompanying the course	
7	Prerequisite for the award of credit points:	
	Module examination pass	
8	Application of the module (in the following study programmes)	
	Applied Mathematics (B.Sc.)	
9	Importance of the grade for the final grade:	
	according to BRPO	
10	Module coordinator:	
	Prof. Dr. phil. Bernhard Bachmann	
11	Other information:	
	Literature will be announced at the beginning of the course.	

12	Language: German

Numerical Mathematics					**NUM**
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1186	360 h	12	3rd sem.	Annual (Winter)	2 semesters

1	Course:	Planned group sizes	Scope		actual contact time / classroom teaching		Self-study	
	Lecture	60 students	0	SCH	0	h	0	h
	Sem. lessons	30 students	8	SCH	120	h	240	h
	Exercise	20 students	0	SCH	0	h	0	h
	Practical or seminar	15 students	0	SCH	0	h	0	h
	Supervised self-study	60 students	0	SCH	0	h	0	h

2	Learning outcomes/competences:	
	The students are familiar with the most important numerical algorithms and their possible applications and can handle numerical problems and estimate the errors of numerical calculations.	
3	Contents:	
	• Rounding and procedural errors, basics of error analysis. • Determination of roots (one and multi-dimensional), root determination of polynomials. • Polynomial interpolation, numerical differentiation and integration. • Elementary matrix operations, matrix norms. • linear systems of equations, LU decomposition, QR decomposition, regression analysis, iterative solution of large linear systems of equations • Eigenvalue problems, vector iteration and inverse iteration, decomposition algorithms, LU and QR algorithm.	
4	Forms of teaching:	
	Sem. lessons	
5	Participation requirements:	
	Formal:	
	Content:	Knowledge of the contents of the modules of the first two semesters Modules: 1003 Analysis; 1098 Principles of Computer Science; 1139 Linear Algebra; 1246 Software Lab 1
6	Forms of assessment:	
	Term paper, written examination, combined examination, project work, oral examination or examination accompanying the course	
7	Prerequisite for the award of credit points:	
	Module examination pass	
8	Application of the module (in the following study programmes)	
	Applied Mathematics (B.Sc.)	
9	Importance of the grade for the final grade:	
	according to BRPO	
10	Module coordinator:	
	Prof. Dr. phil. Bernhard Bachmann	
11	Other information:	
	Literature will be announced at the beginning of the course. Teaching content is summarised in a script accompanying the lecture.	

12	Language: German

Object-Oriented Programming					**OOP**
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1188	150 h	5	3rd sem.	Annual (Winter)	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	0	SCH	0	h	0	h
	Sem. lessons	30 students	2	SCH	30	h	45	h
	Exercise	20 students	0	SCH	0	h	0	h
	Practical or seminar	15 students	2	SCH	30	h	45	h
	Supervised self-study	60 students	0	SCH	0	h	0	h

2 Learning outcomes/competences:

Subject-specific:
Students know the concepts and principles of object-oriented programming. They are able to model and implement problems in an object-oriented way and document them using a modelling language.
Interdisciplinary:
Students master techniques of project realisation, presentation and documentation (applied in an object-oriented programming project).

3 Contents:

Elements of an object-oriented programming language
Function overloading, references, default parameters, variable types, type declaration of function parameters, classes, methods, objects, constructors, destructors, class variables and class methods, dynamic memory management, shallow/deep copying, copy constructors, operator overloading, global and non-global methods, hierarchy of classes / inheritance, multiple inheritance, virtual methods, dynamic binding, polymorphisms, virtual base classes, exception handling, input and output

4 Forms of teaching:
Sem. lessons with practical training and project work

5 Participation requirements:

Formal:	
Content:	Modules: 1098 Principles of Computer Science

6 Forms of assessment:
Term paper, written examination, combined examination, project work, oral examination or examination accompanying the course

7 Prerequisite for the award of credit points:
Module examination pass

8 Application of the module (in the following study programmes)
Applied Mathematics (B.Sc.)

9 Importance of the grade for the final grade:
according to BRPO or SPO if ungraded elective subject

10 Module coordinator:
Prof. Dr. Jonas Ide

11	Other information: Literature will be announced at the beginning of the course. Teaching content is summarised in a script accompanying the lecture.
12	Language: German

Operations Research					**OR**
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1189	240 h	8	5th or 6th sem.		1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	0	SCH	0	h	0	h
	Sem. lessons	30 students	4	SCH	60	h	180	h
	Exercise	20 students	0	SCH	0	h	0	h
	Practical or seminar	15 students	0	SCH	0	h	0	h
	Supervised self-study	60 students	0	SCH	0	h	0	h

2	Learning outcomes/competences:	
	The students solve problems from selected application areas of Operations Research (OR) with the help of suitable tools Models and methods of OR, develop decision support approaches on the basis of case studies and evaluate them.	
3	Contents:	
	• Modelling, solution finding and interpretation as well as sensitivity analysis of linear optimisation problems • Basic features and applications of dynamic, combinatorial, stochastic, robust and multicriteria optimisation • Basic features of decision and game theory • Multi-objective decision problems • Basic features of the precedence diagram method and resource planning • Queue models • Development of decision support models for operational problems (case studies)	
4	Forms of teaching:	
	Sem. lessons with active exercise components	
5	Participation requirements:	
	Formal:	
	Content:	Modules: 1140 Linear Optimisation
6	Forms of assessment:	
	Term paper, written examination, combination examination, project work or oral examination	
7	Prerequisite for the award of credit points:	
	Module examination pass	
8	Application of the module (in the following study programmes)	
	Applied Mathematics (B.Sc.)	
9	Importance of the grade for the final grade:	
	according to BRPO	
10	Module coordinator:	
	Prof. Dr. Jonas Ide	
11	Other information:	
	Literature will be announced at the beginning of the course. Teaching content is summarised in a script accompanying the lecture.	
12	Language:	
	German	

Partial Differential Equations					**PDGL**
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1191	240 h	8	5th or 6th sem.		1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	0	SCH	0	h	0	h
	Sem. lessons	30 students	4	SCH	60	h	180	h
	Exercise	20 students	0	SCH	0	h	0	h
	Practical or seminar	15 students	0	SCH	0	h	0	h
	Supervised self-study	60 students	0	SCH	0	h	0	h

2	Learning outcomes/competences:	
	The students master the most important methods for solving partial differential equations. The application of existence, uniqueness and dependency theorems is just as important as the concrete finding of solutions. They will be able to apply the theoretical contents to practice-relevant partial differential equations.	
3	Contents:	
	• Type classification • Existence and uniqueness theorems • Characteristics of a differential equation • Initial and boundary value problems • Green's formula and functions	
4	Forms of teaching:	
	Sem. lessons	
5	Participation requirements:	
	Formal:	
	Content:	Modules: 1003 Analysis; 1043 Differential Equations; 1139 Linear Algebra; 1186 Numerical Mathematics
6	Forms of assessment:	
	Term paper, written examination, combination examination, project work, oral examination or examination accompanying the course	
7	Prerequisite for the award of credit points:	
	Module examination pass	
8	Application of the module (in the following study programmes)	
	Applied Mathematics (B.Sc.)	
9	Importance of the grade for the final grade:	
	according to BRPO	
10	Module coordinator:	
	Prof. Dr. rer. nat. Jörg Horst	
11	Other information:	
	Literature will be announced at the beginning of the course. The course material is summarised in a script that accompanies the lecture	
12	Language:	
	German	

Principles of Physics and Engineering					**PTG**
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1203	240 h	8	2nd sem.	Annual (Summer)	2 semesters

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	0	SCH	0	h	0	h
	Sem. lessons	30 students	8	SCH	120	h	120	h
	Exercise	20 students	0	SCH	0	h	0	h
	Practical or seminar	15 students	0	SCH	0	h	0	h
	Supervised self-study	60 students	0	SCH	0	h	0	h

2 Learning outcomes/competences:

By imparting selected basic knowledge from physics with the inclusion of technical examples, the students are able to comprehend ways of thinking / approaches, e.g. of physicists and engineers, as partners in the professional life of mathematicians.
The students know the possible applications of mathematicians in the physical-technical field.

3 Contents:

Introduction to the professional field for mathematicians in the physical-technical field:

- Fundamentals of physics: History of physics. What is science? What is physics? Modelling and physical quantities, work and energy.
- Statics: Force, central/general force systems and centres of mass.
- Direct current and direct voltage: Basic quantities and components in electrical engineering (charge, current, voltage, resistance, capacitor and coil), Kirchhoff's theorems, series and parallel connection, linear networks (branch current, mesh current analysis).
- Kinematics: Simple and circular movements, movement and coordinate systems (rigid body kinematics and kinematics of relative movement).
- AC voltage and AC current: Fundamentals and complex AC voltage theory, reactive and apparent resistance, active, reactive and apparent power.
- Electrical engineering applications: Real voltage and current sources, measurement technology, transformers, filter and semiconductor technology.
- Dynamics: Newton's axioms, quantity of motion (angular) momentum, straight, central, elastic impact, undamped and damped oscillation.

4 Forms of teaching:

Sem. lessons supplemented with lectures by students on interesting questions from the natural sciences and technology

5 Participation requirements:

Formal:	
Content:	

6 Forms of assessment:

Term paper, written examination, combined examination, project work, oral examination or examination accompanying the course

7	Prerequisite for the award of credit points: Module examination pass
8	Application of the module (in the following study programmes) Applied Mathematics (B.Sc.)
9	Importance of the grade for the final grade: according to BRPO
10	Module coordinator: Prof. Dr. rer. nat. Jörg Horst
11	Other information: Literature will be announced at the beginning of the course. Teaching content is summarised in a script accompanying the lecture.
12	Language: German

Practical Project / Internship					**PRS**
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1207	450 h	15	7th sem.	each semester	12 weeks

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	0	SCH	0	h	0	h
	Sem. lessons	30 students	0	SCH	0	h	0	h
	Exercise	20 students	0	SCH	0	h	0	h
	Practical or seminar	15 students	2	SCH	30	h	420	h
	Supervised self-study	60 students	0	SCH	0	h	0	h

2	Learning outcomes/competences:	
	Through concrete tasks and practical work in a company, students gain sound insights into professional activities that are professionally related to the objectives and contents of the study programme. In doing so, they can apply the knowledge and skills they have acquired in their previous studies and reflect on the experiences they have had in their work, evaluate them and present them in various forms.	
3	Contents:	
	see SPO §16-21	
4	Forms of teaching:	
	Seminar according to SPO §20	
5	Participation requirements:	
	Formal:	see SPO §16
	Content:	
6	Forms of assessment:	
	In-class examination	
7	Prerequisite for the award of credit points:	
	Module examination pass	
8	Application of the module (in the following study programmes)	
	Applied Mathematics (B.Sc.)	
9	Importance of the grade for the final grade:	
	according to BRPO or SPO if ungraded elective subject	
10	Module coordinator:	
	Dr. math. Elke Koppenrade	
11	Other information:	
12	Language:	
	German	

Project Seminar					**PRO**
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1226	150 h	5	4th or 6th sem.		1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	0	SCH	0	h	0	h
	Sem. lessons	30 students	0	SCH	0	h	0	h
	Exercise	20 students	0	SCH	0	h	0	h
	Practical or seminar	15 students	4	SCH	60	h	90	h
	Supervised self-study	60 students	0	SCH	0	h	0	h

2	Learning outcomes/competences:	
	Students are able to familiarise themselves with concrete problem areas (case studies with a technical, economic or information technology background), to analyse, model and solve the problems in the project team and to present the project results.	
3	Contents:	
	Working on selected case studies from technology, business or computer science which require the use of mathematical models and procedures.	
4	Forms of teaching:	
	Project work in small groups	
5	Participation requirements:	
	Formal:	
	Content:	Basic knowledge according to the problem areas offered
6	Forms of assessment:	
	Course assessment, project work or examination accompanying the course	
7	Prerequisite for the award of credit points:	
	Module examination pass	
8	Application of the module (in the following study programmes)	
	Applied Mathematics (B.Sc.)	
9	Importance of the grade for the final grade:	
	according to BRPO or SPO if ungraded elective subject	
10	Module coordinator:	
	Prof. Dr. phil. Bernhard Bachmann	
11	Other information:	
	Literature will be announced at the beginning of the course.	
12	Language:	
	German	

Software Lab 1					**SWL1**
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1246	150 h	5	1st sem.	Annual (Winter)	2 semesters

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	0	SCH	0	h	0	h
	Sem. lessons	30 students	0	SCH	0	h	0	h
	Exercise	20 students	0	SCH	0	h	0	h
	Practical or seminar	15 students	4	SCH	60	h	90	h
	Supervised self-study	60 students	0	SCH	0	h	0	h

2	Learning outcomes/competences: Students can model mathematical problems and solve them with the support of suitable software (computer algebra systems, spreadsheet tools). They are able to work independently (or in groups) on tasks set in projects, to acquire missing knowledge, to prepare project work and to present the results in a suitable form.
3	Contents: • Fundamentals of computer algebra, • Realisation of descriptive statistics procedures with the help of a spreadsheet tool, • Realisation and presentation of projects.
4	Forms of teaching: Practical, project work
5	Participation requirements: Formal: Content:
6	Forms of assessment: Course assessment, project work or examination accompanying the course
7	Prerequisite for the award of credit points: Module examination pass
8	Application of the module (in the following study programmes) Applied Mathematics (B.Sc.)
9	Importance of the grade for the final grade: according to BRPO or SPO if ungraded elective subject
10	Module coordinator: Dipl.-Wirt.Math. Ralf Derdau
11	Other information: Literature will be announced at the beginning of the course. Teaching content is summarised in a script accompanying the lecture. One computer workstation is available per participant.
12	Language: German

Software Lab 2					**SWL2**
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1247	150 h	5	3rd or 4th sem.	Annual (Winter)	2 semesters

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	0	SCH	0	h	0	h
	Sem. lessons	30 students	0	SCH	0	h	0	h
	Exercise	20 students	0	SCH	0	h	0	h
	Practical or seminar	15 students	4	SCH	60	h	90	h
	Supervised self-study	60 students	0	SCH	0	h	0	h

2	Learning outcomes/competences:	
	The students can implement numerical algorithms with the help of mathematical software (e.g. MATLAB, Python) and are able to solve stochastic problems using suitable software (e.g. SPSS, R). They are able to work on tasks set in projects independently and in groups, to acquire missing knowledge, to prepare project documentation and to present the results in a suitable form.	
3	Contents:	
	• Accompanying to the modules Numerical Mathematics and Differential Equations: Working on numerical methods with the help of mathematical software Accompanying the module Stochastics: Realisation of statistical procedures within the framework of a project.	
4	Forms of teaching:	
	Practical with project work	
5	Participation requirements:	
	Formal:	
	Content:	Participation in the associated events: Numerical Mathematics (1186), Differential Equations (1143), Stochastics (1251)
6	Forms of assessment:	
	Course assessment, project work or examination accompanying the course	
7	Prerequisite for the award of credit points:	
	Module examination pass	
8	Application of the module (in the following study programmes)	
	Applied Mathematics (B.Sc.)	
9	Importance of the grade for the final grade:	
	according to BRPO or SPO if ungraded elective subject	
10	Module coordinator:	
	Dipl.-Wirt.Math. Ralf Derdau	
11	Other information:	
	Literature will be announced at the beginning of the course. Teaching content is summarised in a script accompanying the lecture. One computer workstation is available per participant.	
12	Language:	
	German	

Stochastics					**STO**
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1251	360 h	12	3rd sem.	Annual (Winter)	2 semesters

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	0	SCH	0	h	0	h
	Sem. lessons	30 students	8	SCH	120	h	240	h
	Exercise	20 students	0	SCH	0	h	0	h
	Practical or seminar	15 students	0	SCH	0	h	0	h
	Supervised self-study	60 students	0	SCH	0	h	0	h

2	Learning outcomes/competences:	
	The students master the basic principles of probability theory as well as descriptive and inferential statistics. They are able to set up simple stochastic models, analyse random variables and carry out random experiments and hypothesis tests.	
3	Contents:	
	• Descriptive statistics: basic concepts of statistics, graphical representation of data, empirical distributions of univariate data sets (frequencies, mean values, measures of dispersion, moments, quantiles, concentration measures); multivariate data sets (correlation, regression and time series analysis) • Probability theory: fundamentals of measure theory and integration theory, basic concepts (random process, event, probability space, conditional probability, independence, random variable), elementary probability models and combinatorics, special distribution models (discrete and continuous distributions, especially univariate and multivariate normal distribution), conditional distributions, limit theorems • Inductive statistics: Sampling statistic, point estimation, confidence intervals, hypothesis testing (including parametric one and two sample tests, goodness of fit test, simple analysis of variance)	
4	Forms of teaching:	
	Sem. lessons with active exercise components	
5	Participation requirements:	
	Formal:	
	Content:	Modules: 1003 Analysis; 1139 Linear Algebra; 1246 Software Lab 1
6	Forms of assessment:	
	Term paper, written examination, combined examination, project work, oral examination or examination accompanying the course	
7	Prerequisite for the award of credit points:	
	Module examination pass	
8	Application of the module (in the following study programmes)	
	Applied Mathematics (B.Sc.)	
9	Importance of the grade for the final grade:	
	according to BRPO	

10	Module coordinator: Prof. Dr. rer. nat. Claudia Cottin
11	Other information: Literature will be announced at the beginning of the course. Teaching content is summarised in a script accompanying the lecture.
12	Language: German

Technical English					**ENG**
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1083	150 h	5	5th sem.	Annual (Winter)	2 semesters

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	0	SCH	0	h	0	h
	Sem. lessons	30 students	4	SCH	60	h	90	h
	Exercise	20 students	0	SCH	0	h	0	h
	Practical or seminar	15 students	0	SCH	0	h	0	h
	Supervised self-study	60 students	0	SCH	0	h	0	h

2 Learning outcomes/competences:

- Expertise: The students acquire an extended active language competence at the upper B2 level. They have a sound specialist vocabulary of Technical English and can combine it with Business English terminology relevant to their profession.
- Social competence: they develop sensitivity to differences in intercultural communication, especially in English-speaking business environment.
- Methodological competence: They are able to skim specialist texts for essential information and present them shortly and concisely both in speaking and in writing. . They establish wider contexts and make a critical assessment.
- Personal competence: They show English fluency and a pro-active approach to managing authentic English sources.

3 Contents:

- Students can actively participate in international conferences.
- They master engineering-relevant terminology (e.g. manufacturing processes; mathematical operations; dimensions and shapes; forces and mechanisms; properties of materials; automated systems and Industry 4.0).
- They possess interdisciplinary skills (e.g. discussing readings and trends; pitching a technical product; managing projects; designing conference posters; academic writing).

4 Forms of teaching:

Sem. lessons / individual and group work, etc. / semester project (Assignment)

5 Participation requirements:

Formal:	Regular attendance (70%) and active participation
Content:	English language competence: B1.2 (according to the European Reference Framework for Languages)

6 Forms of assessment:

Combination examination

7	Prerequisite for the award of credit points: Passed semester project and written exam
8	Application of the module (in the following study programmes) Applied Mathematics (B.Sc.)
9	Importance of the grade for the final grade: according to BRPO
10	Module coordinator: Dr. phil. Anna Trebits
11	Other information: Literature will be announced at the beginning of the course. Textbook, additional materials, intranet self-study courses
12	Language: English

Insurance Economics					**VEWL**
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1273	150 h	5	4th or 6th sem.		1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	0	SCH	0	h	0	h
	Sem. lessons	30 students	4	SCH	60	h	90	h
	Exercise	20 students	0	SCH	0	h	0	h
	Practical or seminar	15 students	0	SCH	0	h	0	h
	Supervised self-study	60 students	0	SCH	0	h	0	h

2 Learning outcomes/competences:

The students are familiar with the basic economic models relevant to insurance and the significance of the various sectors of social and individual insurance for use in private and company risk management. They understand the special business features of insurance companies (with regard to organisational and operational structures, accounting, etc.) and have an overview of models and methods of risk management and asset-liability management in insurance companies.

3 Contents:

- Basic economic models relevant to the insurance industry
- Importance of insurance in the context of private and corporate risk management
- Overview of individual and social insurance and their demarcation and interaction (in particular also sources for information procurement)
- Organisation and supervision of the insurance industry
- Legal basis of the insurance contract
- Detailed insights into selected business lines of insurance
- Accounting of insurance companies
- Risk management and asset-liability management in insurance companies

4 Forms of teaching:

Seminar lessons with project work

5 Participation requirements:

Formal:	
Content:	Solid basic knowledge of mathematics Modules: 1099 Principles of Business Administration and Business Mathematics; 1251 Stochastics

6 Forms of assessment:

Term paper, written examination, combined examination, course assessment, project work, oral examination or examination during the course

7 Prerequisite for the award of credit points:

Module examination pass

8 Application of the module (in the following study programmes)

Applied Mathematics (B.Sc.)

9	Importance of the grade for the final grade: according to BRPO or SPO if ungraded elective subject
10	Module coordinator: Prof. Dr. rer. nat. Claudia Cottin
11	Other information: Literature will be announced at the beginning of the course. Accompanying material is provided (e.g. short script and current professional articles).
12	Language: German

Elective Module Mathematical Application Areas					**WM**
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
1320	150 h	5	4th or 6th sem.	Annual (Summer)	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students		SCH		h		h
	Sem. lessons	30 students		SCH		h		h
	Exercise	20 students		SCH		h		h
	Practical or seminar	15 students	0	SCH	0	h	0	h
	Supervised self-study	60 students		SCH		h		h

2	Learning outcomes/competences:
3	Contents:
4	Forms of teaching:
5	Participation requirements:
	Formal:
	Content:
6	Forms of assessment:
7	Prerequisite for the award of credit points:
8	Application of the module (in the following study programmes) Applied Mathematics (B.Sc.)
9	Importance of the grade for the final grade:
10	Module coordinator: Prof. Dr. phil. Bernhard Bachmann
11	Other information:
12	Language: German

Subject-Specific Elective Module					**WM**
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
9027	240 h	8	5th or 6th sem.	each semester	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students		SCH		h		h
	Sem. lessons	30 students		SCH		h		h
	Exercise	20 students		SCH		h		h
	Practical or seminar	15 students	0	SCH	0	h	0	h
	Supervised self-study	60 students		SCH		h		h
2	Learning outcomes/competences:							
3	Contents:							
4	Forms of teaching:							
5	Participation requirements:							
	Formal:							
	Content:							
6	Forms of assessment:							
7	Prerequisite for the award of credit points:							
8	Application of the module (in the following study programmes) Applied Mathematics (B.Sc.)							
9	Importance of the grade for the final grade:							
10	Module coordinator: Prof. Dr. phil. Bernhard Bachmann							
11	Other information:							
12	Language: German							