Module Handbook
Economathematics M.Sc.
SPO 2016
Winter term 2022/23
Date: 06/09/2022
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1 General information

Welcome to the new module handbook of your study program! We are delighted that you have decided to study at the KIT Department of Economics and Management and wish you a good start into the new semester! In the following we would like to give you a short introduction to the most important terms and rules that are important in connection with the choice of modules, courses and examinations.

1.1 Structural elements

The program exists of several subjects (e.g. business administration, economics, operations research). Every subject is split into modules and every module itself consists of one or more interrelated module component exams. The extent of every module is indicated by credit points (CP), which will be credited after the successful completion of the module. Some of the modules are obligatory. According to the interdisciplinary character of the program, a great variety of individual specialization and deepening possibilities exists for a large number of modules. This enables the student to customize content and time schedule of the program according to personal needs, interest and job perspective. The module handbook describes the modules belonging to the program. It describes particularly:

- the structure of the modules
- the extent (in CP),
- the dependencies of the modules,
- the learning outcomes,
- the assessment and examinations.

The module handbook serves as a necessary orientation and as a helpful guide throughout the studies. The module handbook does not replace the course catalog, which provides important information concerning each semester and variable course details (e.g. time and location of the course).

1.2 Begin and completion of a module

Each module and each examination can only be selected once. The decision on the assignment of an examination to a module (if, for example, an examination in several modules is selectable) is made by the student at the moment when he / she is registered for the appropriate examination. A module is completed or passed when the module examination is passed (grade 4.0 or better). For modules in which the module examination is carried out over several partial examinations, the following applies: The module is completed when all necessary module partial examinations have been passed. In the case of modules which offer alternative partial examinations, the module examination is concluded with the examination with which the required total credit points are reached or exceeded. The module grade, however, is combined with the weight of the predefined credit points for the module in the overall grade calculation.

1.3 Module versions

It is not uncommon for modules to be revised due to, for example, new courses or cancelled examinations. As a rule, a new module version is created, which applies to all students who are new to the module. On the other hand, students who have already started the module enjoy confidence and remain in the old module version. These students can complete the module on the same conditions as at the beginning of the module (exceptions are regulated by the examination committee). The date of the student's "binding declaration" on the choice of the module in the sense of §5(2) of the Study and Examination Regulation is decisive. This binding declaration is made by registering for the first examination in this module.

In the module handbook, all modules are presented in their current version. The version number is given in the module description. Older module versions can be accessed via the previous module handbooks in the archive at http://www.wiwi.kit.edu/Archiv_MHB.php.

1.4 General and partial examinations

Module examinations can be either taken in a general examination or in partial examinations. If the module examination is offered as a general examination, the entire learning content of the module will be examined in a single examination. If the module examination is subdivided into partial examinations, the content of each course will be examined in corresponding partial examinations. Registration for examinations can be done online at the campus management portal. The following functions can be accessed on https://campus.studium.kit.edu/:

- Register/unregister for examinations
- Check for examination results
- Create transcript of records

For further and more detailed information, https://studium.kit.edu/Seiten/FAQ.aspx.

1.5 Types of exams

Exams are split into written exams, oral exams and alternative exam assessments. Exams are always graded. Non exam assessments can be repeated several times and are not graded.
1 GENERAL INFORMATION

Caution: exam type dependent on further pandemic developments

Due to the current situation, online formats are also available for examinations that are typically offered as presence examinations, depending on the circumstances. All assessments that are announced in the modules as a written exam (written exam/sP according to SPO § 4 Abs. 2, Pkt. 1) can therefore also be offered as an alternative exam assessment/PLaA (according to SPO § 4 Abs. 2, Pkt. 3) depending on further pandemic developments. And vice versa. As alternative examination formats, a) online examinations with video supervision (sP) and optionally a face-to-face examination in the same examination period are offered. Or b) the Online Open Book exam (PLaA) format.

This option applies to all modules and assessments listed in the module handbook, regardless of whether or not corresponding references are already made to them there. It is also at the discretion of the responsible examiners whether they allow a 'free shot' for their examination when determining the type of examination.

1.6 Repeating exams

Principally, a failed written exam, oral exam or alternative exam assessment can repeated only once. If the repeat examination (including an eventually provided verbal repeat examination) will be failed as well, the examination claim is lost. A request for a second repetition has to be made in written form to the examination committee two months after loosing the examination claim. A counseling interview is mandatory.

For further information see http://www.wiwi.kit.edu/hinweiseZweitwdh.php.

1.7 Examiners

The examination committee has appointed the KIT examiners and lecturers listed in the module handbook for the modules and their courses as examiners for the courses they offer.

1.8 Additional accomplishments

Additional accomplishments are voluntarily taken exams, which have no impact on the overall grade of the student and can take place on the level of single courses or on entire modules. It is also mandatory to declare an additional accomplishment as such at the time of registration for an exam. Additional accomplishments with at most 30 CP may appear additionally in the certificate.

1.9 Further information

For current information about studying at the KIT Department of Economics and Management, please visit our website www.wiwi.kit.edu as well as Instagram, LinkedIn, and YouTube. Please also see current notices and announcements for students at: https://www.wiwi.kit.edu/studium.php.

Information around the legal and official framework of the study program can be found in the respective study and examination regulations of your study program. These are available under the Official Announcements of KIT (http://www.sle.kit.edu/ amtlicheBekanntmachungen.php).

More detailed information about the legal and general conditions of the program can be found in the examination regulation of the program (http://www.sle.kit.edu/amtlicheBekanntmachungen.php).
2 Qualification objectives and profile of the degree program

The interdisciplinary Master’s degree program in Economathematics provides the qualification for a professional activity in the areas of industry, banking, insurance, logistics, software development and research. Through the research-oriented training, the graduates are prepared especially for lifelong learning.

2.1 Professional key qualifications

Graduates have a broad knowledge of mathematical and economic sciences, including specific methods and techniques in the fields of analysis / numerics / optimization, stochastics, finance / risk management / managerial economics and operations management / data analysis / Informatics. They are able to analyze and explain current, complex questions in these fields. They can use methods from economics and mathematics, combine them and work interdisciplinarily. Based on these methods, they are able to handle practical and research-relevant questions. Graduates have trained analytical thinking and can work independently and reflectively. They are also able to acquire additional knowledge for further questions themselves.

2.2 Interdisciplinary qualifications

Graduates can analyze, evaluate and solve problems in new and unfamiliar situations in a multidisciplinary context. They are able to integrate their knowledge independently, deal with high complexity, and they have endurance in solving difficult problems. Graduates are capable of documenting, illustrating and interpreting results which have been obtained. They always take into account social, scientific and ethical conditions. They can argue and defend a position with experts as well as with laymen, on problems and solutions at a scientific level. In addition, they have the ability to work in a team and are able to use their knowledge effectively.

2.3 Learning outcomes

The graduates can name, explain and apply deepening mathematical methods in economics. They are also able to identify the application of these methods. The graduates have an understanding of economic processes and can comment on economic issues. They will gain an in-depth understanding of mathematical methods in the fields of analysis / numerics / optimization and stochastics.
3 Structure of the degree program

The courses are held in the form of modules, with most modules consisting of at least one course (with or without an exercise) or a seminar. Each module closes with a learning control. The average workload is measured in credit points (CP). In general, modules are graded. The grade is included in the final score. The master thesis consists of a separate module with 30 CP. In total, 120 credits must be earned in the Master's degree, approximately evenly distributed over four semesters.

The Master’s degree in Economathematics is based on the two disciplines mathematics and economics, which are offered by the department of Mathematics and the department of Economics and Management. Modules from both disciplines must be selected as follows.

3.1 1. Subject: Mathematical Methods

There are the following four mathematical fields:

- Stochastics
- Applied and Numerical Mathematics / Optimization
- Analysis
- Algebra and Geometry

A minimum of 36 credits must be earned, with 8 credits from the field of Stochastics and 8 credits from one of the fields of Analysis or Applied and Numerical Mathematics / Optimization. The remaining credits must be obtained by any examination from the four mathematical fields. The modules belonging to these fields can be found in the module handbook.

3.2 2. Subject: Finance - Risk Management - Managerial Economics

18 CP must be acquired. The modules belonging to the three fields can be found in the module handbook.

3.3 3. Subject: Operations Management - Data Analysis - Informatics

18 CP must be acquired. The modules belonging to the three fields can be found in the module handbook.

3.4 Seminars

Furthermore, two seminar modules with 3 CP have to be taken. Precisely each one has to be chosen from the two disciplines mathematics and economics.

3.5 Elective subject

A further 12 credits are to be earned flexibly from the above-mentioned mathematical or economics modules or as a maximum of one seminar in economics. In particular, this gives the possibility of professional deepening in preparation for the Master Thesis. All modules in the elective subject must be graded.

3.6 Master Thesis

The master's thesis is usually written in the fourth semester and has 30 credits. Prerequisite for admission to the master’s thesis module is that the student successfully completed module examinations of 70 credits. The master’s thesis can be supervised in both participating departments and should, as far as possible, deal with a topic relevant to content and methodology for business mathematics / economathematics. A prerequisite is an appropriate deepening in the subject field of the work.
4 Key qualifications

Part of the degree program is also the acquisition of key and interdisciplinary qualifications. This field includes overarching events on social topics, complementary scientific programs, the application of specialist knowledge in the field of work, competence training for the targeted training of soft skills as well as foreign language training in the scientific context.

The master's degree program in Economathematics at the Departments for Mathematics and Economics and Management is characterized by an exceptionally high degree of interdisciplinarity. With the combination of mathematical and economics subjects, the acquisition of knowledge from different disciplines is an integral part of the course. Interdisciplinary thinking in connections is thereby naturally promoted. In addition, the seminars of the Master's degree program contribute significantly to the promotion of the soft skills by the training of scientifically highly qualified editing and presentation of special topics.

The key competences integrally shared within the degree program can be assigned to the following fields:

4.1 Basic skills (soft skills)
- Teamwork, social communication and creativity techniques (for example, working in small groups, working together on the homework and reworking the course material)
- Presentation creation and techniques
- Logical and systematic argumentation and writing (for example, in exercises, seminars, courses and writing homework)
- Structured problem solving and communication

4.2 Practice orientation (enabling skills)
- Empowerment in a professional context
- Competences in project management
- Business basic knowledge
- English as a technical language

4.3 Orientation knowledge
- Mediation of interdisciplinary knowledge
- Institutional knowledge about economic and legal systems
- Knowledge about international organizations
- Media, technology and innovation

Courses that provide the necessary competencies are summarized in the module for key qualifications and are regularly updated in the relevant module description of the module handbook. This list is coordinated with the House of Competence.
5 Exemplary study courses
The following versions are just a few of the many options of available study courses.

5.1 Version 1

5.1.1 Semester 1: 30 CP, 5 examinations
Subject 1: Analysis 8 CP, Stochastics 8 CP, choice 5 CP = 21 CP Subject 2: Finance 1 9 CP (SS) and Insurance Management I 9 CP (WS)

5.1.2 Semester 2: 28 CP, 6 examinations
Subject 1: Choice 6 CP + Choice 4 CP (or 5 + 5 or 7 + 5) = 10 CP Subject 2: Finance 2 9 CP (WS) or Finance 1 (SS) Subject 3: Informatics 9 CP

5.1.3 Semester 3: 32 CP, 6 examinations, 1 non exam assessment
Subject 1: choice 5 CP Subject 3: Stochastic Methods and Simulation 9 CP Subject 4: 3 CP (Seminar WiWi) Subject 5: 3 CP (Seminar Math) Optional compulsory: 8 CP + 4 CP (or other partitioning) = 12 CP

5.1.4 Semester 4: 30 CP
Master Thesis

5.2 Version 2

5.2.1 Semester 1: 33 CP, 5 examinations
Subject 1: Analysis 8 CP, Stochastics 8 CP, choice 8 CP = 24 CP Subject 2: Finance 1 9 CP (SS) and Insurance Management I 9 CP (WS)

5.2.2 Semester 2: 30 CP, 6 examinations
Subject 1: Option 8 CP + choice 4 CP (or other partitioning like 6 + 6 or 7 + 5) = 12 CP Subject 2: Finance 2 9 CP (WS) or Finance 1 (SS) Subject 3: Informatics 9 CP

5.2.3 Semester 3: 27 CP, 5 examinations, 1 non exam assessment
Subject 3: Stochastic Methods and Simulation 9 CP Subject 4: 3 CP (Seminar WiWi) Subject 5: 3 CP (Seminar Math) Optional: 8 CP + 4 CP (or other partitioning such as 6 + 6 or 7 + 5) = 12 CP

5.2.4 Semester 4: 30 CP
Master Thesis

5.3 Version 3

5.3.1 Semester 1: 30 CP, 5 examinations
Subject 1: Analysis 8 CP, Stochastics 8 CP, choice 5 CP = 21 CP Subject 2: Finance 1 9 CP

5.3.2 Semester 2: 30 CP, 6 examinations, 1 non exam assessment
Subject 2: Finance 2 9 CP Subject 3: Informatics 9 CP, Stochastic Methods and Simulation 9 CP = 18 CP Subject 5: 3 CP (Seminar Math)

5.3.3 semester 3: 30 credits, 5 - 6 examinations (depending on denomination)
Subject 1: Option 15 CP (conceivable in various forms, for example 5 + 5 + 5, 8 + 7, 6 + 4 + 5) Optional compulsory: 12 CP (e.g., 8 + 4 CP or 9 + 3 CP) Subject 4: 3 CP (Seminar WiWi)

5.3.4 Semester 4: 30 CP
Master Thesis
5.4 Version 4: Start in summer term (with specific possible choices)

5.4.1 Semester 1: 29 CP, 5 examinations
Subject 1: Introduction to Scientific Computing (Numerics and Applied Mathematics) 8 CP, Financial Mathematics in Continuous Time (Stochastics) 8 CP, Time Series (Stochastics) 4 CP = 20 CP Subject 2: Finance 1: Derivatives 4.5 CP, Asset Pricing 4.5 CP = 9 CP

5.4.2 Semester 2: 30 CP, 5 examinations
Subject 1: Functional Analysis (Analysis) 8 CP, Spatial Stochastics (Stochastics) (8 CP) = 16 CP Subject 2: Finance 2: Fixed-income securities 4.5 CP, Credit Risks 4.5 CP = 9 CP Subject 3: Informatics: Algorithms for Internet Applications 5 CP

5.4.3 Semester 3: 31 CP, 6 examinations, 1 non exam assessment
Subject 3: Informatics: Smart Energy Distribution 4 CP Subject 3: Operations Research in Supply Chain Management and Healthcare Management: Tactical and Operational Supply Chain Management 4.5 CP + Event Discrete Simulation in Production and Logistics 4.5 CP = 9 CP Subject 4: Seminar WiWi 3 CP (examination) Subject 5: Seminar Math 3 CP (study performance) Optional subject: Stochastic Geometry (Stochastics) 8 CP, Generalized Regression Models (Stochastics) 4 CP = 12 CP

5.4.4 Semester 4: 30 CP
Master Thesis

5.5 Version 5: Start in summer term (with specific possible choices)

5.5.1 Semester 1: 29 CP, 5 examinations
Subject 1: Introduction to Scientific Computing (Numerics and Applied Mathematics) 8 CP, Financial Mathematics in Continuous Time (Stochastics) 8 CP, Time Series (Stochastics) 4 CP = 20 CP Subject 2: Finance 1: Derivatives 4.5 CP, Asset Pricing 4.5 CP = 9 CP

5.5.2 Semester 2: 33 CP, 5 examinations, 1 non exam assessment
Subject 1: Functional analysis (analysis) 8 CP, asymptotic stochastics (stochastics) 8 CP = 16 CP Subject 2: Finance 2: Fixed-income securities 4.5 CP, credit risks 4.5 CP = 9 CP Subject 3: Informatics: Algorithms for Internet Applications 5 CP Subject 5: 3 CP (Seminart math) 3 CP (Study performance)

5.5.3 Semester 3: 28 CP, 6 examinations
Subject 3: Informatics: Smart Energy Distribution 4 CP Subject 3: Operations Research in Supply Chain Management and Healthcare Management: Tactical and Operational Supply Chain Management 4.5 CP + Event Discrete Simulation in Production and Logistics 4.5 CP = 9CP Subject 4: Seminar WiWi 3 CP (examination) Optional subject: boundary and eigenvalue problems (analysis) 8 CP, generalized regression models (stochastics) 4 CP = 12 CP

5.5.4 Semester 4: 30 CP
Master Thesis

5.6 Version 6: Start in winter term (with specific possible choices)

5.6.1 Semester 1: 31.5 CP, 5 examinations
Subject 1: Functional Analysis (Analysis) 8 CP, Financial Mathematics in Discrete Time (Stochastics) 8 CP, Algebra 8 CP = 24 CP Subject 2: Finance 1: Valuation 4.5 CP Subject 4: Seminar WiWi 3 CP

5.6.2 Semester 2: 32.5 CP, 6 examinations
Subject 1: Financial Mathematics in Continuous Time (Stochastics) 8 CP, Time Series (Stochastics) 4 CP = 12 CP Subject 2: Finance 1: Derivatives 4.5 CP Subject 3: Informatics: Document Management and Groupware Systems 4 CP Scope: Boundary and eigenvalue problems 8 CP, Generalized regression models (stochastics) 4 CP = 12 CP

5.6.3 Semester 3: 26 CP, 5 examination credits, 1 non exam assessment
5.6.4 Semester 4: 30 CP
Master Thesis

5.7 Version 7: Start in winter term (with specific possible choices)

5.7.1 Semester 1: 31.5 CP, 5 examinations
Subject 1: Functional Analysis (Analysis) 8 CP, Financial Mathematics in Discrete Time (Stochastics) 8 CP, Algebra 8 CP = 24 CP
Subject 2: Finance 1: Valuation 4.5 CP Subject 4: Seminar WiWi 3 CP

5.7.2 Semester 2: 32.5 CP, 6 examinations
Subject 1: Financial Mathematics in Continuous Time (Stochastics) 8 CP, Time Series (Stochastics) 4 CP = 12 CP Subject 2: Finance 1: Derivatives 4.5 CP Subject 3: Informatics: Document Management and Groupware Systems 4 CP Compulsory subject: Introduction to scientific computing (numerics and applied mathematics) 8 CP, Generalized Regression Models (Stochastics) 4 CP = 12 CP

5.7.3 Semester 3: 26.5 CP, 5 examinations, 1 non exam assessment

5.7.4 Semester 4: 30 CP
Master Thesis

5.8 Version 8: Start in winter term (with specific possible choices)

5.8.1 Semester 1: 31.5 CP, 5 examinations
Subject 1: Functional Analysis (Analysis) 8 CP, Financial Mathematics in Discrete Time (Stochastics) 8 CP, Algebra 8 CP = 24 CP
Subject 2: Finance 1: Valuation 4.5 CP Subject 4: Seminar WiWi 3 CP

5.8.2 Semester 2: 29.5 CP, 6 examinations
Subject 1: Financial Mathematics in Continuous Time (Stochastics) 8 CP, Time Series (Stochastics) 4 CP = 12 CP Subject 2: Finance 1: Derivatives 4.5 CP Subject 3: Informatics: Document Management and Groupware Systems 4 CP + Efficient Algorithms 5 CP = 9 CP Compulsory subject: Generalized regression models (stochastics) 4 CP

5.8.3 Semester 3: 29 CP, 5 examinations, 1 non exam assessment
Subject 2: Finance 2: Financial Intermediation 4.5 CP + eFinance: Information Management for Securities Trading 4.5 CP = 9 CP Subject 3: Operations Research in Supply Chain Management: Graph Theory and Advanced Location Models 4.5 CP, Site Planning and Strategic Supply Chain Management 4.5 CP = 9 CP Subject 5: Seminar Math 3 CP Required field: differential geometry (algebra and geometry) 8 CP

5.8.4 Semester 4: 30 CP
Master Thesis

5.9 Version 9: Start in winter term (with specific possible choices)

5.9.1 Semester 1: 31.5 CP, 5 examinations
Subject 1: Functional Analysis (Analysis) 8 CP, Financial Mathematics in Discrete Time (Stochastics) 8 CP, Algebra 8 CP = 24 CP
Subject 2: Insurance Management I: Insurance Production 4.5 CP Subject 4: Seminar WiWi 3 CP

5.9.2 Semester 2: 29.5 CP, 6 examinations
Subject 1: Financial Mathematics in Continuous Time (Stochastics) 8 CP, Time Series (Stochastics) 4 CP = 12 CP Subject 2: Insurance Management I: Insurance Marketing 4.5 CP Subject 3: Stochastic modeling and optimization: Simulation I 4.5 CP + Simulation II 4.5 CP = 9 CP Required field: Computer science: Smart Energy Distribution 4 CP
5.9.3 Semester 3: 29 CP, 6 examinations, 1 non exam assessment

Subject 2: Decision-making and game theory: auction theory 4.5 CP + experimental economic research 4.5 CP = 9 CP
Subject 3: Operations Research in Supply Chain Management: Graph Theory and Advanced Location Models 4.5 CP, Site Planning and Strategic Supply Chain Management 4.5 CP = 9 CP
Subject 5: Seminar Math 3 CP

Required field: Informatics: Knowledge Discovery 5 CP + Seminar Informatik B (Master) 3 CP = 8 CP

5.9.4 Semester 4: 30 CP

Master Thesis
### 6 Field of study structure

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<td>Ruin Theory</td>
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<td>M-MATH-104057</td>
<td>Key Moments in Geometry</td>
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<td>M-MATH-104058</td>
<td>Numerical Linear Algebra in Image Processing</td>
<td>6 CR</td>
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<td>Mathematical Topics in Kinetic Theory</td>
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<td>M-MATH-102884</td>
<td>Scattering Theory</td>
<td>8 CR</td>
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<tr>
<td>M-MATH-104261</td>
<td>Lie Groups and Lie Algebras</td>
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<td>Bott Periodicity</td>
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<td>Dispersive Equations</td>
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<td>Comparison of Numerical Integrators for Nonlinear Dispersive Equations</td>
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<td>Selected Topics in Harmonic Analysis</td>
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<td>Fourier Analysis and its Applications to PDEs</td>
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<td>Boundary Element Methods</td>
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<td>Monotonicity Methods in Analysis</td>
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<td>Nonlinear Maxwell Equations</td>
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<td>M-MATH-105651</td>
<td>Applications of Topological Data Analysis</td>
<td>4 CR</td>
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<td>Selected Methods in Fluids and Kinetic Equations</td>
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<td>M-MATH-105964</td>
<td>Introduction to Convex Integration</td>
<td>3 CR</td>
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<td>Space and Time Discretization of Nonlinear Wave Equations</td>
<td>6 CR</td>
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<td>M-MATH-105973</td>
<td>Translation Surfaces</td>
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<td>Introduction to Stochastic Differential Equations</td>
<td>4 CR</td>
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<td>M-MATH-106052</td>
<td>Random Graphs and Networks</td>
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<td>Stochastic Simulation</td>
<td>5 CR</td>
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<tr>
<td>M-MATH-106063</td>
<td>Numerical Complex Analysis</td>
<td>6 CR</td>
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<tr>
<td>M-MATH-106064</td>
<td>Topological Genomics</td>
<td>3 CR</td>
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</table>
7 Modules

7.1 Module: Adaptive Finite Elemente Methods [M-MATH-102900]

**Responsible:** Prof. Dr. Willy Dörfler

**Organisation:** KIT Department of Mathematics

**Part of:** Mathematical Methods (Analysis or Applied and Numerical Mathematics, Optimization)

Elective Field

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<th>Duration</th>
<th>Level</th>
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**Mandatory**

| T-MATH-105898 | Adaptive Finite Element Methods | 6 CR | Dörfler |

**Prerequisites**
none
7.2 Module: Advanced Inverse Problems: Nonlinearity and Banach Spaces [M-MATH-102955]

**Responsible:** Prof. Dr. Andreas Rieder  
**Organisation:** KIT Department of Mathematics  
**Part of:** Mathematical Methods (Analysis or Applied and Numerical Mathematics, Optimization)  
**Elective Field**

<table>
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**Mandatory**

| T-MATH-105927 | Advanced Inverse Problems: Nonlinearity and Banach Spaces | 5 CR | Rieder |

**Prerequisites**  
none
7.3 Module: Advanced Machine Learning and Data Science [M-WIWI-105659]

**Responsible:** Prof. Dr. Maxim Ulrich

**Organisation:** KIT Department of Economics and Management

**Part of:** Finance - Risk Management - Managerial Economics

<table>
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**Mandatory**

| T-WIWI-111305 | Advanced Machine Learning and Data Science | 9 CR | Ulrich |

**Competence Certificate**

The assessment is carried out in an alternative form. The final grade is evaluated based on the intermediate presentations during the project, the quality of the implementation, the final written thesis and a final presentation.

**Prerequisites**

see T-WIWI-106193 "Advanced Machine Learning and Data Science".

**Competence Goal**

After a successful project, the students can:

- select and apply modern machine learning methods to solve a data science problem;
- organize themselves in a team in a goal-oriented manner and bring an extensive software project in the field of data science and machine learning to success;
- deepen their data science and machine learning skills
- solve a finance problem with the help of data science and machine learning algorithm.

**Content**

The course is targeted at students with a major in Data Science and/or Machine Learning and/or Quantitative Finance. It offers students the opportunity to develop hands-on knowledge on new developments in the intersection of quantitative financial markets, data science and machine learning. The result of the project should not only be a final thesis, but the implementation of methods or development of an algorithm in machine learning and data science. Typically, problems and data are taken from current research and innovations in the field of quantitative asset and risk management.

**Workload**

Total effort for 9 credit points: approx. 270 hours are divided into the following parts: Communication:Exchange during the project: 30 h, Final presentation: 10 h; Implementation and thesis: Preparation before development (Problem analysis and solution design): 70 h, Solution implementation: 110 h, Tests and quality assurance: 50 h.

**Recommendation**

None
7.4 Module: Advanced Topics in Strategy and Management [M-WIWI-103119]

**Responsible:** Prof. Dr. Hagen Lindstädt

**Organisation:** KIT Department of Economics and Management

**Part of:** Finance - Risk Management - Managerial Economics

**Elective Field**

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**Compulsory Elective Courses (Election: 9 credits)**

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<th>Credits</th>
<th>Grading</th>
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<th>Language</th>
<th>Level</th>
<th>Version</th>
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<tr>
<td>T-WIWI-106188</td>
<td>Workshop Current Topics in Strategy and Management</td>
<td>3</td>
<td>CR</td>
<td>Each term</td>
<td>German</td>
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<td>T-WIWI-106189</td>
<td>Workshop Business Wargaming – Analyzing Strategic Interactions</td>
<td>3</td>
<td>CR</td>
<td>Each term</td>
<td>German</td>
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<td>T-WIWI-106190</td>
<td>Strategy and Management Theory: Developments and &quot;Classics&quot;</td>
<td>3</td>
<td>CR</td>
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**Competence Certificate**

The assessment is carried out as partial exams (according to Section 4 (2), 1-3 SPO) of the single courses of this module, whose sum of credits must meet the minimum requirement of credits of this module. The assessment procedures are described for each course of the module separately.

The overall grade of the module is the average of the grades for each course weighted by the credits and truncated after the first decimal.

**Prerequisites**

None

**Competence Goal**

Students

- are able to analyze business strategies and derive recommendations using appropriate frameworks
- learn to express their position through compelling reasoning in structured discussions
- are qualified to critically examine recent research topics in the field of strategic management
- can derive own conclusions from less structured information by using interdisciplinary knowledge

**Content**

The module is divided into three main topics:

The students

- analyze and discuss a wide range of business strategies on the basis of collectively selected case studies.
- participate in a business wargaming workshop and analyze strategic interactions.
- write a paper about current topics in the field of strategic management theory.

**Annotation**

This course is admission restricted. After being admitted to one course of this module, the participation at the other courses will be guaranteed.

Every course of this module will be at least offered every second term. Thus, it will be possible to complete the module within two terms.

**Recommendation**

None
7.5 Module: Algebra [M-MATH-101315]

**Responsible:** Prof. Dr. Frank Herrlich

**Organisation:** KIT Department of Mathematics

**Part of:** Mathematical Methods (Algebra and Geometry)
Elective Field

<table>
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**Mandatory**

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<td>T-MATH-102253</td>
<td>Algebra</td>
<td>8</td>
<td>CR Herrlich, Kühlein</td>
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**Prerequisites**

None
7.6 Module: Algebraic Geometry [M-MATH-101724]

**Responsible:** Prof. Dr. Frank Herrlich

**Organisation:** KIT Department of Mathematics

**Part of:**
- Mathematical Methods (Algebra and Geometry)
- Elective Field

<table>
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<td>8 CR</td>
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</table>
### 7.7 Module: Algebraic Number Theory [M-MATH-101725]

**Responsible:** PD Dr. Stefan Kühnlein  
**Organisation:** KIT Department of Mathematics  
**Part of:** Mathematical Methods (Algebra and Geometry)  
**Elective Field:**

<table>
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<td>T-MATH-103346</td>
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</table>
M 7.8 Module: Algebraic Topology [M-MATH-102948]

Responsible: Prof. Dr. Roman Sauer
Organisation: KIT Department of Mathematics
Part of: Mathematical Methods (Algebra and Geometry)
Elective Field

<table>
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Mandatory

| T-MATH-105915 | Algebraic Topology | 8 CR | Krannich, Sauer |

Prerequisites

none
7.9 Module: Algebraic Topology II [M-MATH-102953]

**Responsible:** Prof. Dr. Roman Sauer

**Organisation:** KIT Department of Mathematics

**Part of:** Mathematical Methods (Algebra and Geometry)

**Elective Field**

<table>
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**Mandatory**

| T-MATH-105926 | Algebraic Topology II | 8 CR | Sauer |

**Prerequisites**

none
7.0 Module: Analytical and Numerical Homogenization [M-MATH-105636]

**Responsible:** Prof. Dr. Marlis Hochbruck  
**Organisation:** KIT Department of Mathematics  
**Part of:** Mathematical Methods (Analysis or Applied and Numerical Mathematics, Optimization)  
**Elective Field**

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<td>Analytical and Numerical Homogenization</td>
<td>6 CR</td>
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</table>

**Prerequisites**

none

**Competence Goal**
The topic of the lecture are numerical multiscale methods presented exemplarily for elliptic problems. Students know the basic analytical results for existence and uniqueness of the solution of multiscale problems and from homogenization theory. In addition, they know methods for the numerical approximation of multiscale and the homogenized solution. They are able to analyze the convergence of these methods and assess the pros and cons of the different approaches.

**Content**

- Analytical fundamentals (basic results from analysis for elliptic partial differential equations and from homogenization theory)
- Approximation of the homogenized solution (e.g., heterogeneous multiscale method)
- Approximation of the multiscale solution (e.g., local orthogonal decomposition)

**Annotation**

Upon request the lecture will be held in english.
7.11 Module: Analytics and Statistics [M-WIWI-101637]

**Responsible:** Prof. Dr. Oliver Grothe  
**Organisation:** KIT Department of Economics and Management  
**Part of:** Finance - Risk Management - Managerial Economics  
**Elective Field**

<table>
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<td>T-WIWI-103123</td>
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**Supplementary Courses (Selection: between 4,5 and 5 credits)**

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<td>Machine Learning 2 – Advanced Methods</td>
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<tr>
<td>T-WIWI-111247</td>
<td>Mathematics for High Dimensional Statistics</td>
<td>4,5 CR</td>
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<td>Multivariate Statistical Methods</td>
<td>4,5 CR</td>
<td>Grothe</td>
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<td>T-WIWI-112109</td>
<td>Topics in Stochastic Optimization</td>
<td>4,5 CR</td>
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**Competence Certificate**
The assessment is carried out as partial written exams (according to Section 4(2), 1 of the examination regulation) of the single courses of this module, whose sum of credits must meet the minimum requirement of credits of this module. The examinations are offered every semester. Re-examinations are offered at every ordinary examination date. The assessment procedures are described for each course of the module separately.

The overall grade of the module is the average of the grades for each course weighted by the credits and truncated after the first decimal.

**Prerequisites**
The course “Advanced Statistics” is compulsory.

**Competence Goal**
A Student

- Deepens the knowledge of descriptive and inferential statistics.
- Deals with simulation methods.
- Learns basic and advanced methods of statistical analysis of multivariate and high-dimensional data.

**Content**

- Deriving estimates and testing hypotheses
- Stochastic processes
- Multivariate statistics, copulas
- Dependence measures
- Dimension reduction
- High-dimensional methods
- Prediction

**Annotation**
The planned lectures and courses for the next three years are announced online.

**Workload**
The total workload for this module is approximately 270 hours.

Responsible: Prof. Dr. Stefan Nickel
Organisation: KIT Department of Economics and Management
Part of: Operations Management - Data Analysis - Informatics
Elective Field

Credits: 9
Grading scale: Grade to a tenth
Recurrence: Each term
Duration: 1 term
Language: German
Level: 4
Version: 9

Compulsory Elective Courses (Elective: between 1 and 2 items)

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<td>T-WIWI-102704</td>
<td>Facility Location and Strategic Supply Chain Management</td>
<td>4.5 CR</td>
<td>Nickel</td>
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<tr>
<td>T-WIWI-102714</td>
<td>Tactical and Operational Supply Chain Management</td>
<td>4.5 CR</td>
<td>Nickel</td>
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</table>

Supplementary Courses (Elective: at most 1 item)

<table>
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<th>Instructor</th>
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<tr>
<td>T-WIWI-102726</td>
<td>Global Optimization I</td>
<td>4.5 CR</td>
<td>Stein</td>
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<td>T-WIWI-106199</td>
<td>Modeling and OR-Software: Introduction</td>
<td>4.5 CR</td>
<td>Nickel</td>
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<tr>
<td>T-WIWI-106545</td>
<td>Optimization under Uncertainty</td>
<td>4.5 CR</td>
<td>Rebennack</td>
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Competence Certificate
The assessment is carried out as partial exams (according to § 4(2), 1 of the examination regulation) of the single courses of this module, whose sum of credits must meet the minimum requirement of credits of this module.

The assessment procedures are described for each course of the module separately.

The overall grade of the module is the average of the grades for each course weighted by the credits and truncated after the first decimal.

Prerequisites
At least one of the courses Facility Location and Strategic Supply Chain Management and Tactical and Operational Supply Chain Management has to be taken.

Competence Goal
The student

• is familiar with basic concepts and terms of Supply Chain Management,
• knows the different areas of Supply Chain Management and their respective optimization problems,
• is acquainted with classical location problem models (in the plane, on networks and discrete) as well as fundamental methods for distribution and transport planning, inventory planning and management,
• is able to model practical problems mathematically and estimate their complexity as well as choose and adapt appropriate solution methods.

Content
Supply Chain Management is concerned with the planning and optimization of the entire, inter-company procurement, production and distribution process for several products taking place between different business partners (suppliers, logistics service providers, dealers). The main goal is to minimize the overall costs while taking into account several constraints including the satisfaction of customer demands.

This module considers several areas of Supply Chain Management. On the one hand, the determination of optimal locations within a supply chain is addressed. Strategic decisions concerning the location of facilities like production plants, distribution centers or warehouses are of high importance for the rentability of supply chains. Thoroughly carried out, location planning tasks allow an efficient flow of materials and lead to lower costs and increased customer service. On the other hand, the planning of material transport in the context of Supply Chain Management represents another focus of this module. By linking transport connections and different facilities, the material source (production plant) is connected with the material sink (customer). For given material flows or shipments, it is considered how to choose the optimal (in terms of minimal costs) distribution and transportation chain from the set of possible logistics chains, which asserts the compliance of delivery times and further constraints.

Furthermore, this module offers the possibility to learn about different aspects of the tactical and operational planning level in Supply Chain Management, including methods of scheduling as well as different approaches in procurement and distribution logistics. Finally, issues of warehousing and inventory management will be discussed.

Annotation
The planned lectures and courses for the next three years are announced online.
Workload
The total workload of the module is about 240 hours. The workload is proportional to the credit points of the individual courses.

Recommendation
The courses Introduction to Operations Research I and II are helpful.
7.13 Module: Applications of Topological Data Analysis [M-MATH-105651]

Responsible: Dr. Andreas Ott
Organisation: KIT Department of Mathematics
Part of: Mathematical Methods (Stochastics)
Mathematical Methods (Analysis or Applied and Numerical Mathematics, Optimization)
Mathematical Methods (Algebra and Geometry)
Elective Field

<table>
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Mandatory

| T-MATH-111290 | Applications of Topological Data Analysis | 4 CR | Ott |

Prerequisites
None
7.14 Module: Bifurcation Theory [M-MATH-103259]

**Responsible:** Dr. Rainer Mandel

**Organisation:** KIT Department of Mathematics

**Part of:** Mathematical Methods (Analysis or Applied and Numerical Mathematics, Optimization) Elective Field

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**Prerequisites**
None

**Annotation**
Course is held in English
### 7.15 Module: Bott Periodicity [M-MATH-104349]

**Organisation:** KIT Department of Mathematics  
**Part of:** Mathematical Methods (Algebra and Geometry)  
**Elective Field:**

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**Prerequisites**

None
7.16 Module: Boundary and Eigenvalue Problems [M-MATH-102871]

**Responsible:** Prof. Dr. Wolfgang Reichel  
**Organisation:** KIT Department of Mathematics  
**Part of:** Mathematical Methods (Analysis or Applied and Numerical Mathematics, Optimization)  
**Elective Field:**

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**Mandatory**

| T-MATH-105833 | Boundary and Eigenvalue Problems | 8 CR | Frey, Hundertmark, Lamm, Plum, Reichel, Schnaubelt |

Economathematics M.Sc.  
Module Handbook as of 06/09/2022
### 7.17 Module: Boundary Element Methods [M-MATH-103540]

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**Prerequisites**
None

**Mandatory**

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**Responsible:** PD Dr. Tilo Arens

**Organisation:** KIT Department of Mathematics

**Part of:** Mathematical Methods (Analysis or Applied and Numerical Mathematics, Optimization)

**Elective Field**
### 7.18 Module: Brownian Motion [M-MATH-102904]

**Responsible:** Prof. Dr. Nicole Bäuerle  
**Organisation:** KIT Department of Mathematics  
**Part of:** Mathematical Methods (Stochastics)  
**Elective Field**

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**Mandatory**

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**Prerequisites**

none
Module: Classical Methods for Partial Differential Equations [M-MATH-102870]

**Responsible:** Prof. Dr. Michael Plum

**Organisation:** KIT Department of Mathematics

**Part of:** Mathematical Methods (Analysis or Applied and Numerical Mathematics, Optimization) Elective Field

### Mandatory

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**Credits:** 8  
**Grading scale:** Grade to a tenth  
**Recurrence:** Each winter term  
**Duration:** 1 term  
**Level:** 4  
**Version:** 1
7.20 Module: Collective Decision Making [M-WIWI-101504]

**Responsible:** Prof. Dr. Clemens Puppe

**Organisation:** KIT Department of Economics and Management

**Part of:** Finance - Risk Management - Managerial Economics

Elective Field

<table>
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<td>Each term</td>
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**Compulsory Elective Courses (Election: )**

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<tr>
<td>T-WIWI-102740</td>
<td>Public Management</td>
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<td>T-WIWI-102859</td>
<td>Social Choice Theory</td>
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**Competence Certificate**
The assessment is carried out as partial exams (according to Section 4(2), 1 or 2 of the examination regulation) of the single courses of this module, whose sum of credits must meet the minimum requirement of credits of this module. The assessment procedures are described for each course of the module separately.

The overall grade of the the module is the average of the grades for each course weighted by the credits and truncated after the first decimal.

**Prerequisites**
None

**Competence Goal**

Students

- are able to model practical problems of the public sector and to analyze them with respect to positive and normative questions,
- understand individual incentives and social outcomes of different institutional designs,
- are familiar with the functioning and design of democratic elections and can analyze them with respect to their individual incentives.

**Content**
The focus of the module is on mechanisms of public decisions making, including voting and the aggregation of preferences and judgements.

**Workload**
The total workload for this module is approximately 270 hours. For further information see German version.
7.21 Module: Combinatorics [M-MATH-102950]

Responsible: Prof. Dr. Maria Aksenovich
Organisation: KIT Department of Mathematics
Part of: Mathematical Methods (Algebra and Geometry)
Elective Field

<table>
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</table>

Competence Certificate
The final grade is given based on the written final exam (3h).

By successfully working on the problem sets, a bonus can be obtained. To obtain the bonus, one has to achieve 50% of the points on the solutions of the exercise sheets 1-6 and also of the exercise sheets 7-12. If the grade in the final written exam is between 4.0 and 1.3, then the bonus improves the grade by one step (0.3 or 0.4).

Prerequisites
none

Competence Goal
The students understand, describe, and use fundamental notions and techniques in combinatorics. They can analyze, structure, and formally describe typical combinatorial questions. The students can use the results and methods such as inclusion-exclusion, generating functions, Young tableaux, as well as the developed proof ideas, in solving combinatorial problems. In particular, they can analyze the existence and the number of ordered and unordered arrangements of a given size. The students understand and critically use the combinatorial methods. Moreover, the students can communicate using English technical terminology.

Content
The course is an introduction into combinatorics. Starting with counting problems and bijections, classical methods such as inclusion-exclusion principle and generating functions are discussed. Further topics include Catalan families, permutations, Young tableaux, partial orders, and combinatorial designs.

Module grade calculation
The grade of the module is the grade of the written exam.

Annotation
- Regular cycle: every 2nd year, summer semester
- Course is held in English
### 7.22 Module: Commutative Algebra [M-MATH-104053]

**Responsible:** Prof. Dr. Frank Herrlich  
**Organisation:** KIT Department of Mathematics  
**Part of:** Mathematical Methods (Algebra and Geometry)  
**Elective Field**

<table>
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**Prerequisites**

None
7.23 Module: Comparison Geometry [M-MATH-102940]

**Responsible:** Prof. Dr. Wilderich Tuschmann  
**Organisation:** KIT Department of Mathematics  
**Part of:** Mathematical Methods (Algebra and Geometry)  
**Elective Field**

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<td>Comparison Geometry</td>
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</table>

**Prerequisites**

none
We will compare numerical integrators (e.g., splitting methods, exponential integrators) for nonlinear dispersive equations such as the nonlinear Schrödinger equation and Kortweg-de Vries equation. We will analyze their convergence properties with regard to the regularity assumptions on the solution.
### 7.25 Module: Complex Analysis [M-MATH-102878]

**Responsible:** Dr. Christoph Schmoeger  
**Organisation:** KIT Department of Mathematics  
**Part of:** Mathematical Methods (Analysis or Applied and Numerical Mathematics, Optimization)  
**Elective Field:**

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</table>

**Mandatory**

| T-MATH-105849 | Complex Analysis | 8 CR | Herzog, Plum, Reichel, Schmoeger, Schnaubelt |

**Content**

- infinite products
- Mittag-Leffler theorem
- Montel's theorem
- Riemann mapping theorem
- conformal mappings
- univalent (schlicht) functions
- automorphisms of some domains
- harmonic functions
- Schwarz reflection principle
- regular and singular points of power series
### Module: Compressive Sensing [M-MATH-102935]

**Responsible:** Prof. Dr. Andreas Rieder  
**Organisation:** KIT Department of Mathematics  
**Part of:** Mathematical Methods (Analysis or Applied and Numerical Mathematics, Optimization)  
**Elective Field**

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### M 7.27 Module: Computer-Assisted Analytical Methods for Boundary and Eigenvalue Problems [M-MATH-102883]

**Responsible:** Prof. Dr. Michael Plum  
**Organisation:** KIT Department of Mathematics  
**Part of:** Mathematical Methods (Analysis or Applied and Numerical Mathematics, Optimization) 
**Elective Field**

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# 7.28 Module: Continuous Time Finance [M-MATH-102860]

**Responsible:** Prof. Dr. Nicole Bäuerle  
**Organisation:** KIT Department of Mathematics  
**Part of:** Mathematical Methods (Stochastics)  
**Elective Field**

<table>
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</table>
7.29 Module: Control Theory [M-MATH-102941]

**Responsible:** Prof. Dr. Roland Schnaubelt

**Organisation:** KIT Department of Mathematics

**Part of:** Mathematical Methods (Analysis or Applied and Numerical Mathematics, Optimization)

**Elective Field**

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**Prerequisites**

none
7.30 Module: Convex Geometry [M-MATH-102864]

**Responsible:** Prof. Dr. Daniel Hug  
**Organisation:** KIT Department of Mathematics  
**Part of:**  
- Mathematical Methods (Stochastics)  
- Mathematical Methods (Algebra and Geometry)  
- Elective Field

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**Competence Goal**

The students

- know fundamental combinatorial, geometric and analytic properties of convex sets and convex functions and apply these to related problems,
- are familiar with fundamental geometric and analytic inequalities for functionals of convex sets and their applications to geometric extremal problems and can present central ideas and techniques of proofs,
- know selected integral formulas for convex sets and the required results on invariant measures.
- know how to work self-organized and self-reflexive.

**Content**

1. Convex Sets  
1.1. Combinatorial Properties  
1.2. Support and Separation Properties  
1.3. Extremal Representations  
2. Convex Functions  
2.1. Basic Properties  
2.2. Regularity  
2.3. Support Function  
3. Brunn-Minkowski Theory  
3.1. Hausdorff Metric  
3.2. Volume and Surface Area  
3.3. Mixed Volumes  
3.4. Geometric Inequalities  
3.5. Surface Area Measures  
3.6. Projection Functions  
4. Integralgeometric Formulas  
4.1. Invariant Measures  
4.2. Projection and Section Formulas
### 7.31 Module: Decision and Game Theory [M-WIWI-102970]

**Responsible:** Prof. Dr. Clemens Puppe  
**Organisation:** KIT Department of Economics and Management  
**Part of:** Finance - Risk Management - Managerial Economics  
**Elective Field:**

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**Wahlpflichtangebot (Election: 9 credits)**

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<td>T-WIWI-102614</td>
<td>Experimental Economics</td>
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<td>T-WIWI-102861</td>
<td>Advanced Game Theory</td>
<td>4,5 CR</td>
<td>Ehrhart, Puppe, Reiß</td>
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</table>

**Competence Certificate**

The assessment is carried out as partial exams (according to Section 4(2), 1 or 2 of the examination regulation) of the single courses of this module, whose sum of credits must meet the minimum requirement of credits of this module. The assessment procedures are described for each course of the module separately.

The overall grade of the module is the average of the grades for each course weighted by the credits and truncated after the first decimal.

**Prerequisites**

None

**Competence Goal**

The student learns the basics of individual and strategic decisions on an advanced and formal level.

He learns to analyze economic problems through abstract and method-based thinking and to design solution strategies. In the tutorials, the concepts and results of the lecture will be applied in case studies.

**Content**

See German version.

**Workload**

The total workload for this module is approximately 270 hours. For further information see German version.
7.32 Module: Differential Geometry [M-MATH-101317]

**Responsible:** Prof. Dr. Wilderich Tuschmann

**Organisation:** KIT Department of Mathematics

**Part of:** Mathematical Methods (Algebra and Geometry)
Elective Field

<table>
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**Mandatory**

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<tr>
<td>T-MATH-102275</td>
<td>Differential Geometry</td>
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**Prerequisites**

None
### 7.33 Module: Discrete Dynamical Systems [M-MATH-105432]

**Responsible:** PD Dr. Gerd Herzog  
**Organisation:** KIT Department of Mathematics  
**Part of:** Mathematical Methods (Analysis or Applied and Numerical Mathematics, Optimization)  
**Elective Field**

<table>
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**Mandatory**

| T-MATH-110952 | Discrete Dynamical Systems | 3 CR | Herzog |

**Prerequisites**

none
7.34 Module: Discrete Time Finance [M-MATH-102919]

**Responsible:** Prof. Dr. Nicole Bäuerle

**Organisation:** KIT Department of Mathematics

**Part of:** Mathematical Methods (Stochastics)

**Elective Field**

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**Mandatory**

| T-MATH-105839 | Discrete Time Finance | 8 CR | Bäuerle, Fasen-Hartmann, Trabs |

**Prerequisites**

none
7.35 Module: Dispersive Equations [M-MATH-104425]

**Responsible:** Prof. Dr. Wolfgang Reichel

**Organisation:** KIT Department of Mathematics

**Part of:** Mathematical Methods (Analysis or Applied and Numerical Mathematics, Optimization)

**Elective Field**

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**Mandatory**

| T-MATH-109001 | Dispersive Equations | 6 CR | Reichel |

**Prerequisites**

None
## 7.36 Module: Dynamical Systems [M-MATH-103080]

**Responsible:** Prof. Dr. Jens Rottmann-Matthes  
**Organisation:** KIT Department of Mathematics  
**Part of:** Mathematical Methods (Analysis or Applied and Numerical Mathematics, Optimization)  
**Elective Field**

<table>
<thead>
<tr>
<th>Credits</th>
<th>Grading scale</th>
<th>Recurrence</th>
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### Mandatory

| T-MATH-106114 | Dynamical Systems | 8 CR | Rottmann-Matthes |

**Prerequisites**

none

**Responsible:** Prof. Dr. Melanie Schienle  
**Organisation:** KIT Department of Economics and Management  
**Part of:** Finance - Risk Management - Managerial Economics  
**Elective Field:**

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<td>Applied Econometrics</td>
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**Supplementary Courses (Election: between 4,5 and 5 credits)**

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<td>Financial Econometrics</td>
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<td>T-WIWI-103126</td>
<td>Non- and Semiparametrics</td>
<td>4,5 CR</td>
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<td>T-WIWI-103127</td>
<td>Panel Data</td>
<td>4,5 CR</td>
<td>Heller</td>
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<td>T-WIWI-110868</td>
<td>Predictive Modeling</td>
<td>4,5 CR</td>
<td>Heller</td>
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<tr>
<td>T-WIWI-111387</td>
<td>Probabilistic Time Series Forecasting Challenge</td>
<td>4,5 CR</td>
<td>Krüger</td>
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<tr>
<td>T-WIWI-103065</td>
<td>Statistical Modeling of Generalized Regression Models</td>
<td>4,5 CR</td>
<td>Heller</td>
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<tr>
<td>T-WIWI-110939</td>
<td>Financial Econometrics II</td>
<td>4,5 CR</td>
<td>Schienle</td>
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</table>

**Competence Certificate**

The assessment is carried out as partial exams (according to Section 4(2), 1-3 of the examination regulation) of the single courses of this module, whose sum of credits must meet the minimum requirement of credits of this module. The examinations are offered every semester. Re-examinations are offered at every ordinary examination date. The assessment procedures are described for each course of the module separately. The overall grade of the module is the average of the grades for each course weighted by the credits and truncated after the first decimal.

**Prerequisites**

The course "Applied Econometrics" [2520020] is compulsory and must be examined.

**Competence Goal**

The student shows an in depth understanding of advanced Econometric techniques suitable for different types of data. He/She is able to apply his/her theoretical knowledge to real world problems with the help of statistical software and to evaluate performance of different approaches based on statistical criteria.

**Content**

The courses of this module offer students a broad range of advanced Econometric techniques for state-of-the art data analysis.

**Workload**

The total workload for this module is approximately 270 hours.
7.38 Module: Econometrics and Statistics II [M-WIWI-101639]

Responsible: Prof. Dr. Melanie Schienle
Organisation: KIT Department of Economics and Management
Part of: Finance - Risk Management - Managerial Economics
Elective Field

Credits | Grading scale | Recurrence | Duration | Language | Level | Version
---|---|---|---|---|---|---
9 | Grade to a tenth | Each term | 1 term | German | 4 | 4

Compulsory Elective Courses (Election: between 9 and 10 credits)

<table>
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<td>Financial Econometrics</td>
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<td>T-WIWI-103124</td>
<td>Multivariate Statistical Methods</td>
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<td>Grothe</td>
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<td>T-WIWI-103126</td>
<td>Non- and Semiparametrics</td>
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<td>Schienle</td>
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<td>T-WIWI-103127</td>
<td>Panel Data</td>
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<td>T-WIWI-103128</td>
<td>Portfolio and Asset Liability Management</td>
<td>4.5 CR</td>
<td>Safarian</td>
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<td>T-WIWI-110868</td>
<td>Predictive Modeling</td>
<td>4.5 CR</td>
<td>Krüger</td>
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<tr>
<td>T-WIWI-111387</td>
<td>Probabilistic Time Series Forecasting Challenge</td>
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<td>T-WIWI-103065</td>
<td>Statistical Modeling of Generalized Regression Models</td>
<td>4.5 CR</td>
<td>Heller</td>
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<td>T-WIWI-103129</td>
<td>Stochastic Calculus and Finance</td>
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<td>T-WIWI-110939</td>
<td>Financial Econometrics II</td>
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Competence Certificate
The assessment is carried out as partial exams (according to Section 4(2), 1-3 of the examination regulation) of the single courses of this module, whose sum of credits must meet the minimum requirement of credits of this module. The examinations are offered every semester. Re-examinations are offered at every ordinary examination date. The assessment procedures are described for each course of the module separately. The overall grade of the module is the average of the grades for each course weighted by the credits and truncated after the first decimal.

Prerequisites
This module can only be passed if the module "Econometrics and Statistics I" has been finished successfully before.

Competence Goal
The student shows an in depth understanding of advanced Econometric techniques suitable for different types of data. He/She is able to apply his/her theoretical knowledge to real world problems with the help of statistical software and to evaluate performance of different approaches based on statistical criteria.

Content
This modula builds on prerequisites acquired in Module "Econometrics and Statistics I". The courses of this module offer students a broad range of advanced Econometric techniques for state-of-the art data analysis.

Workload
The total workload for this module is approximately 270 hours.

Responsible: Prof. Dr. Kay Mitusch
Organisation: KIT Department of Economics and Management
Part of: Finance - Risk Management - Managerial Economics
Elective Field

<table>
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Compulsory Elective Courses (Election: 1 item)

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<tr>
<td>T-WIWI-102609</td>
<td>Advanced Topics in Economic Theory</td>
<td>4,5 CR</td>
<td>Mitusch</td>
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<tr>
<td>T-WIWI-102861</td>
<td>Advanced Game Theory</td>
<td>4,5 CR</td>
<td>Ehrhart, Puppe, Reiß</td>
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Supplementary Courses (Election: 1 item)

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<td>Asset Pricing</td>
<td>4,5 CR</td>
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<td>T-WIWI-102622</td>
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<td>T-WIWI-109050</td>
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<td>Financial Intermediation</td>
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Competence Certificate
The assessment is carried out as partial exams (according to Section 4(2), 1 or 2 of the examination regulation) of the single courses of this module, whose sum of credits must meet the minimum requirement of credits of this module. The exams are offered at the beginning of the recess period about the subject matter of the latest held lecture. Re-examinations are offered at every ordinary examination date. The assessment procedures are described for each course of the module separately. The overall grade for the module is the average of the grades for each course weighted by the credits and truncated after the first decimal.

Prerequisites
One of the courses T-WIWI-102861 "Advanced Game Theory" and T-WIWI-102609 "Advanced Topics in Economic Theory" is compulsory.

Competence Goal
The students
- have learnt the methods of formal economic modeling, particularly of General Equilibrium Theory and contract theory
- will be able to apply these methods to the topics in Finance, specifically the areas of financial markets and institutions and corporate finance
- have gained many useful insights into the relationship between firms and investors and the functioning of financial markets

Content
The mandatory course “Advanced Topics in Economic Theory” is devoted in equal parts to General Equilibrium Theory and to contract theory. The course “Asset Pricing” will apply techniques of General Equilibrium Theory to valuation of financial assets. The courses “Corporate Financial Policy” and “Finanzintermediation” will apply the techniques of contract theory to issues of corporate finance and financial institutions.

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

**Responsible:** Prof. Dr. Christof Weinhardt

**Organisation:** KIT Department of Economics and Management

**Part of:** Finance - Risk Management - Managerial Economics

**Elective Field**

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**Compulsory Elective Courses (Electing: at least 9 credits)**

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<td>4.5 CR</td>
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**Competence Certificate**
The assessment is carried out as partial exams (according to Section 4 (2), 1-3 SPO) of single courses of this module, whose sum of credits must meet the minimum requirement of credits of this module. The assessment procedures are described for each course of the module separately. The overall grade of the module is the average of the grades for each course weighted by the credits and truncated after the first decimal.

**Prerequisites**
None.

**Competence Goal**
The student

- is aware of design options for energy and especially electricity markets and can derive implications for the market results from the market design,
- knows about current trends regarding the Smart Grid and understands affiliated modelling approaches,
- can evaluate business models of electricity grids according to the regulation regime
- is prepared for scientific contributions in the field of energy system analysis.

**Content**
The module conveys scientific and practical knowledge to analyse energy markets and according business models. To do so the scientific discussion on energy market designs is evaluated and analysed. Different energy market models are presented and their design implications are evaluated. Furthermore, the electricity system is analysed with regards to being a network industry and resulting regulation and business models are discussed. Besides these traditional areas of energy economics we will look at methods and models of digitalisation in the energy sector.

**Annotation**
The lecture Smart Grid Applications will be available starting in the winter term 2018/19.

**Workload**
The total workload for this module is approximately 270 hours. For further information see German version.

**Responsible:** Prof. Dr. Wolf Fichtner  
**Organisation:** KIT Department of Economics and Management  
**Part of:** Operations Management - Data Analysis - Informatics

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#### Mandatory

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<td>T-WIWI-107043</td>
<td>Liberalised Power Markets</td>
<td>3 CR</td>
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#### Supplementary Courses (Electation: at least 6 credits)

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<td>T-WIWI-112151</td>
<td>Energy Trading and Risk Management</td>
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<td>Simulation Game in Energy Economics</td>
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<td>Quantitative Methods in Energy Economics</td>
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<td>Regulation Theory and Practice</td>
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#### Competence Certificate

The assessment is carried out as partial written exams (according to Section 4(2), 1 of the examination regulation) of the single courses of this module, whose sum of credits must meet the minimum requirement of credits of this module. The examinations take place every semester. Re-examinations are offered at every ordinary examination date. The assessment procedures are described for each course of the module separately.

The overall grade of the module is the average of the grades for each course weighted by the credits and truncated after the first decimal.

#### Prerequisites

The lecture Liberalised Power Markets has to be examined.

#### Competence Goal

The student

- gains detailed knowledge about the new requirements of liberalised energy markets,
- describes the planning tasks on the different energy markets,
- knows solution approaches to respective planning tasks.

#### Content

**Liberalised Power Markets:** The European liberalisation process, energy markets, pricing, market failure, investment incentives, market power  
**Energy Trade and Risk Management:** trade centres, trade products, market mechanisms, position and risk management  
**Simulation Game in Energy Economics:** Simulation of the German electricity system

#### Workload

The total workload for this module is approximately 270 hours.

#### Recommendation

The courses are conceived in a way that they can be attended independently from each other. Therefore, it is possible to start the module in winter and summer term.
### Module: Energy Economics and Technology [M-WIWI-101452]

**Responsible:** Prof. Dr. Wolf Fichtner  
**Organisation:** KIT Department of Economics and Management  
**Part of:** Operations Management - Data Analysis - Informatics  
**Elective Field**

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#### Compulsory Elective Courses (Election: at least 9 credits)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>Grading scale</th>
<th>Recurrence</th>
<th>Duration</th>
<th>Language</th>
<th>Level</th>
<th>Version</th>
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<tbody>
<tr>
<td>T-WIWI-102793</td>
<td>Efficient Energy Systems and Electric Mobility</td>
<td>3.5 CR</td>
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<td>German/English</td>
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<td>T-WIWI-102650</td>
<td>Energy and Environment</td>
<td>4.5 CR</td>
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<td>3 CR</td>
<td>Ardone, Pustisek</td>
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<td>German/English</td>
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**Competence Certificate**  
The assessment is carried out as partial written exams (according to Section 4(2), 1 of the examination regulation) of the single courses of this module, whose sum of credits must meet the minimum requirement of credits of this module. The examinations take place every semester. Re-examinations are offered at every ordinary examination date. The assessment procedures are described for each course of the module separately.

The overall grade of the module is the average of the grades for each course weighted by the credits and truncated after the first decimal.

**Prerequisites**  
To integrate the module “Energy Economics and Technology” in the degree programme “Wirtschaftsmathematik” it is compulsory to choose the course „Energy Systems Analysis“.

**Competence Goal**  
The student

- gains detailed knowledge about present and future energy supply technologies (focus on final energy carriers electricity and heat),
- knows the techno-economic characteristics of plants for energy provision, for energy transport as well as for energy distribution and demand,
- is able to assess the environmental impact of these technologies.

**Content**  
*Heat Economy*: district heating, heating technologies, reduction of heat demand, statutory provisions  
*Energy Systems Analysis*: Interdependencies in energy economics, energy systems modelling approaches in energy economics  
*Energy and Environment*: emission factors, emission reduction measures, environmental impact  
*Efficient Energy Systems and Electric Mobility*: concepts and current trends in energy efficiency, Overview of and economical, ecological and social impacts through electric mobility

**Workload**  
The total workload for this module is approximately 270 hours. For further information see German version.
### 7.43 Module: Evolution Equations [M-MATH-102872]

**Responsible:** Prof. Dr. Roland Schnaubelt  
**Organisation:** KIT Department of Mathematics  
**Part of:** Mathematical Methods (Analysis or Applied and Numerical Mathematics, Optimization)  
**Elective Field:**  

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**Mandatory**  

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Economathematics M.Sc.  
Module Handbook as of 06/09/2022
Module: Experimental Economics [M-WIWI-101505]

Responsible: Prof. Dr. Johannes Philipp Reiß
Organisation: KIT Department of Economics and Management
Part of: Finance - Risk Management - Managerial Economics
Elective Field

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Compulsory Elective Courses (Election: 2 items)

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Competence Certificate
The assessment is carried out as partial exams (according to Section 4 (2), 1-3 SPO) of the core course and further single courses of this module, whose sum of credits must meet the minimum requirement of credits of this module. The assessment procedures are described for each course of the module separately.

The overall grade of the module is the average of the grades for each course weighted by the credits and truncated after the first decimal.

Prerequisites
None.

Competence Goal
Students
- are acquainted with the methods of Experimental Economics along with its strengths and weaknesses;
- understand how theory-guided research in Experimental Economics interacts with the development of theory;
- are provided with foundations in data analysis;
- design an economic experiment and analyze its outcome.

Content
The module Experimental Economics offers an introduction into the methods and topics of Experimental Economics. It also fosters and extends knowledge in theory-guided experimental economics and its interaction with theory development. Throughout the module, readings of selected papers are required.

Annotation
The course "Predictive Mechanism and Market Design" is offered every second winter semester, e.g. WS2013 / 14, WS2015 / 16, ...

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Recommendation
Basic knowledge in mathematics, statistics, and game theory is assumed.
Module: Exponential Integrators [M-MATH-103700]

**Responsible:** Prof. Dr. Marlis Hochbruck

**Organisation:** KIT Department of Mathematics

**Part of:** Mathematical Methods (Analysis or Applied and Numerical Mathematics, Optimization)

**Elective Field**

**Credits** 6

**Grading scale** Grade to a tenth

**Recurrence** Irregular

**Duration** 1 term

**Level** 4

**Version** 1

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**Competence Certificate**

Oral exam of approximately 20 minutes

**Prerequisites**

None

**Content**

In this class we consider the construction, analysis, implementation and application of exponential integrators. The focus will be on two types of stiff problems.

The first one is characterized by a Jacobian that possesses eigenvalues with large negative real parts. Parabolic partial differential equations and their spatial discretization are typical examples. The second class consists of highly oscillatory problems with purely imaginary eigenvalues of large modulus.

Apart from motivating the construction of exponential integrators for various classes of problems, our main intention in this class is to present the mathematics behind these methods. We will derive error bounds that are independent of stiffness or highest frequencies in the system.

Since the implementation of exponential integrators requires the evaluation of the product of a matrix function with a vector, we will briefly discuss some possible approaches as well.
**Module: Extremal Graph Theory [M-MATH-102957]**

**Responsible:** Prof. Dr. Maria Aksenovich  
**Organisation:** KIT Department of Mathematics  
**Part of:** Mathematical Methods (Algebra and Geometry)  
**Elective Field**

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**Mandatory**

| T-MATH-105931 | Extremal Graph Theory | 4 CR | Aksenovich |

**Competence Certificate**
The final grade is given based on an oral exam (approx. 30 min.).

**Competence Goal**
The students understand, describe, and use fundamental notions and techniques in extremal graph theory. They can analyze, structure, and formally describe typical combinatorial questions. The students understand and use Szemerédi's regularity lemma and Szemerédi's theorem, can use probabilistic techniques, such as dependent random choice and multistep random colorings, know the best bounds for the extremal numbers of complete graphs, cycles, complete bipartite graphs, and bipartite graphs with bounded maximum degree. They understand and can use the Ramsey theorem for graphs and hypergraphs, as well as stepping-up techniques for bounding Ramsey numbers. Moreover, the students know and understand the behavior of Ramsey numbers for graphs with bounded maximum degree. The students can communicate using English technical terminology.

**Content**
The course is concerned with advanced topics in graph theory. It focuses on the areas of extremal functions, regularity, and Ramsey theory for graphs and hypergraphs. Further topics include Turán's theorem, Erdös-Stone theorem, Szemerédi's lemma, graph colorings and probabilistic techniques.

**Annotation**
Course is held in English

**Recommendation**
Basic knowledge of linear algebra, analysis and graph theory is recommended.
7.47 Module: Extreme Value Theory [M-MATH-102939]

**Responsible:** Prof. Dr. Vicky Fasen-Hartmann

**Organisation:** KIT Department of Mathematics

**Part of:** Mathematical Methods (Stochastics)

**Elective Field**

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<th>Duration</th>
<th>Level</th>
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**Prerequisites**

None
**7.48 Module: Finance 1 [M-WIWI-101482]**

**Responsible:** Prof. Dr. Martin Ruckes  
Prof. Dr. Marliese Uhrig-Homburg

**Organisation:** KIT Department of Economics and Management

**Part of:** Finance - Risk Management - Managerial Economics  
Elective Field

<table>
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**Compulsory Elective Courses (Elective: 9 credits)**

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<td>Derivatives</td>
<td>4,5 CR</td>
<td>Uhrig-Homburg</td>
</tr>
<tr>
<td>T-WIWI-102621</td>
<td>Valuation</td>
<td>4,5 CR</td>
<td>Ruckes</td>
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<tr>
<td>T-WIWI-102647</td>
<td>Asset Pricing</td>
<td>4,5 CR</td>
<td>Ruckes, Uhrig-Homburg</td>
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**Competence Certificate**

The assessment is carried out as partial exams (according to Section 4(2), 1 or 2 of the examination regulation) of the single courses of this module, whose sum of credits must meet the minimum requirement of credits of this module. The assessment procedures are described for each course of the module separately.

The overall grade of the module is the average of the grades for each course weighted by the credits and truncated after the first decimal.

**Prerequisites**

None

**Competence Goal**

The student

- has core skills in economics and methodology in the field of finance  
- assesses corporate investment projects from a financial perspective  
- is able to make appropriate investment decisions on financial markets

**Content**

The courses of this module equip the students with core skills in economics and methodology in the field of modern finance. Securities which are traded on financial and derivative markets are presented, and frequently applied trading strategies are discussed. A further focus of this module is on the assessment of both profits and risks in security portfolios and corporate investment projects from a financial perspective.

**Workload**

The total workload for this module is approximately 270 hours. For further information see German version.
7.49 Module: Finance 2 [M-WIWI-101483]

**Responsible:** Prof. Dr. Martin Ruckes
Prof. Dr. Marliese Uhrig-Homburg

**Organisation:** KIT Department of Economics and Management

**Part of:** Finance - Risk Management - Managerial Economics
Elective Field

<table>
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<th>Duration</th>
<th>Language</th>
<th>Level</th>
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<td>German/English</td>
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**Compulsory Elective Courses (Elective: at least 9 credits)**

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<td>Ruckes, Uhrig-Homburg</td>
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<tr>
<td>T-WIWI-108880</td>
<td>Blockchains &amp; Cryptofinance</td>
<td>4,5 CR</td>
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<td>Schuster, Uhrig-Homburg</td>
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<tr>
<td>T-WIWI-110995</td>
<td>Bond Markets</td>
<td>4,5 CR</td>
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<td>Uhrig-Homburg</td>
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<td>T-WIWI-110997</td>
<td>Bond Markets - Models &amp; Derivatives</td>
<td>3 CR</td>
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<td>Uhrig-Homburg</td>
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<td>Uhrig-Homburg</td>
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**Competence Certificate**
The assessment is carried out as partial exams (according to Section 4(2), 1 or 2 of the examination regulation) of the single courses of this module, whose sum of credits must meet the minimum requirement of credits of this module. The assessment procedures are described for each course of the module separately.

The overall grade of the module is the average of the grades for each course weighted by the credits and truncated after the first decimal.

**Prerequisites**
It is only possible to choose this module in combination with the module Finance 1. The module is passed only after the final partial exam of Finance 1 is additionally passed.

**Competence Goal**
The student is in a position to discuss, analyze and provide answers to advanced economic and methodological issues in the field of modern finance.

**Content**
The module Finance 2 is based on the module Finance 1. The courses of this module equip the students with advanced skills in economics and methodology in the field of modern finance on a broad basis.

**Annotation**
The courses eFinance: Information Engineering and Management for Securities Trading [2540454] and Financial Analysis [2530205] can be chosen from summer term 2015 on.

**Workload**
The total workload for this module is approximately 270 hours. For further information see German version.
Compulsory Elective Courses (Election: at least 9 credits)

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Competence Certificate
The assessment is carried out as partial exams (according to Section 4(2), 1 or 2 of the examination regulation) of the single courses of this module, whose sum of credits must meet the minimum requirement of credits of this module. The assessment procedures are described for each course of the module separately.

The overall grade of the module is the average of the grades for each course weighted by the credits and truncated after the first decimal.

Prerequisites
It is only possible to choose this module in combination with the module Finance 1 and Finance 2. The module is passed only after the final partial exams of Finance 1 and Finance 2 are additionally passed.

Competence Goal
The student is in a position to discuss, analyze and provide answers to advanced economic and methodological issues in the field of modern finance.

Content
The courses of this module equip the students with advanced skills in economics and methodology in the field of modern finance on a broad basis.

Workload
The total workload for this module is approximately 270 hours. For further information see German version.
### 7.51 Module: Finite Element Methods [M-MATH-102891]

**Responsible:** Prof. Dr. Willy Dörfler  
Prof. Dr. Christian Wieners

**Organisation:** KIT Department of Mathematics

**Part of:** Mathematical Methods (Analysis or Applied and Numerical Mathematics, Optimization)  
Elective Field

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Dörfler, Hochbruck, Jahnke, Rieder, Wieners
Module: Finite Group Schemes [M-MATH-103258]

**Responsible:** Prof. Dr. Frank Herrlich

**Organisation:** KIT Department of Mathematics

**Part of:** Mathematical Methods (Algebra and Geometry)

**Elective Field**

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Januszewski
### Module: Forecasting: Theory and Practice [M-MATH-102956]

**Responsible:** Prof. Dr. Tilmann Gneiting  
**Organisation:** KIT Department of Mathematics  
**Part of:** Mathematical Methods (Stochastics)  
**Elective Field**

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**Mandatory**

| T-MATH-105928 | Forecasting: Theory and Practice | 8 CR | Gneiting |

**Prerequisites**

None

**Annotation**

- Regular cycle: every 2nd year, starting winter semester 16/17
- Course is held in English

### Competence Certificate
The module examination is an alternative exam assessment with a maximum score of 100 points to be achieved. These points are distributed over 4 worksheets to be submitted during the semester. The worksheets cover the respective material of the module and are handed out, worked on and assessed in lecture weeks 3 (10 points), 6 (20 points), 9 (30 points) and 12 (40 points). The module-wide exam (all 4 worksheets) must be taken in the same semester.

The worksheets are a mixture of analytical tasks and programming tasks with financial data.

### Competence Goal
This MSc module teaches students fundamental stats and analytics concepts, as well necessary financial economic intuition, necessary to identify, design and execute interesting research questions in quant finance and financial machine learning. Topics include: Maximum Likelihood learning of arma-garch models, expectation maximization learning applied to stochastic volatility and valuation models, Kalman filter techniques to learn latent states, estimation of affine jump diffusion models with options and higher-order moments, stochastic calculus, dynamic modeling of asset markets (bond, equity, options), equilibrium determination of risk premiums, risk premiums for higher moment risk, risk decomposition (fundamental vs idiosyncratic), option-implied return distributions, mixture-density-networks and neural nets.

### Content
Learning Objectives: Skills and understanding of how to successfully set-up, execute and interpret financial data driven research with the following methods: MLE, Kalman Filter, Expectation Maximization, Option Pricing, dynamic asset pricing theory, backward-looking historical return densities, forward-looking options-implied return densities, mixture-density-network, neural networks. Programming is not taught in this course, yet, some graded and non-graded exercises might make heavy use of software based data analysis. See the course's pre-requisites and comments in the module handbook.

### Annotation
- Strongly recommended to have good knowledge in financial econometrics (MLE, OLS, GLS, ARMA-GARCH), mathematics (differential equations, difference equations and optimization), investments (CAPM, factor models), asset pricing (SDF, SDF pricing), derivatives (Black-Scholes, risk-neutral pricing), and programming of statistical concepts (Java or R or Python or Matlab or C or ...)
- Strongly recommended to have a strong interest for interdisciplinary research work in statistics, programming, applied math and financial economics.
- Students lacking the prior knowledge might find the resources of the Chair helpful: [www.youtube.com/c/cram-kit](http://www.youtube.com/c/cram-kit).

### Workload
The total workload for this course is approximately 270 hours. This is for a student with the appropriate prior knowledge in financial econometrics, finance, mathematics and programming. Students without programming experience of statistical concepts will need to invest extra time. Students who have struggled in math- or programming- or finance- oriented classes, will find this course very challenging. Please check the pre-requisites and comments in the module handbook.
# 7.55 Module: Foundations of Continuum Mechanics [M-MATH-103527]

**Responsible:** Prof. Dr. Christian Wieners  
**Organisation:** KIT Department of Mathematics  
**Part of:** Mathematical Methods (Analysis or Applied and Numerical Mathematics, Optimization)  
**Elective Field**

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<td>3 CR</td>
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**Prerequisites**

none
7.56 Module: Fourier Analysis [M-MATH-102873]

**Responsible:** Prof. Dr. Roland Schnaubelt

**Organisation:** KIT Department of Mathematics

**Part of:** Mathematical Methods (Analysis or Applied and Numerical Mathematics, Optimization)

**Elective Field**

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**Mandatory**

| T-MATH-105845 | Fourier Analysis | 8 CR | Schnaubelt |

**Content**

- Fourier series
- Fourier transform on L1 and L2
- Tempered distributions and their Fourier transform
- Explicit solutions of the Heat-, Schrödinger- and Wave equation in R^n
- the Hilbert transform
- the interpolation theorem of Marcinkiewicz
- Singular integral operators
- the Fourier multiplier theorem of Mihlin
Module: Fourier Analysis and its Applications to PDEs [M-MATH-104827]

Responsible: TT-Prof. Dr. Xian Liao

Organisation: KIT Department of Mathematics

Part of: Mathematical Methods (Analysis or Applied and Numerical Mathematics, Optimization)
Elective Field

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Prerequisites

None
7.58 Module: Fractal Geometry [M-MATH-105649]

**Responsible:** PD Dr. Steffen Winter

**Organisation:** KIT Department of Mathematics

**Part of:**
- Mathematical Methods (Stochastics)
- Mathematical Methods (Algebra and Geometry)
- Elective Field

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**Prerequisites**

None
### 7.59 Module: Functional Analysis [M-MATH-101320]

**Responsible:** Prof. Dr. Roland Schnaubelt  
**Organisation:** KIT Department of Mathematics  
**Part of:** Mathematical Methods (Analysis or Applied and Numerical Mathematics, Optimization)  
**Elective Field**

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</table>
| T-MATH-102255 | Functional Analysis | 8 CR  
| Frey, Herzog, Hundertmark, Lamm, Plum, Reichel, Schmoeger, Schnaubelt |

**Prerequisites**

None
Module: Functions of Matrices [M-MATH-102937]

**Responsible:** PD Dr. Volker Grimm

**Organisation:** KIT Department of Mathematics

**Part of:** Mathematical Methods (Analysis or Applied and Numerical Mathematics, Optimization)

**Elective Field**

**Credits:** 8

**Grading scale:** Grade to a tenth

**Recurrence:** Irregular

**Duration:** 1 term

**Level:** 4

**Version:** 1

**Mandatory**

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**Prerequisites**

none
Module: Functions of Operators [M-MATH-102936]

**Responsible:** PD Dr. Volker Grimm

**Organisation:** KIT Department of Mathematics

**Part of:** Mathematical Methods (Analysis or Applied and Numerical Mathematics, Optimization)

**Elective Field**

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### 7.62 Module: Generalized Regression Models [M-MATH-102906]

**Responsible:** PD Dr. Bernhard Klar  
**Organisation:** KIT Department of Mathematics  
**Part of:** Mathematical Methods (Stochastics)  
**Elective Field**

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**Prerequisites**

None
### 7.63 Module: Geometric Group Theory [M-MATH-102867]

**Responsible:** Prof. Dr. Roman Sauer  
**Organisation:** KIT Department of Mathematics  
**Part of:** Mathematical Methods (Algebra and Geometry)  
**Elective Field**

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Herrlich, Leuzinger, Link, Sauer, Tuschmann
7.64 Module: Geometric Numerical Integration [M-MATH-102921]

**Responsible:** Prof. Dr. Tobias Jahnke

**Organisation:** KIT Department of Mathematics

**Part of:** Mathematical Methods (Analysis or Applied and Numerical Mathematics, Optimization)

**Elective Field**

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**Mandatory**

| T-MATH-105919 | Geometric Numerical Integration | 6 CR | Hochbruck, Jahnke |

**Prerequisites**

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**Responsible:** Prof. Dr. Frank Herrlich

**Organisation:** KIT Department of Mathematics

**Part of:** Mathematical Methods (Algebra and Geometry)

**Elective Field:**
### 7.66 Module: Global Differential Geometry [M-MATH-102912]

**Responsible:** Prof. Dr. Wilderich Tuschmann  
**Organisation:** KIT Department of Mathematics  
**Part of:** Mathematical Methods (Algebra and Geometry)  
**Elective Field**

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**Prerequisites**

none
7.7 Module: Graph Theory [M-MATH-101336]

Responsible: Prof. Dr. Maria Aksenovich
Organisation: KIT Department of Mathematics
Part of: Mathematical Methods (Algebra and Geometry)
Elective Field

Credits 8
Grading scale Grade to a tenth
Recurrence Irregular
Duration 1 term
Language English
Level 4
Version 2

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Competence Certificate
The final grade is given based on the written final exam (3h).
By successfully working on the problem sets, a bonus can be obtained. To obtain the bonus, one has to achieve 50% of the points on the solutions of the exercise sheets 1-6 and also of the exercise sheets 7-12. If the grade in the final written exam is between 4.0 and 1.3, then the bonus improves the grade by one step (0.3 or 0.4).

Prerequisites
None

Competence Goal
The students understand, describe and use fundamental notions and techniques in graph theory. They can represent the appropriate mathematical questions in terms of graphs and use the results such as Menger’s theorem, Kuratowski’s theorem, Turan’s theorem, as well as the developed proof ideas, to solve these problems. The students can analyze graphs in terms of their characteristics such as connectivity, planarity, and chromatic number. They are well positioned to understand graph theoretic methods and use them critically. Moreover, the students can communicate using English technical terminology.

Content
The course Graph Theory treats the fundamental properties of graphs, starting with basic ones introduced by Euler and including the modern results obtained in the last decade. The following topics are covered: structure of trees, paths, cycles and walks in graphs, minors, unavoidable subgraphs in dense graphs, planar graphs, graph coloring, Ramsey theory, and regularity in graphs.

Annotation
- Regular cycle: every 2nd year, winter semester
- Course is held in English
Module: Group Actions in Riemannian Geometry [M-MATH-102954]

**Responsible:** Prof. Dr. Wilderich Tuschmann

**Organisation:** KIT Department of Mathematics

**Part of:** Mathematical Methods (Algebra and Geometry)
Elective Field

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**Mandatory**

| T-MATH-105925 | Group Actions in Riemannian Geometry | 5 CR | Tuschmann |

**Prerequisites**

none
7.69 Module: Growth and Agglomeration [M-WIWI-101496]

Responsible: Prof. Dr. Ingrid Ott
Organisation: KIT Department of Economics and Management
Part of: Finance - Risk Management - Managerial Economics
Elective Field

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Compulsory Elective Courses (Election: 9 credits)

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<td>T-WIWI-103107</td>
<td>Spatial Economics</td>
<td>4.5 CR</td>
<td>Ott</td>
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<tr>
<td>T-WIWI-111318</td>
<td>Growth and Development</td>
<td>4.5 CR</td>
<td>Ott</td>
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</tbody>
</table>

Competence Certificate
The assessment is carried out as partial written exams (see the lectures descriptions).

The overall grade for the module is the average of the grades for each course weighted by the credits.

Prerequisites
None

Competence Goal
The student
- gains deepened knowledge of micro-based general equilibrium models
- understands how based on individual optimizing decisions aggregate phenomena like economic growth or agglomeration (cities / metropolises) result
- is able to understand and evaluate the contribution of these phenomena to the development of economic trends
- can derive policy recommendations based on theory

Content
The module includes the contents of the lectures Endogenous Growth Theory, Spatial Economics and Dynamic Macroeconomics. While the first lecture focuses on dynamic programming in modern macroeconomics, the other two lectures are more formal and analytical.

The common underlying principle of all three lectures in this module is that, based on different theoretical models, economic policy recommendations are derived.

Workload
The total workload for this module is approximately 270 hours. For further information see German version.

Recommendation
Attendance of the course Introduction Economic Policy [2560280] is recommended.
Successful completion of the courses Economics I: Microeconomics and Economics II: Macroeconomics is required.
### 7.70 Module: Harmonic Analysis [M-MATH-105324]

**Responsible:** Prof. Dr. Dorothee Frey  
**Organisation:** KIT Department of Mathematics  
**Part of:** Mathematical Methods (Analysis or Applied and Numerical Mathematics, Optimization)  
**Elective Field**

<table>
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</table>

**Mandatory**

| T-MATH-111289 | Harmonic Analysis | 8 CR |

**Content**

- Fourier series
- Fourier transform on L1 and L2
- Tempered distributions and their Fourier transform
- Explicit solutions of the Heat-, Schrödinger- and Wave equation in \( \mathbb{R}^n \)
- the Hilbert transform
- the interpolation theorem of Marcinkiewicz
- Singular integral operators
- the Fourier multiplier theorem of Mihlin
7.71 Module: Harmonic Analysis for Dispersive Equations [M-MATH-103545]

**Responsible:** apl. Prof. Dr. Peer Kunstmann

**Organisation:** KIT Department of Mathematics

**Part of:** Mathematical Methods (Analysis or Applied and Numerical Mathematics, Optimization)

**Elective Field**

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</table>

**Mandatory**

| T-MATH-107071 | Harmonic Analysis for Dispersive Equations | 8 CR | Kunstmann |

**Prerequisites**

None

**Content**

Fourier transform, Fourier multipliers, interpolation, singular integral operators, Mihlin's Theorem, Littlewood-Paley decomposition, oscillating integrals, dispersive estimates, Strichartz estimates, nonlinear equations.
# 7.72 Module: Homotopy Theory [M-MATH-102959]

**Responsible:** Prof. Dr. Roman Sauer  
**Organisation:** KIT Department of Mathematics  
**Part of:** Mathematical Methods (Algebra and Geometry) Elective Field

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<tr>
<td>T-MATH-105933</td>
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</table>
# 7.73 Module: Informatics [M-WIWI-101472]

**Responsible:**
- Dr.-Ing. Michael Färber
- Prof. Dr. Andreas Oberweis
- Prof. Dr. Harald Sack
- Prof. Dr. Ali Sunyaev
- Prof. Dr. Melanie Volkamer
- Prof. Dr.-Ing. Johann Marius Zöllner

**Organisation:**
KIT Department of Economics and Management

**Part of:**
Operations Management - Data Analysis - Informatics Elective Field

<table>
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<tr>
<th>Credits</th>
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<th>Duration</th>
<th>Level</th>
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**Compulsory Elective Area (Election: )**

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<td>Computational Economics</td>
<td>4,5</td>
<td>Shukla</td>
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<tr>
<td>T-WIWI-109248</td>
<td>Critical Information Infrastructures</td>
<td>4,5</td>
<td>Sunyaev</td>
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<tr>
<td>T-WIWI-109246</td>
<td>Digital Health</td>
<td>4,5</td>
<td>Sunyaev</td>
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<tr>
<td>T-WIWI-109270</td>
<td>Human Factors in Security and Privacy</td>
<td>4,5</td>
<td>Volkamer</td>
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<tr>
<td>T-WIWI-102661</td>
<td>Database Systems and XML</td>
<td>4,5</td>
<td>Oberweis</td>
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<tr>
<td>T-WIWI-110346</td>
<td>Supplement Enterprise Information Systems</td>
<td>4,5</td>
<td>Oberweis</td>
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<tr>
<td>T-WIWI-109372</td>
<td>Supplement Software- and Systemsengineering</td>
<td>4,5</td>
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<td>T-WIWI-106423</td>
<td>Information Service Engineering</td>
<td>4,5</td>
<td>Sack</td>
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<td>T-WIWI-102666</td>
<td>Knowledge Discovery</td>
<td>4,5</td>
<td>Färber</td>
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<td>T-WIWI-102667</td>
<td>Management of IT-Projects</td>
<td>4,5</td>
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<td>Machine Learning 1 - Basic Methods</td>
<td>4,5</td>
<td>Zöllner</td>
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<td>T-WIWI-106341</td>
<td>Machine Learning 2 – Advanced Methods</td>
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<td>T-WIWI-102697</td>
<td>Business Process Modelling</td>
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<td>T-WIWI-102679</td>
<td>Nature-Inspired Optimization Methods</td>
<td>4,5</td>
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<td>T-WIWI-109799</td>
<td>Process Mining</td>
<td>4,5</td>
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<tr>
<td>T-WIWI-110848</td>
<td>Semantic Web Technologies</td>
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<td>Käfer</td>
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<tr>
<td>T-WIWI-102895</td>
<td>Software Quality Management</td>
<td>4,5</td>
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**Seminars and Advanced Labs (Election: between 0 and 1 Items)**

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<tr>
<td>T-WIWI-110144</td>
<td>Emerging Trends in Digital Health</td>
<td>4,5</td>
<td>Sunyaev</td>
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<tr>
<td>T-WIWI-110143</td>
<td>Emerging Trends in Internet Technologies</td>
<td>4,5</td>
<td>Sunyaev</td>
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<tr>
<td>T-WIWI-109249</td>
<td>Sociotechnical Information Systems Development</td>
<td>4,5</td>
<td>Sunyaev</td>
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<tr>
<td>T-WIWI-111126</td>
<td>Advanced Lab Blockchain Hackathon (Master)</td>
<td>4,5</td>
<td>Sunyaev</td>
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<tr>
<td>T-WIWI-111125</td>
<td>Advanced Lab Sociotechnical Information Systems Development (Master)</td>
<td>4,5</td>
<td>Sunyaev</td>
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<tr>
<td>T-WIWI-110548</td>
<td>Advanced Lab Informatics (Master)</td>
<td>4,5</td>
<td>Professorenschaft des Instituts AIFB</td>
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<tr>
<td>T-WIWI-108439</td>
<td>Advanced Lab Security, Usability and Society</td>
<td>4,5</td>
<td>Volkamer</td>
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<td>T-WIWI-109786</td>
<td>Advanced Lab Security</td>
<td>4,5</td>
<td>Volkamer</td>
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<tr>
<td>T-WIWI-109985</td>
<td>Project Lab Cognitive Automobiles and Robots</td>
<td>4,5</td>
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<td>T-WIWI-109983</td>
<td>Project Lab Machine Learning</td>
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<td>Zöllner</td>
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<tr>
<td>T-WIWI-109251</td>
<td>Selected Issues in Critical Information Infrastructures</td>
<td>4,5</td>
<td>Sunyaev</td>
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</table>
Competence Certificate
The assessment is carried out as partial exams of the single courses of this module, whose sum of credits must meet the minimum requirement of credits of this module. For passing the module exam in every singled partial exam the respective minimum requirements has to be achieved.

The examinations are offered every semester. Re-examinations are offered at every ordinary examination date. The assessment procedures are described for each course of the module separately.

When every singled examination is passed, the overall grade of the module is the average of the grades for each course weighted by the credits and truncated after the first decimal.

Prerequisites
It is only allowed to choose one lab.

Competence Goal
The student

- has the ability to master methods and tools in a complex discipline and to demonstrate innovativeness regarding the methods used,
- knows the principles and methods in the context of their application in practice,
- is able to grasp and apply the rapid developments in the field of computer science, which are encountered in work life, quickly and correctly, based on a fundamental understanding of the concepts and methods of computer science,
- is capable of finding and defending arguments for solving problems.

Content
The thematic focus will be based on the choice of courses in the areas of Applied Technical Cognitive Systems, Business Information Systems, Critical Information Infrastructures, Information Service Engineering, Security - Usability - Society or Web Science.

Workload
The total workload for this module is approximately 270 hours. The total number of hours per course is calculated from the time required to attend the lectures and exercises, as well as the examination times and the time required for an average student to achieve the learning objectives of the module.
7.74 Module: Information Systems in Organizations [M-WIWI-104068]

Responsible: Prof. Dr. Alexander Mädche
Organisation: KIT Department of Economics and Management
Part of: Finance - Risk Management - Managerial Economics
Elective Field

<table>
<thead>
<tr>
<th>Credits</th>
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<th>Recurrence</th>
<th>Duration</th>
<th>Language</th>
<th>Level</th>
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Compulsory Elective Courses (Election: at least 9 credits)

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<tr>
<th>Module Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>Grade</th>
<th>Instructor(s)</th>
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<tbody>
<tr>
<td>T-WIWI-105777</td>
<td>Business Intelligence Systems</td>
<td>4,5 CR</td>
<td>Mädche, Nadj, Toreini</td>
<td></td>
</tr>
<tr>
<td>T-WIWI-110851</td>
<td>Designing Interactive Systems</td>
<td>4,5 CR</td>
<td>Mädche</td>
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<tr>
<td>T-WIWI-108437</td>
<td>Practical Seminar: Information Systems and Service Design</td>
<td>4,5 CR</td>
<td>Mädche</td>
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</table>

Competence Certificate
The assessment is carried out as partial exams (according to Section 4 (2), 1-3 SPO) of the core course and further single courses of this module, whose sum of credits must meet the minimum requirement of credits of this module. The assessment procedures are described for each course of the module separately.

The overall grade of the module is the average of the grades for each course weighted by the credits and truncated after the first decimal.

Prerequisites
None

Competence Goal
The student
- has a comprehensive understanding of conceptual and theoretical foundations of informations systems in organizations
- is aware of the most important classes of information systems used in organizations: process-centric, information-centric and people-centric information systems.
- knows the most important activities required to execute in the pre-implementation, implementation and post-implementation phase of information systems in organizations in order to create business value
- has a deep understanding of key capabilities of business intelligence systems and/or interactive information systems used in organizations

Content
During the last decades we witnessed a growing importance of Information Technology (IT) in the business world along with faster and faster innovation cycles. IT has become core for businesses from an operational company-internal and external customer perspective. Today, companies have to rethink their way of doing business, from an internal as well as an external digitalization perspective.

This module focuses on the internal digitalization perspective. The contents of the module abstract from the technical implementation details and focus on foundational concepts, theories, practices and methods for information systems in organizations. The students get the necessary knowledge to guide the successful digitalization of organizations. Each lecture in the module is accompanied with a capstone project that is carried out in cooperation with an industry partner.

Annotation
New module starting summer term 2018.

Workload
The total workload for this module is approximately 270 hours.
7.75 Module: Innovation and Growth [M-WIWI-101478]

Responsible: Prof. Dr. Ingrid Ott
Organisation: KIT Department of Economics and Management
Part of: Finance - Risk Management - Managerial Economics
Elective Field

Credits: 9
Grading scale: Grade to a tenth
Recurrence: Each term
Duration: 1 term
Language: German/English
Level: 4
Version: 4

Compulsory Elective Courses (Election: between 9 and 10 credits)

<table>
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<th>Credits</th>
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<td>Dynamic Macroeconomics</td>
<td>4,5 CR</td>
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<td>T-WIWI-102840</td>
<td>Innovation Theory and Policy</td>
<td>4,5 CR</td>
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<td>T-WIWI-111318</td>
<td>Growth and Development</td>
<td>4,5 CR</td>
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Competence Certificate
The assessment is carried out as partial written exams (according to Section 4(2), 1 of the examination regulation) of the single courses of this module, whose sum of credits must meet the minimum requirement of credits of this module. The exams are offered at the beginning of the recess period about the subject matter of the latest held lecture. Re-examinations are offered at every ordinary examination date. The assessment procedures are described for each course of the module separately.

The overall grade for the module is the average of the grades for each course weighted by the credits and truncated after the first decimal.

Prerequisites
None

Competence Goal
Students shall be given the ability to

- know the basic techniques for analyzing static and dynamic optimization models that are applied in the context of micro-and macroeconomic theories
- understand the important role of innovation to the overall economic growth and welfare
- identify the importance of alternative incentive mechanisms for the emergence and dissemination of innovations
- explain, in which situations market interventions by the state, for example taxes and subsidies, can be legitimized, and evaluate them in the light of economic welfare

Content
The module includes courses that deal with issues of innovation and growth in the context of micro-and macroeconomic theories. The dynamic analysis makes it possible to analyze the consequences of individual decisions over time, and sheds light on the tension between static and dynamic efficiency in particular. In this context is also analyzed, which policy is appropriate to carry out corrective interventions in the market and thus increase welfare in the presence of market failure.

Workload
Total expenditure of time for 9 credits: 270 hours

Attendance time per lecture: 3x14h
Preparation and wrap-up time per lecture: 3x14h
Rest: Exam Preparation

The exact distribution is subject to the credits of the courses of the module.

Recommendation
Basic knowledge of micro- and macroeconomics is assumed, as taught in the courses Economics I [2600012], and Economics II [2600014]. In addition, an interest in quantitative-mathematical modeling is required.
7.76 Module: Integral Equations [M-MATH-102874]

**Responsible:** PD Dr. Frank Hettlich

**Organisation:** KIT Department of Mathematics

**Part of:** Mathematical Methods (Analysis or Applied and Numerical Mathematics, Optimization)
Elective Field

<table>
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**Mandatory**

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</table>
Module: Introduction into Particulate Flows [M-MATH-102943]

Responsible: Prof. Dr. Willy Dörfler
Organisation: KIT Department of Mathematics
Part of: Mathematical Methods (Analysis or Applied and Numerical Mathematics, Optimization)
Elective Field

<table>
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<td>Introduction into Particulate Flows</td>
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<td>CR Dörfler</td>
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</table>

Prerequisites
none
### Module: Introduction to Aperiodic Order [M-MATH-105331]

**Responsible:** Prof. Dr. Tobias Hartnick  
**Organisation:** KIT Department of Mathematics  
**Part of:** Mathematical Methods (Algebra and Geometry)  
**Elective Field**

<table>
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**Mandatory**

| T-MATH-110811 | Introduction to Aperiodic Order | 3 CR | Hartnick |

**Prerequisites**

None
7.79 Module: Introduction to Convex Integration [M-MATH-105964]

**Responsible:** Prof. Dr. Wolfgang Reichel  
**Organisation:** KIT Department of Mathematics  
**Part of:** Mathematical Methods (Analysis or Applied and Numerical Mathematics, Optimization)  
**Elective Field**

<table>
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**Mandatory**

| T-MATH-112119 | Introduction to Convex Integration | 3 CR | Zillinger |

**Competence Certificate**  
The module will be completed with an oral exam (approx. 30 min).

**Prerequisites**  
none

**Competence Goal**  
The main aim of this lecture is to introduce students to convex integration as a tool to construct solutions to partial differential equations. In particular, they will be able to

- discuss the structure of convex integration algorithms,  
- state major theorems and their relation,  
- discuss regularity of convex integration solutions and uniqueness,  
- discuss building blocks of constructions and their properties.

**Content**  
This lecture provides an introduction to the methods of convex integration and its applications:

- for isometric immersions,  
- for the m-well problem in elasticity,  
- for equations of fluid dynamics and  
- higher regularity of convex integration solutions.

**Module grade calculation**  
The grade of the module is the grade of the oral exam.

**Workload**  
Total workload: 90 hours  
Attendance: 30 h

- lectures and examination  
Self studies: 60 h

- follow-up and deepening of the course content,  
- literature study and internet research on the course content,  
- preparation for the module examination

**Recommendation**  
The modules "Classical Methods for Partial Differential Equations" and "Functional Analysis" are recommended.
Module: Introduction to Fluid Dynamics [M-MATH-105650]

Responsible: Prof. Dr. Wolfgang Reichel
Organisation: KIT Department of Mathematics
Part of: Mathematical Methods (Analysis or Applied and Numerical Mathematics, Optimization)
Elective Field

<table>
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<tr>
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<tr>
<td>T-MATH-111297</td>
<td>Introduction to Fluid Dynamics</td>
<td>3 CR</td>
<td>Reichel</td>
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</table>

Prerequisites

None

Competence Goal

The main aim of this lecture is to introduce students to mathematical fluid dynamics. In particular, by the end of the course students will be able to:

- discuss and explain the various formulations of the Euler equations and when these formulations are equivalent,
- state major theorems and their relation,
- discuss weak formulations, existence and uniqueness results.

Content

Mathematical description and analysis of fluid dynamics:

- physical motivation of the incompressible Euler and Navier-Stokes equations,
- Vorticity-Stream formulation and Eulerian and Lagrangian coordinates,
- Local existence theory and energy methods,
- Weak solutions and the Beale-Kato-Majda criterion.

Recommendation

Partial Differential Equations
7.81 Module: Introduction to Geometric Measure Theory [M-MATH-102949]

**Responsible:** PD Dr. Steffen Winter

**Organisation:** KIT Department of Mathematics

**Part of:** Mathematical Methods (Algebra and Geometry)

**Elective Field**

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<th>Duration</th>
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**Prerequisites**

none
7.82 Module: Introduction to Homogeneous Dynamics [M-MATH-105101]

**Responsible:** Prof. Dr. Tobias Hartnick

**Organisation:** KIT Department of Mathematics

**Part of:**
- Mathematical Methods (Stochastics)
- Mathematical Methods (Analysis or Applied and Numerical Mathematics, Optimization)
- Mathematical Methods (Algebra and Geometry)
- Elective Field

**Credits:** 6

**Grading scale:** Grade to a tenth

**Recurrence:** Irregular

**Duration:** 1 term

**Level:** 4

**Version:** 1

### Mandatory

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**Prerequisites**

None
Module: Introduction to Kinetic Equations [M-MATH-105837]

Responsible: Prof. Dr. Wolfgang Reichel
Organisation: KIT Department of Mathematics
Part of: Mathematical Methods (Analysis or Applied and Numerical Mathematics, Optimization)

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**Mandatory**

| T-MATH-111721 | Introduction to Kinetic Equations | 3 CR | Zillinger |

**Competence Certificate**
oral examination of circa 30 minutes

**Prerequisites**
none

**Competence Goal**
The main aim of this lecture is to introduce students to the theory of kinetic transport equations. In particular, by the end of the course students will be able to

- discuss properties of the free transport, Boltzmann and Vlasov-Poisson equations,
- state major theorems and their relation,
- discuss notions of solutions and their properties,
- discuss the effects of phase mixing and challenges of nonlinear equations.

**Content**
Mathematical description and analysis of kinetic transport equations:

- the free transport, Boltzmann and Vlasov-Poisson equations,
- linear theory, phase mixing and Landau damping,
- equilibrium solutions and stability,
- nonlinear results and methods,
- renormalized solutions.

**Module grade calculation**
The module grade is the grade of the final oral exam.

**Workload**
Total workload: 90 h
Attendance: 30 h

- lectures and examination

Self studies: 60 h

- follow-up and deepening of the course content,
- literature study and internet research on the course content,
- preparation for the module examination

**Recommendation**
The course "Classical Methods for Partial Differential Equations" should be studied beforehand.
Module: Introduction to Kinetic Theory [M-MATH-103919]

**Responsible:** Prof. Dr. Martin Frank

**Organisation:** KIT Department of Mathematics

**Part of:** Mathematical Methods (Analysis or Applied and Numerical Mathematics, Optimization)

**Elective Field**

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**Mandatory**

| T-MATH-108013 | Introduction to Kinetic Theory | 4 CR | Frank |

**Prerequisites**

None

**Competence Goal**

After successfully taking part in the module’s classes and exams, students have gained knowledge and abilities as described in the “Inhalt” section. Specifically, Students know common means of mesoscopic and macroscopic description of particle systems. Furthermore, students are able to describe the basics of multiscale methods, such as the asymptotic analysis and the method of moments. Students are able to apply numerical methods to solve engineering problems related to particle systems. They can name the assumptions that are needed to be made in the process. Students can judge whether specific models are applicable to the specific problem and discuss their results with specialists and colleagues.

**Content**

- From Newton's equations to Boltzmann's equation
- Rigorous derivation of the linear Boltzmann equation
- Properties of kinetic equations (existence & uniqueness, H theorem)
- The diffusion limit
- From Boltzmann to Euler & Navier-Stokes
- Method of Moments
- Closure techniques
- Selected numerical methods

**Recommendation**

Partial Differential Equations, Functional Analysis

Responsible: Dr. Daniel Weiß
Organisation: KIT Department of Mathematics
Part of: Mathematical Methods (Analysis or Applied and Numerical Mathematics, Optimization)
Elective Field

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Mandatory

| T-MATH-105913 | Introduction to Matlab and Numerical Algorithms | 5 CR | Weiß, Wieners |

Prerequisites
none
Module: Introduction to Microlocal Analysis [M-MATH-105838]

Responsible: TT-Prof. Dr. Xian Liao
Organisation: KIT Department of Mathematics
Part of: Mathematical Methods (Analysis or Applied and Numerical Mathematics, Optimization)
Elective Field

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Competence Certificate
oral examination of circa 30 minutes

Prerequisites
none

Competence Goal
- Students will become familiar with the notions of Fourier multipliers and pseudo-differential operators
- Students can state major theorems and their relation
- Students will understand the structure of the propagation of singularities by introducing the wave front set and apply them to the domain of partial differential equations, control theory, etc.

Content
1. Pseudo-differential operators
2. Symbolic calculus
3. Wavefront set
4. Propagation of singularities
5. Microlocal defective measure

Module grade calculation
The module grade is the grade of the final oral exam.

Workload
Total workload: 90 h
Attendance: 30 h
- lectures and examination
Self studies: 60 h
- follow-up and deepening of the course content,
- literature study and internet research on the course content,
- preparation for the module examination

Recommendation
The following courses should be studied beforehand: “Classical Methods for Partial Differential Equations” und “Functional Analysis”.
### 7.87 Module: Introduction to Scientific Computing [M-MATH-102889]

**Responsible:** Prof. Dr. Willy Dörfler  
Prof. Dr. Tobias Jahnke  
**Organisation:** KIT Department of Mathematics  
**Part of:** Mathematical Methods (Analysis or Applied and Numerical Mathematics, Optimization)  
Elective Field

<table>
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**Prerequisites**

None
Module: Introduction to Stochastic Differential Equations [M-MATH-106045]

**Mandatory**

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**Competence Certificate**
The module will be completed with an oral exam (approx. 30 min).

**Prerequisites**
none

**Competence Goal**
The students will

- know fundamental examples for linear and non-linear stochastic differential equations,
- be able to apply basic solution concepts for stochastic differential equations,
- know fundamental theorems of stochastic calculus and will be able to apply these to stochastic differential equations.

**Content**

1. Introduction and recapitulation of stochastic integration, Itô's formula, Lévy Theorem
2. Burkholder-Davis-Gundy inequality
3. Existence and uniqueness of solutions of stochastic differential equations
4. Explicit solutions of linear stochastic differential equations
5. Change of the time scale of Brownian motion
6. Representation of continuous time martingales
7. Brownian martingales
8. Local and global solutions of stochastic differential equations
9. Girsanov Theorem

**Module grade calculation**
The module grade is the grade of the oral exam.

**Workload**
Total workload: 120 hours

**Recommendation**
The contents of the module "Probability Theory" are strongly recommended. The module "Continuous Time Finance" is recommended.
Module: Inverse Problems [M-MATH-102890]

**Responsible:** Prof. Dr. Roland Griesmaier

**Organisation:** KIT Department of Mathematics

**Part of:** Mathematical Methods (Analysis or Applied and Numerical Mathematics, Optimization)

**Elective Field**

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Arens, Griesmaier, Hettlich, Rieder
### 7.90 Module: Key Moments in Geometry [M-MATH-104057]

**Responsible:** Prof. Dr. Wilderich Tuschmann  
**Organisation:** KIT Department of Mathematics  
**Part of:** Mathematical Methods (Algebra and Geometry)  
**Elective Field**

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**Prerequisites**  
None
### Module: L2-Invariants [M-MATH-102952]

**Responsible:** Dr. Holger Kammeyer  
**Organisation:** KIT Department of Mathematics  
**Part of:**  
- Mathematical Methods (Analysis or Applied and Numerical Mathematics, Optimization)  
- Mathematical Methods (Algebra and Geometry)  
- Elective Field

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#### Prerequisites

none
Module: Lie Groups and Lie Algebras [M-MATH-104261]

**Responsible:** Prof. Dr. Tobias Hartnick

**Organisation:** KIT Department of Mathematics

**Part of:** Mathematical Methods (Algebra and Geometry)

**Elective Field**

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7.94 Module: Marketing and Sales Management [M-WIWI-105312]

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**Responsible:** Prof. Dr. Martin Klarmann

**Organisation:** KIT Department of Economics and Management

**Part of:** Operations Management - Data Analysis - Informatics

**Elective Field**

**Credits:** 9

**Grading scale:** Grade to a tenth

**Recurrence:** Each summer term

**Duration:** 1 term

**Language:** German/English

**Level:** 4

**Version:** 5

**Compulsory Elective Courses (Election: at least 1 item)**

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<td>T-WIWI-107720</td>
<td>Market Research</td>
<td>4.5 CR</td>
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<td>T-WIWI-109864</td>
<td>Product and Innovation Management</td>
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**Supplementary Courses (Election: at most 1 item)**

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<td>6 CR</td>
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<td>Pricing Excellence</td>
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**Competence Certificate**

The assessment is carried out as partial exams (according to Section 4(2) of the examination regulation) of the single courses of this module, whose sum of credits must meet the minimum requirement of credits of this module. For passing the module exam in every singled partial exam the respective minimum requirements has to be achieved.

When every singled examination is passed, the overall grade of the module is the average of the grades for each course weighted by the credits and truncated after the first decimal.

**Prerequisites**

The course “Market Research” is obligatory.

**Competence Goal**

Students

- have an advanced knowledge about central marketing contents
- have a fundamental understanding of the marketing instruments
- know and understand several strategic concepts and how to implement them
- are able to implement their extensive marketing knowledge in a practical context
- know several qualitative and quantitative approaches to prepare decisions in Marketing
- have the theoretical knowledge to write a master thesis in Marketing
- have the theoretical knowledge to work in/together with the Marketing department

**Content**

The aim of this module is to deepen central marketing contents in different areas.

**Annotation**

Please note that only one of the listed 1.5-ECTS courses can be chosen in the module.

**Workload**

The total workload for this module is approximately 270 hours.
Module: Markov Decision Processes [M-MATH-102907]

**Responsible:** Prof. Dr. Nicole Bäuerle

**Organisation:** KIT Department of Mathematics

**Part of:** Mathematical Methods (Stochastics) Elective Field

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**Mandatory**

| T-MATH-105921 | Markov Decision Processes | 5 CR | Bäuerle |

**Prerequisites**

none
# 7.96 Module: Master's Thesis [M-MATH-102917]

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**Responsible:** Dr. Sebastian Grensing  
**Organisation:** KIT Department of Mathematics  
**Part of:** Master's Thesis

- **Credits:** 30  
- **Grading scale:** Grade to a tenth  
- **Recurrence:** Each term  
- **Duration:** 1 term  
- **Level:** 4  
- **Version:** 1
Module: Mathematical Methods in Signal and Image Processing [M-MATH-102897]

**Responsible:** Prof. Dr. Andreas Rieder

**Organisation:** KIT Department of Mathematics

**Part of:** Mathematical Methods (Analysis or Applied and Numerical Mathematics, Optimization) Elective Field

<table>
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</table>

**Prerequisites**

none
### 7.98 Module: Mathematical Methods of Imaging [M-MATH-103260]

**Responsible:** Prof. Dr. Andreas Rieder  
**Organisation:** KIT Department of Mathematics  
**Part of:** Mathematical Methods (Analysis or Applied and Numerical Mathematics, Optimization)  
**Elective Field**

<table>
<thead>
<tr>
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<th>Grading scale</th>
<th>Recurrence</th>
<th>Duration</th>
<th>Level</th>
<th>Version</th>
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**Mandatory**

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<th>Grade</th>
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<th>Duration</th>
<th>Level</th>
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<tr>
<td>T-MATH-106488</td>
<td>Mathematical Methods of Imaging</td>
<td>5</td>
<td>CR</td>
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<td>1 term</td>
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**Prerequisites**

None
### 7.99 Module: Mathematical Modelling and Simulation in Practise [M-MATH-102929]

#### Responsible:
PD Dr. Gudrun Thäter

#### Organisation:
KIT Department of Mathematics

#### Part of:
Mathematical Methods (Analysis or Applied and Numerical Mathematics, Optimization)

#### Elective Field

<table>
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<th>Duration</th>
<th>Language</th>
<th>Level</th>
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#### Mandatory

| T-MATH-105889 | Mathematical Modelling and Simulation in Practise | 4 CR | Thäter |

### Prerequisites
None
Module: Mathematical Programming [M-WIWI-101473]

**Responsible:** Prof. Dr. Oliver Stein

**Organisation:** KIT Department of Economics and Management

**Part of:** Operations Management - Data Analysis - Informatics

**Elective Field**

**Credits:** 9

**Grading scale:** Grade to a tenth

**Recurrence:** Each term

**Duration:** 1 term

**Language:** German/English

**Level:** 4

**Version:** 7

### Compulsory Elective Courses (Election: at most 2 items)

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<th>Credits</th>
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<tr>
<td>T-WIWI-102719</td>
<td>Mixed Integer Programming I</td>
<td>4,5 CR</td>
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<tr>
<td>T-WIWI-102726</td>
<td>Global Optimization I</td>
<td>4,5 CR</td>
<td>Stein</td>
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<tr>
<td>T-WIWI-103638</td>
<td>Global Optimization I and II</td>
<td>9 CR</td>
<td>Stein</td>
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<td>Convex Analysis</td>
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<td>4,5 CR</td>
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<td>Nonlinear Optimization I</td>
<td>4,5 CR</td>
<td>Stein</td>
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<tr>
<td>T-WIWI-103637</td>
<td>Nonlinear Optimization I and II</td>
<td>9 CR</td>
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<td>Parametric Optimization</td>
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### Supplementary Courses (Election: at most 2 items)

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<td>T-WIWI-102727</td>
<td>Global Optimization II</td>
<td>4,5 CR</td>
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<td>T-WIWI-102723</td>
<td>Graph Theory and Advanced Location Models</td>
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<td>T-WIWI-106549</td>
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<td>Mathematics for High Dimensional Statistics</td>
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<td>Operations Research in Supply Chain Management</td>
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<td>Optimization Models and Applications</td>
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### Competence Certificate

The assessment is carried out as partial exams (according to Section 4(2), 1 or 2 of the examination regulation) of the single courses of this module, whose sum of credits must meet the minimum requirement of credits of this module. The assessment procedures are described for each course of the module separately.

The overall grade of the module is the average of the grades for each course weighted by the credits and truncated after the first decimal.

### Prerequisites

At least one of the courses "Mixed Integer Programming I", "Parametric Optimization", "Convex Analysis", "Nonlinear Optimization I" and "Global Optimization I" has to be taken.

### Competence Goal

The student

- names and describes basic notions for advanced optimization methods, in particular from continuous and mixed integer programming,
- knows the indispensable methods and models for quantitative analysis,
- models and classifies optimization problems and chooses the appropriate solution methods to solve also challenging optimization problems independently and, if necessary, with the aid of a computer,
- validates, illustrates and interprets the obtained solutions,
- identifies drawbacks of the solution methods and, if necessary, is able to makes suggestions to adapt them to practical problems.
Content
The module focuses on theoretical foundations as well as solution algorithms for optimization problems with continuous and mixed integer decision variables.

Annotation
The lectures are partly offered irregularly. The curriculum of the next three years is available online (www.ior.kit.edu).
For the lectures of Prof. Stein a grade of 30 % of the exercise course has to be fulfilled. The description of the particular lectures is more detailed.

Workload
The total workload for this module is approximately 270 hours. For further information see German version.
### Module: Mathematical Statistics [M-MATH-102909]

**Responsible:** PD Dr. Bernhard Klar
Prof. Dr. Mathias Trabs

**Organisation:** KIT Department of Mathematics

**Part of:** Mathematical Methods (Stochastics)
Elective Field

<table>
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<tr>
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<th>Duration</th>
<th>Level</th>
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<td>T-MATH-105872 Mathematical Statistics</td>
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<td>Ebner, Fasen-Hartmann, Klar, Trabs</td>
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**Prerequisites**
none
**7.102 Module: Mathematical Topics in Kinetic Theory [M-MATH-104059]**

**Responsible:** Prof. Dr. Dirk Hundertmark  
**Organisation:** KIT Department of Mathematics  
**Part of:** Mathematical Methods (Analysis or Applied and Numerical Mathematics, Optimization)  
**Elective Field**

<table>
<thead>
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<th>Grading scale</th>
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<td>4 CR</td>
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</table>

**Prerequisites**

None

**Competence Goal**

The students are familiar with the basic questions in kinetic theory and methodical approaches to their solutions. With the acquired knowledge they are able to understand the required analytical methods and are able to apply them to the basic equations in kinetic theory.

**Content**

- Boltzmann equation: Cauchy problem and properties of solutions  
- entropy and H theorem  
- equilibrium and convergence to equilibrium  
- other models of kinetic theory
7.103 Module: Maxwell's Equations [M-MATH-102885]

Responsible: PD Dr. Frank Hettlich
Organisation: KIT Department of Mathematics
Part of: Mathematical Methods (Analysis or Applied and Numerical Mathematics, Optimization)
Elective Field

<table>
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<th>Credits</th>
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<th>Duration</th>
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Mandatory

| T-MATH-105856 | Maxwell's Equations | 8 CR | Arens, Griesmaier, Hettlich |

Economathematics M.Sc.
Module Handbook as of 06/09/2022
# 7.104 Module: Medical Imaging [M-MATH-102896]

**Responsible:** Prof. Dr. Andreas Rieder  
**Organisation:** KIT Department of Mathematics  
**Part of:** Mathematical Methods (Analysis or Applied and Numerical Mathematics, Optimization) Elective Field

<table>
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### Mandatory

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### Prerequisites

None
Module: Methodical Foundations of OR [M-WIWI-101414]

### Responsible
Prof. Dr. Oliver Stein

### Organisation
KIT Department of Economics and Management

### Part of
Operations Management - Data Analysis - Informatics

### Elective Field

### Credits
9

### Grade to a tenth
Grade to a tenth

### Recurrence
Each term

### Duration
1 term

### Level
4

### Version
10

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### Compulsory Elective Courses (Electron: at least 1 item as well as between 4,5 and 9 credits)

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<th>Course Name</th>
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<tr>
<td>T-WIWI-102726</td>
<td>Global Optimization I</td>
<td>4,5</td>
<td>CR</td>
<td>Stein</td>
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<tr>
<td>T-WIWI-103638</td>
<td>Global Optimization I and II</td>
<td>9</td>
<td>CR</td>
<td>Stein</td>
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<tr>
<td>T-WIWI-102724</td>
<td>Nonlinear Optimization I</td>
<td>4,5</td>
<td>CR</td>
<td>Stein</td>
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<tr>
<td>T-WIWI-103637</td>
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### Supplementary Courses (Electron: )

<table>
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<td>Global Optimization II</td>
<td>4,5</td>
<td>CR</td>
<td>Stein</td>
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<tr>
<td>T-WIWI-102725</td>
<td>Nonlinear Optimization II</td>
<td>4,5</td>
<td>CR</td>
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<td>T-WIWI-102704</td>
<td>Facility Location and Strategic Supply Chain Management</td>
<td>4,5</td>
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### Competence Certificate
The assessment is carried out as partial written exams (according to Section 4(2), 1 of the examination regulation) of the single courses of this module, whose sum of credits must meet the minimum requirement of credits of this module. The assessment procedures are described for each course of the module separately.

The overall grade of the module is the average of the grades for each course weighted by the credits and truncated after the first decimal.

### Prerequisites
At least one of the courses Nonlinear Optimization I and Global Optimization I has to be examined.

### Competence Goal
The student
- names and describes basic notions for optimization methods, in particular from nonlinear and from global optimization,
- knows the indispensable methods and models for quantitative analysis,
- models and classifies optimization problems and chooses the appropriate solution methods to solve also challenging optimization problems independently and, if necessary, with the aid of a computer,
- validates, illustrates and interprets the obtained solutions.

### Content
The modul focuses on theoretical foundations as well as solution algorithms for optimization problems with continuous decision variables. The lectures on nonlinear programming deal with local solution concepts, whereas the lectures on global optimization treat approaches for global solutions.

### Annotation
The planned lectures and courses for the next three years are announced online (http://www.ior.kit.edu).

### Workload
The total workload for this module is approximately 270 hours. For further information see German version.

### Recommendation
The courses Introduction to Operations Research I and II are helpful.
# 7.106 Module: Metric Geometry [M-MATH-105931]

**Responsible:** Prof. Dr. Alexander Lytchak  
**Organisation:** KIT Department of Mathematics  
**Part of:** Mathematical Methods (Algebra and Geometry) Elective Field

<table>
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<th>Credits</th>
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<th>Language</th>
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<td>1 term</td>
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</table>

## Mandatory

| T-MATH-111933 | Metric Geometry | 8 CR | Lytchak |

### Competence Certificate
oral examination of circa 20 minutes

### Prerequisites
None

### Module grade calculation
The module grade is the grade of the final oral exam.
Module: Microeconomic Theory [M-WIWI-101500]

Responsible: Prof. Dr. Clemens Puppe
Organisation: KIT Department of Economics and Management
Part of: Finance - Risk Management - Managerial Economics
Elective Field

Credits 9
Grading scale Grade to a tenth
Recurrence Each term
Duration 1 term
Language German/English
Level 4
Version 3

Compulsory Elective Courses (Election: at least 9 credits)

<table>
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<tr>
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<th>Course Title</th>
<th>CR</th>
<th>Instructor</th>
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<tr>
<td>T-WIWI-102609</td>
<td>Advanced Topics in Economic Theory</td>
<td>4,5</td>
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<tr>
<td>T-WIWI-102861</td>
<td>Advanced Game Theory</td>
<td>4,5</td>
<td>Ehrhart, Puppe, Reiß</td>
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<td>T-WIWI-102859</td>
<td>Social Choice Theory</td>
<td>4,5</td>
<td>Puppe</td>
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<td>T-WIWI-102613</td>
<td>Auction Theory</td>
<td>4,5</td>
<td>Ehrhart</td>
</tr>
<tr>
<td>T-WIWI-105781</td>
<td>Incentives in Organizations</td>
<td>4,5</td>
<td>Nieken</td>
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Competence Certificate
The assessment is carried out as partial exams (according to Section 4(2), 1 or 2 of the examination regulation) of the single courses of this module, whose sum of credits must meet the minimum requirement of credits of this module. The assessment procedures are described for each course of the module separately.

The overall grade of the the module is the average of the grades for each course weighted by the credits and truncated after the first decimal.

Prerequisites
None

Competence Goal
Students
- are able to model practical microeconomic problems mathematically and to analyze them with respect to positive and normative questions,
- understand individual incentives and social outcomes of different institutional designs.

An example of a positive question is: which regulation policy results in which firm decisions under imperfect competition? An example of a normative question is: which voting rule has appealing properties?

Content
The student should gain an understanding of advanced topics in economic theory, game theory and welfare economics. Core topics are, among others, strategic interactions in markets, cooperative and non-cooperative bargaining (Advanced Game Theory), allocation under asymmetric information and general equilibrium over time (Advanced Topics in Economic Theory), voting and the aggregation of preferences and judgements (Social Choice Theory).

Workload
The total workload for this module is approximately 270 hours. For further information see German version.
<table>
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<tr>
<th>Credits</th>
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<th>Duration</th>
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### Mandatory

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<td>Monotonicity Methods in Analysis</td>
<td>3 CR</td>
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Responsible: PD Dr. Gerd Herzog
Organisation: KIT Department of Mathematics
Part of: Mathematical Methods (Analysis or Applied and Numerical Mathematics, Optimization) Elective Field

**Responsible:** Prof. Dr. Tobias Lamm

**Organisation:** KIT Department of Mathematics

**Part of:** Mathematical Methods (Analysis or Applied and Numerical Mathematics, Optimization)

Elective Field

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**Prerequisites**

None
7.110 Module: Nonlinear Maxwell Equations [M-MATH-105066]

**Responsible:** Prof. Dr. Roland Schnaubelt

**Organisation:** KIT Department of Mathematics

**Part of:** Mathematical Methods (Analysis or Applied and Numerical Mathematics, Optimization)

**Elective Field**

<table>
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**Mandatory**

| T-MATH-110283 | Nonlinear Maxwell Equations | 8 CR | Schnaubelt |

**Prerequisites**

none
# 7.111 Module: Nonlinear Maxwell Equations [M-MATH-103257]

**Responsible:** Prof. Dr. Roland Schnaubelt  
**Organisation:** KIT Department of Mathematics  
**Part of:** Mathematical Methods (Analysis or Applied and Numerical Mathematics, Optimization)  
**Elective Field**

<table>
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<th>Duration</th>
<th>Level</th>
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<td>T-MATH-106484</td>
<td>Nonlinear Maxwell Equations</td>
<td>3 CR Schnaubelt</td>
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**Prerequisites**

- none

**Content**

- Short introduction to nonlinear contraction semigroups in Hilbert spaces and to the spaces H(curl) and H(div).
- **Semilinear case:** Maxwell's equations with linear material laws and nonlinear conductivity. Wellposedness by means of maximal monotone operators. Long-term behavior.
- **Quasilinear case:** Maxwell's equations with nonlinear instantaneous material laws. Local wellposedness on the whole space via linearisation, apriori estimates and regularization. Blow-up examples. Outlook to results on domains.
Module: Nonlinear Wave Equations [M-MATH-105326]

**Responsible:** Dr. Birgit Schörkhuber

**Organisation:** KIT Department of Mathematics

**Part of:** Mathematical Methods (Analysis or Applied and Numerical Mathematics, Optimization)

**Elective Field**

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**Mandatory**

| T-MATH-110806 | Nonlinear Wave Equations | 4 CR | Schörkhuber |

**Prerequisites**

None
7.113 Module: Nonparametric Statistics [M-MATH-102910]

**Responsible:** PD Dr. Bernhard Klar

**Organisation:** KIT Department of Mathematics

**Part of:** Mathematical Methods (Stochastics)

**Elective Field**

**Credits** 4

**Grading scale** Grade to a tenth

**Recurrence** Irregular

**Duration** 1 term

**Level** 4

**Version** 2

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**Prerequisites**

None
7.114 Module: Numerical Analysis of Helmholtz Problems [M-MATH-105764]

**Responsible:** TT-Prof. Dr. Barbara Verfürth

**Organisation:** KIT Department of Mathematics

**Part of:** Mathematical Methods (Analysis or Applied and Numerical Mathematics, Optimization)

**Elective Field**

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**Competence Certificate**

oral examination of circa 30 minutes

**Prerequisites**

none

**Module grade calculation**

The module grade is the grade of the final oral exam.
7.115 Module: Numerical Complex Analysis [M-MATH-106063]

Responsibility: Prof. Dr. Marlis Hochbruck
Organisation: KIT Department of Mathematics
Part of: Mathematical Methods (Analysis or Applied and Numerical Mathematics, Optimization)
Elective Field

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<td>Numerical Complex Analysis</td>
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Competence Certificate
oral exam of ca. 20 minutes

Prerequisites
none

Module grade calculation
The module grade ist the grade of the oral exam.

Workload
total workload: 180 h
Module: Numerical Continuation Methods [M-MATH-102944]

Responsible: Prof. Dr. Jens Rottmann-Matthes
Organisation: KIT Department of Mathematics
Part of: Mathematical Methods (Analysis or Applied and Numerical Mathematics, Optimization)
Elective Field

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Rottmann-Matthes

Prerequisites

none
Module: Numerical Linear Algebra for Scientific High Performance Computing

**Responsible:** Jun.-Prof. Dr. Hartwig Anzt

**Organisation:** KIT Department of Mathematics

**Part of:** Mathematical Methods (Analysis or Applied and Numerical Mathematics, Optimization)

**Elective Field**

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**Prerequisites**

None
7.118 Module: Numerical Linear Algebra in Image Processing [M-MATH-104058]

**Responsible:** PD Dr. Volker Grimm

**Organisation:** KIT Department of Mathematics

**Part of:** Mathematical Methods (Analysis or Applied and Numerical Mathematics, Optimization)

**Elective Field**

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**Prerequisites**

None
### 7.119 Module: Numerical Methods for Differential Equations [M-MATH-102888]

**Responsible:** Prof. Dr. Willy Dörfler  
Prof. Dr. Tobias Jahnke

**Organisation:** KIT Department of Mathematics

**Part of:** Mathematical Methods (Analysis or Applied and Numerical Mathematics, Optimization)  
Elective Field

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Dörfler, Hochbruck, Jahnke, Rieder, Wieners
Module: Numerical Methods for Hyperbolic Equations [M-MATH-102915]

**Responsible:** Prof. Dr. Willy Dörfler

**Organisation:** KIT Department of Mathematics

**Part of:** Mathematical Methods (Analysis or Applied and Numerical Mathematics, Optimization)

**Elective Field**

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## Mandatory

| T-MATH-105900 | Numerical Methods for Hyperbolic Equations | 6 CR | Dörfler |

**Prerequisites**

none

**Competence Goal**

.
### 7.121 Module: Numerical Methods for Integral Equations [M-MATH-102930]

**Responsible:** PD Dr. Tilo Arens  
**Organisation:** KIT Department of Mathematics  
**Part of:** Mathematical Methods (Analysis or Applied and Numerical Mathematics, Optimization)  
**Elective Field:**  
**Credits:** 8  
**Grading scale:** Grade to a tenth  
**Recurrence:** Irregular  
**Duration:** 1 term  
**Level:** 5  
**Version:** 1

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Module: Numerical Methods for Maxwell's Equations [M-MATH-102931]

**Responsible:** Prof. Dr. Marlis Hochbruck
Prof. Dr. Tobias Jahnke

**Organisation:** KIT Department of Mathematics

**Part of:** Mathematical Methods (Analysis or Applied and Numerical Mathematics, Optimization)
Elective Field

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Hochbruck, Jahnke

**Responsible:** Prof. Dr. Marlis Hochbruck  
**Organisation:** KIT Department of Mathematics  
**Part of:** Mathematical Methods (Analysis or Applied and Numerical Mathematics, Optimization)  
**Elective Field**

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**Mandatory**

| T-MATH-105899 | Numerical Methods for Time-Dependent Partial Differential Equations | 8 CR | Hochbruck, Jahnke |
### Module: Numerical Methods in Computational Electrodynamics [M-MATH-102894]

**Responsible:** Prof. Dr. Willy Dörfler  
**Organisation:** KIT Department of Mathematics  
**Part of:** Mathematical Methods (Analysis or Applied and Numerical Mathematics, Optimization)  
**Elective Field:**

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**Prerequisites**

none
## 7.125 Module: Numerical Methods in Fluid Mechanics [M-MATH-102932]

**Responsible:** Prof. Dr. Willy Dörfler  
PD Dr. Gudrun Thäter

**Organisation:** KIT Department of Mathematics

**Part of:** Mathematical Methods (Analysis or Applied and Numerical Mathematics, Optimization)  
Elective Field

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7.126 Module: Numerical Methods in Mathematical Finance [M-MATH-102901]

**Responsible:** Prof. Dr. Tobias Jahnke

**Organisation:** KIT Department of Mathematics

**Part of:** Mathematical Methods (Analysis or Applied and Numerical Mathematics, Optimization)

**Elective Field**

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**Mandatory**

| T-MATH-105865 | Numerical Methods in Mathematical Finance | 8 CR | Jahnke |

**Prerequisites**

none
7.127 Module: Numerical Methods in Mathematical Finance II [M-MATH-102914]

**Responsible:** Prof. Dr. Tobias Jahnke

**Organisation:** KIT Department of Mathematics

**Part of:** Mathematical Methods (Analysis or Applied and Numerical Mathematics, Optimization)

**Elective Field**

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| T-MATH-105880 | Numerical Methods in Mathematical Finance II | 8 CR | Jahnke |

**Prerequisites**

none
Module: Numerical Optimisation Methods [M-MATH-102892]

Responsible: Prof. Dr. Christian Wieners
Organisation: KIT Department of Mathematics
Part of: Mathematical Methods (Analysis or Applied and Numerical Mathematics, Optimization)
          Elective Field

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7.129 Module: Numerical Simulation in Molecular Dynamics [M-MATH-105327]

**Responsible:** PD Dr. Volker Grimm

**Organisation:** KIT Department of Mathematics

**Part of:** Mathematical Methods (Analysis or Applied and Numerical Mathematics, Optimization)

**Elective Field**

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**Mandatory**

| T-MATH-110807 | Numerical Simulation in Molecular Dynamics | 8 CR | Grimm |

**Prerequisites**

None

**Responsible:** Prof. Dr. Stefan Nickel

**Organisation:** KIT Department of Economics and Management

**Part of:** Operations Management - Data Analysis - Informatics

**Elective Field**

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**Election notes**

At least one of the courses "Operations Research in Supply Chain Management", "Graph Theory and Advanced Location Models", "Modeling and OR-Software: Advanced Topics" and "Special Topics of Stochastic Optimization (elective)" has to be taken. Students who choose the module in the field "compulsory elective modules" may select any two courses of the module.

**Compulsory Elective Courses (Election: between 1 and 2 items)**

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<td>T-WIWI-106200</td>
<td>Modeling and OR-Software: Advanced Topics</td>
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<td>Operations Research in Supply Chain Management</td>
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**Supplementary Courses (Election: at most 1 item)**

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**Competence Certificate**

The assessment is carried out as partial exams (according to § 4(2), 1 of the examination regulation) of the single courses of this module, whose sum of credits must meet the minimum requirement of credits of this module.

The assessment procedures are described for each course of the module separately.

The overall grade of the module is the average of the grades for each course weighted by the credits and truncated after the first decimal.

**Prerequisites**

At least one of the courses "Operations Research in Supply Chain Management", "Graph Theory and Advanced Location Models", "Modeling and OR-Software: Advanced Topics" and "Special Topics of Stochastic Optimization (elective)" has to be taken.

**Competence Goal**

The student

- is familiar with basic concepts and terms of Supply Chain Management,
- knows the different areas of SCM and their respective optimization problems,
- is acquainted with classical location problem models (in planes, in networks and discrete) as well as fundamental methods for distribution and transport planning, inventory planning and management,
- is able to model practical problems mathematically and estimate their complexity as well as choose and adapt appropriate solution methods.
Content
Supply Chain Management is concerned with the planning and optimization of the entire, inter-company procurement, production and distribution process for several products taking place between different business partners (suppliers, logistics service providers, dealers). The main goal is to minimize the overall costs while taking into account several constraints including the satisfaction of customer demands.

This module considers several areas of SCM. On the one hand, the determination of optimal locations within a supply chain is addressed. Strategic decisions concerning the location of facilities as production plants, distribution centers or warehouses are of high importance for the rentability of Supply Chains. Thoroughly carried out, location planning tasks allow an efficient flow of materials and lead to lower costs and increased customer service. On the other hand, the planning of material transport in the context of supply chain management represents another focus of this module. By linking transport connections and different facilities, the material source (production plant) is connected with the material sink (customer). For given material flows or shipments, it is considered how to choose the optimal (in terms of minimal costs) distribution and transportation chain from the set of possible logistics chains, which asserts the compliance of delivery times and further constraints. Furthermore, this module offers the possibility to learn about different aspects of the tactical and operational planning level in Supply Chain Management, including methods of scheduling as well as different approaches in procurement and distribution logistics. Finally, issues of warehousing and inventory management will be discussed.

Annotation
Some lectures and courses are offered irregularly.
The planned lectures and courses for the next three years are announced online.

Workload
Total effort for 9 credits: ca. 270 hours

- Presence time: 84 hours
- Preparation/Wrap-up: 112 hours
- Examination and examination preparation: 74 hours

Recommendation
Basic knowledge as conveyed in the module Introduction to Operations Research is assumed.
Module: Optimisation and Optimal Control for Differential Equations [M-MATH-102899]

Responsible: Prof. Dr. Christian Wieners
Organisation: KIT Department of Mathematics
Part of: Mathematical Methods (Analysis or Applied and Numerical Mathematics, Optimization)
Elective Field

<table>
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Mandatory

T-MATH-105864 Optimisation and Optimal Control for Differential Equations 4 CR

Prerequisites
none
Module: Optimization in Banach Spaces [M-MATH-102924]

**Responsible:** Prof. Dr. Roland Griesmaier

**Organisation:** KIT Department of Mathematics

**Part of:** Mathematical Methods (Analysis or Applied and Numerical Mathematics, Optimization)

**Elective Field**

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<tbody>
<tr>
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<td>Optimization in Banach Spaces</td>
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</table>

**Competence Certificate**

The exam takes place in form of an oral examination of approximately 30 minutes.

**Prerequisites**

none

**Competence Goal**

The students can transfer properties from finite dimensional optimization problems to infinite dimensional cases. Furthermore, they can apply these results to problems from approximation theory, calculus of variation and optimal control. The students know about the main theorems and their proofs and can explain conclusions with the help of examples.

**Content**

Basics from Functional Analysis (in particular separation theorems, properties of convex functions and generalized derivatives), duality theory of convex problems, differentiable optimization problems (Lagrange multiplier), sufficient optimality conditions, existence results, applications in approximation theory, calculus of variation, and optimal control theory.

**Module grade calculation**

The grade of the module is the grade of the oral examination.

**Workload**

Total workload: 150 hours

Time of attendance: 60 hours

- lecture including course related examinations

Self-study: 90 hours

- enhancement of course content by post-processing the lectures at home
- working on exercises
- enhancement of course content by additional literature and internet research
- preparation of the course related modul-exam

**Recommendation**

Some basic knowledge of finite dimensional optimization theory and functional analysis is desirable.
### 7.133 Module: Parallel Computing [M-MATH-101338]

**Responsible:** PD Dr. Mathias Krause  
Prof. Dr. Christian Wieners

**Organisation:** KIT Department of Mathematics

**Part of:** Mathematical Methods (Analysis or Applied and Numerical Mathematics, Optimization)  
Elective Field

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</table>

**Mandatory**

| T-MATH-102271 | Parallel Computing | 5 CR | Krause, Wieners |

**Prerequisites**

None
Module: Percolation [M-MATH-102905]

**Responsible:** Prof. Dr. Günter Last

**Organisation:** KIT Department of Mathematics

**Part of:** Mathematical Methods (Stochastics)

**Elective Field**

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<th>Credits</th>
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</table>

**Prerequisites**

none

**Competence Goal**

The students

- are acquainted with basic models of discrete and continuum percolation,
- acquire the skills needed to use specific probabilistic and graph-theoretical methods for the analysis of these models,
- know how to work self-organised and self-reflexive.
Module: Poisson Processes [M-MATH-102922]

**Responsible:** Prof. Dr. Günter Last

**Organisation:** KIT Department of Mathematics

**Part of:** Mathematical Methods (Stochastics)

**Elective Field**

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<tr>
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<td>Poisson Processes</td>
<td>5 CR</td>
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</table>

**Competence Certificate**

oral exam

**Prerequisites**

none

**Competence Goal**

The students know about important properties of the Poisson process. The focus is on probabilistic methods and results which are independent of the specific phase space. The students understand the central role of the Poisson process as a specific point process and as a random measure.

**Content**

- Distributional properties of Poisson processes
- The Poisson process as a particular point process
- Stationary Poisson and point processes
- Random measures and Cox processes
- Poisson cluster processes and compound Poisson processes
- The spatial Gale-Shapley algorithm

**Module grade calculation**

Marking: grade of exam
### 7.136 Module: Potential Theory [M-MATH-102879]

**Responsible:** Prof. Dr. Andreas Kirsch  
**Organisation:** KIT Department of Mathematics  
**Part of:** Mathematical Methods (Analysis or Applied and Numerical Mathematics, Optimization) Elective Field

<table>
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<td>Potential Theory</td>
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### Module: Probability Theory and Combinatorial Optimization [M-MATH-102947]

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</table>

**Prerequisites**

- none
**M 7.138 Module: Project Centered Software-Lab [M-MATH-102938]**

**Responsible:** PD Dr. Gudrun Thäter

**Organisation:** KIT Department of Mathematics

**Part of:** Mathematical Methods (Analysis or Applied and Numerical Mathematics, Optimization)

**Elective Field**

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**Mandatory**

| T-MATH-105907 | Project Centered Software-Lab | 4 CR | Thäter |

**Prerequisites**

none
### 7.139 Module: Random Graphs [M-MATH-102951]

**Responsible:** Prof. Dr. Daniel Hug  
**Organisation:** KIT Department of Mathematics  
**Part of:** Mathematical Methods (Stochastics)  
**Elective Field**

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**Mandatory**

| T-MATH-105929 | Random Graphs | 6 CR | Hug |

**Prerequisites**

none

**Annotation**

cannot be completed together with M-MATH-106052 - Zufällige Graphen und Netzwerke
7.140 Module: Random Graphs and Networks [M-MATH-106052]

**Responsible:** Prof. Dr. Daniel Hug  
**Organisation:** KIT Department of Mathematics  
**Part of:** Mathematical Methods (Stochastics)  
**Elective Field**

<table>
<thead>
<tr>
<th>Credits</th>
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<td>T-MATH-112241</td>
<td>Random Graphs and Networks</td>
<td>8 CR</td>
<td>Hug</td>
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</table>

**Competence Certificate**

oral exam of ca. 30 min

**Prerequisites**

none

**Content**

In the course, models of random graphs and networks are presented and methods will be developed which allow to state and prove results about the structure of such models. In particular, the following models are treated:

- Erdös--Renyi graphs
- Configuration models
- Preferential-Attachment graphs
- Generalized inhomogeneous random graphs
- Geometric random graphs

and the following methods are addressed:

- Branching processes
- Coupling arguments
- Probabilistic bounds
- Martingales
- Local convergence of random graphs

**Module grade calculation**

The grade of the module is the grade of the oral exam.

**Annotation**

can not be completed together with M-MATH-102951 - Random Graphs

**Workload**

Total workload: 240 hours

**Recommendation**

The contents of the module 'Probability Theory' are strongly recommended.
7.141 Module: Ruin Theory [M-MATH-104055]

**Responsible:** Prof. Dr. Vicky Fasen-Hartmann

**Organisation:** KIT Department of Mathematics

**Part of:** Mathematical Methods (Stochastics) Elective Field

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**Mandatory**

| T-MATH-108400 | Ruin Theory | 4 CR | Fasen-Hartmann |

**Prerequisites**

None
### 7.142 Module: Scattering Theory [M-MATH-102884]

**Responsible:** PD Dr. Frank Hettlich  
**Organisation:** KIT Department of Mathematics  
**Part of:** Mathematical Methods (Analysis or Applied and Numerical Mathematics, Optimization)  
**Elective Field:**

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Arens, Griesmaier, Hettlich
7.143 Module: Selected Methods in Fluids and Kinetic Equations [M-MATH-105897]

**Responsible:** Prof. Dr. Wolfgang Reichel

**Organisation:** KIT Department of Mathematics

**Part of:** Mathematical Methods (Analysis or Applied and Numerical Mathematics, Optimization)

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**Mandatory**

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**Competence Certificate**

The module will be completed with an oral exam (approx. 30 min).

**Prerequisites**

none

**Competence Goal**

The main aim of this lecture is to introduce students to tools and techniques developed in recent years to analyze the evolution of fluids and kinetic equations. The students will learn how to use these techniques and how to apply them to families of equations.

**Content**

In this lecture we discuss selected techniques and tools that have lead to significant progress in the analysis of fluids and kinetic equations. These, for instance, include:

- energy methods and local well-posedness results (e.g. fixed point results, Osgood lemma)
- Newton iteration
- Cauchy-Kowalewskaya and ghost energy approaches

No prior knowledge of fluids or kinetic equations is required.

**Module grade calculation**

The grade of the module is the grade of the oral exam.

**Workload**

Total workload: 90 hours

Attendance: 30 h

- lectures and examination

Self studies: 60 h

- follow-up and deepening of the course content,
- literature study and internet research on the course content,
- preparation for the module examination

**Recommendation**

The modules "Classical Methods for Partial Differential Equations" and "Functional Analysis" are recommended.
Module: Selected Topics in Harmonic Analysis [M-MATH-104435]

**Responsible:** Prof. Dr. Dirk Hundertmark  
**Organisation:** KIT Department of Mathematics  
**Part of:** Mathematical Methods (Analysis or Applied and Numerical Mathematics, Optimization) Elective Field  

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</table>

**Mandatory**  
T-MATH-109065 Selected Topics in Harmonic Analysis 3 CR Hundertmark

**Prerequisites**  
None

**Competence Goal**  
The students are familiar with the concepts of singular integral operators and weighted estimates in Harmonic Analysis. They know the relations between the BMO space and the Muckenhoupt weights and also how to use dyadic analysis operators to obtain estimates for Calderon-Zygmund operators.

**Content**  
- Calderon-Zygmund and Singular Integral operators  
- BMO space and Muckenhoupt weights  
- Reverse Holder Inequality and Factorisation of Ap weights  
- Extrapolation Theory and weighted norm inequalities for singular integral operators
7.145 Module: Seminar [M-MATH-102730]

**Responsible:** PD Dr. Stefan Kühnlein

**Organisation:** KIT Department of Mathematics

**Part of:** Mathematical Seminar

<table>
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**Elective Seminar (Election: 1 item)**

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<td>Seminar Mathematics</td>
<td>3 CR</td>
<td>Kühnlein</td>
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7.146 Module: Seminar [M-WIWI-102973]

**Responsible:** Prof. Dr. Hagen Lindstädt
Prof. Dr. Oliver Stein

**Organisation:** KIT Department of Economics and Management

**Part of:** Seminar in Economics and Management
Elective Field

**Credits:** 3
**Grading scale:** Grade to a tenth
**Recurrence:** Each term
**Duration:** 1 term
**Language:** German
**Level:** 4
**Version:** 1

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<th>Wahlpflichtangebot (Election: 3 credits)</th>
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<tbody>
<tr>
<td>T-WIWI-103479  Seminar in Informatics A (Master)</td>
</tr>
<tr>
<td>T-WIWI-103481  Seminar in Operations Research A (Master)</td>
</tr>
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</table>

**Competence Certificate**

The module examination consists of one seminar (according to §4 (3), 3 of the examination regulation). A detailed description of the assessment is given in the specific course characterisation.

The final mark for the module is the mark of the seminar.

**Prerequisites**

None.

**Competence Goal**

The students are in a position to independently handle current, research-based tasks according to scientific criteria.

- They are able to research, analyze, abstract and critically review the information.
- They can draw own conclusions using their interdisciplinary knowledge from the less structured information and selectively develop current research results.
- They can logically and systematically present the obtained results both orally and in written form in accordance with scientific guidelines (structuring, technical terminology, referencing). They can argue and defend the results professionally in the discussion.

**Content**

Competences which are gained in the seminar module especially prepare the student for composing the final thesis. Within the term paper and the presentation the student exercises himself in scientific working techniques supported by the supervisor.

Beside advancing skills in techniques of scientific working there are gained integrative key qualifications as well. A detailed description of these qualifications is given in the section "Key Qualifications" of the module handbook.

Furthermore, the module also includes additional key qualifications provided by the KQ-courses.

**Annotation**

The listed seminar titles are placeholders. Currently offered seminars of each semester will be published on the websites of the institutes and in the course catalogue of the KIT. In general, the current seminar topics of each semester are already announced at the end of the previous semester. Furthermore for some seminars there is an application required. The available places are listed on the internet: https://portal.wiwi.kit.edu.

**Recommendation**

None.
Module: Seminar [M-WIWI-102971]

**Responsible:**
- Prof. Dr. Hagen Lindstädt
- Prof. Dr. Oliver Stein

**Organisation:**
KIT Department of Economics and Management

**Part of:**
Seminar in Economics and Management
Elective Field

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### Wahlpflichtangebot (Election: 3 credits)

| T-WIWI-103474 | Seminar in Business Administration A (Master) | 3 CR | Professorenschaft des Fachbereichs Betriebswirtschaftslehre |
| T-WIWI-103478 | Seminar in Economics A (Master) | 3 CR | Professorenschaft des Fachbereichs Volkswirtschaftslehre |
| T-WIWI-103483 | Seminar in Statistics A (Master) | 3 CR | Grothe, Schienle |

### Competence Certificate
The modul examination consists of one seminar (according to §4 (3), 3 of the examintaion regulation). A detailed description of the assessment is given in the specific course characterization. The final mark for the module is the mark of the seminar.

### Prerequisites
None.

### Competence Goal
The students are in a position to independently handle current, research-based tasks according to scientific criteria.
- They are able to research, analyze, abstract and critically review the information.
- They can draw own conclusions using their interdisciplinary knowledge from the less structured information and selectively develop current research results.
- They can logically and systematically present the obtained results both orally and in written form in accordance with scientific guidelines (structuring, technical terminology, referencing). They can argue and defend the results professionally in the discussion.

### Content
Competences which are gained in the seminar module especially prepare the student for composing the final thesis. Within the term paper and the presentation the student exercises himself in scientific working techniques supported by the supervisor. Beside advancing skills in techniques of scientific working there are gained integrative key qualifications as well. A detailed description of these qualifications is given in the section "Key Qualifications" of the module handbook. Furthermore, the module also includes additional key qualifications provided by the KQ-courses.

### Annotation
The listed seminar titles are placeholders. Currently offered seminars of each semester will be published on the websites of the institutes and in the course catalogue of the KIT. In general, the current seminar topics of each semester are already announced at the end of the previous semester. Furthermore for some seminars there is an application required. The available places are listed on the internet: https://portal.wiwi.kit.edu.

### Recommendation
None.
Module: Seminar [M-WIWI-102974]

**Responsible:** Prof. Dr. Hagen Lindstädt  
Prof. Dr. Oliver Stein  

**Organisation:** KIT Department of Economics and Management  

**Part of:** Elective Field  

**Credits** 3  
**Grading scale** Grade to a tenth  
**Recurrence** Each term  
**Duration** 1 term  
**Language** German/English  
**Level** 4  
**Version** 1  

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<td>3 CR</td>
</tr>
<tr>
<td>T-WIWI-103482 Seminar in Operations Research B (Master)</td>
<td>3 CR</td>
</tr>
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</table>

**Competence Certificate**  
The modul examination consists of one seminar (according to §4 (3), 3 of the examintaion regulation). A detailed description of the assessment is given in the specific course characerization.  
The final mark for the module is the mark of the seminar.

**Prerequisites**  
None.

**Competence Goal**  
- The students are in a position to independently handle current, research-based tasks according to scientific criteria.  
- They are able to research, analyze, abstract and critically review the information.  
- They can draw own conclusions using their interdisciplinary knowledge from the less structured information and selectively develop current research results.  
- They can logically and systematically present the obtained results both orally and in written form in accordance with scientific guidelines (structuring, technical terminology, referencing). They can argue and defend the results professionally in the discussion.

**Content**  
Competences which are gained in the seminar module especially prepare the student for composing the final thesis. Within the term paper and the presentation the student exercises himself in scientific working techniques supported by the supervisor.  
Beside advancing skills in techniques of scientific working there are gained integrative key qualifications as well.

**Annotation**  
The listed seminar titles are placeholders. Currently offered seminars of each semester will be published on the websites of the institutes and in the course catalogue of the KIT. In general, the current seminar topics of each semester are already announced at the end of the previous semester. Furthermore for some seminars there is an application required.  
The available places are listed on the internet: https://portal.wiwi.kit.edu.

**Workload**  
The total workload for this module is approximately 90 hours.
### Module: Seminar [M-WIWI-102972]

**Responsible:** Prof. Dr. Hagen Lindstädt
Prof. Dr. Oliver Stein

**Organisation:** KIT Department of Economics and Management

**Part of:** Elective Field

<table>
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<th>Duration</th>
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<th>Level</th>
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#### Wahlpflichtangebot (Election: 1 item)

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<tr>
<td>T-WIWI-103477</td>
<td>Seminar in Economics B (Master)</td>
<td>3 CR</td>
<td>Professorenschaft des Fachbereichs Volkswirtschaftslehre</td>
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<tr>
<td>T-WIWI-103484</td>
<td>Seminar in Statistics B (Master)</td>
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### Competence Certificate
The module examination consists of one seminar (according to §4 (3), 3 of the examination regulation). A detailed description of the assessment is given in the specific course characterization.

The final mark for the module is the mark of the seminar.

### Prerequisites
None.

### Competence Goal
- The students are in a position to independently handle current, research-based tasks according to scientific criteria.
- They are able to research, analyze, abstract and critically review the information.
- They can draw own conclusions using their interdisciplinary knowledge from the less structured information and selectively develop current research results.
- They can logically and systematically present the obtained results both orally and in written form in accordance with scientific guidelines (structuring, technical terminology, referencing). They can argue and defend the results professionally in the discussion.

### Content
Competences which are gained in the seminar module especially prepare the student for composing the final thesis. Within the term paper and the presentation the student exercises himself in scientific working techniques supported by the supervisor.

Beside advancing skills in techniques of scientific working there are gained integrative key qualifications as well.

### Annotation
The listed seminar titles are placeholders. Currently offered seminars of each semester will be published on the websites of the institutes and in the course catalogue of the KIT. In general, the current seminar topics of each semester are already announced at the end of the previous semester. Furthermore for some seminars there is an application required.

The available places are listed on the internet: https://portal.wiwi.kit.edu.

### Workload
The total workload for this module is approximately 90 hours.
7.150 Module: Service Operations [M-WIWI-102805]

**Responsible:** Prof. Dr. Stefan Nickel  
**Organisation:** KIT Department of Economics and Management  
**Part of:** Operations Management - Data Analysis - Informatics

<table>
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<td>Each term</td>
<td>1 term</td>
<td>German</td>
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**Election notes**
At least one of the four courses Operations Research in Supply Chain Management, Operations Research in Health Care Management, Practical seminar: Health Care Management or Discrete-Event Simulation in Production and Logistics has to be assigned. Students who choose the module in the field "compulsory elective modules" may select any two courses of the module.

**Compulsory Elective Courses (Election: at most 2 items)**

<table>
<thead>
<tr>
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<th>Course Title</th>
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<tr>
<td>T-WIWI-102718</td>
<td>Discrete-Event Simulation in Production and Logistics</td>
<td>4.5 CR</td>
<td>Speckermann</td>
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<tr>
<td>T-WIWI-102884</td>
<td>Operations Research in Health Care Management</td>
<td>4.5 CR</td>
<td>Nickel</td>
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<tr>
<td>T-WIWI-102715</td>
<td>Operations Research in Supply Chain Management</td>
<td>4.5 CR</td>
<td>Nickel</td>
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<tr>
<td>T-WIWI-102716</td>
<td>Practical Seminar: Health Care Management (with Case Studies)</td>
<td>4.5 CR</td>
<td>Nickel</td>
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**Supplementary Courses (Election: at most 1 item)**

<table>
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<th>Course Title</th>
<th>Credits</th>
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<tr>
<td>T-MACH-112213</td>
<td>Applied material flow simulation</td>
<td>4.5 CR</td>
<td>Baumann</td>
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<td>T-WIWI-102872</td>
<td>Challenges in Supply Chain Management</td>
<td>4.5 CR</td>
<td>Mohr</td>
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<tr>
<td>T-WIWI-110971</td>
<td>Demand-Driven Supply Chain Planning</td>
<td>4.5 CR</td>
<td>Packowski</td>
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</table>

**Competence Certificate**

The assessment is carried out as partial exams (according to Section 4 (2), 1-3 SPO), whose sum of credits must meet the minimum requirement of credits of this module. The assessment procedures are described for each course of the module separately. The overall grade of the module is the average of the grades for each course weighted by the credits and truncated after the first decimal.

**Prerequisites**
At least one of the four courses Operations Research in Supply Chain Management, Operations Research in Health Care Management, Practical seminar: Health Care Management or Discrete-Event Simulation in Production and Logistics has to be assigned.

**Competence Goal**

Students

- know the theoretical bases and the key components of Business Intelligence systems,
- acquire the basic skills to make use of business intelligence and analytics software in the service context
- are introduced into various application scenarios of analytics in the service context
- are able to distinguish different analytics methods and apply them in context
- learn how to apply analytics software in the service context
- are trained for the structured compilation and solution of practice relevant problems with the help of commercial business intelligence software packages as well as analytics methods and tools

**Content**

The importance of services in modern economies is most evident – nearly 70% of gross value added are achieved in the tertiary sector and a growing number of industrial enterprises add customer specific services to their material goods or transform their business models fundamentally. The growing availability of data “Big Data” and their intelligent processing by applying analytic methods and business intelligence systems plays a key role.

It is the goal of the module to give students a comprehensive overview on the subject Business Intelligence & Analytics focusing on service issues. Various scenarios illustrate how the methods and systems introduced help to improve existing services or create innovative data-based services.
**Annotation**
This module is part of the KSRI teaching profile "Digital Service Systems". Further information on a service-specific profiling is available under www.ksri.kit.edu/teaching.

**Workload**
The total workload for this module is approximately 270 hours. For further information see German version.

**Recommendation**
The course Practical Seminar Health Care should be combined with the course OR in Health Care Management.
7.151 Module: Sobolev Spaces [M-MATH-102926]

**Responsible:** Prof. Dr. Andreas Kirsch

**Organisation:** KIT Department of Mathematics

**Part of:** Mathematical Methods (Analysis or Applied and Numerical Mathematics, Optimization)

**Elective Field**

<table>
<thead>
<tr>
<th>Credits</th>
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<th>Duration</th>
<th>Level</th>
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**Mandatory**

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<th>T-MATH-105896</th>
<th>Sobolev Spaces</th>
<th>5 CR</th>
<th>Kirsch</th>
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</thead>
</table>

[Economathematics M.Sc.
Module Handbook as of 06/09/2022](#)
Module: Space and Time Discretization of Nonlinear Wave Equations [M-MATH-105966]

Responsible: Prof. Dr. Marlis Hochbruck
Organisation: KIT Department of Mathematics
Part of: Mathematical Methods (Analysis or Applied and Numerical Mathematics, Optimization)
Elective Field

Credits | Grading scale | Recurrence | Duration | Level | Version
---|---|---|---|---|---
6 | Grade to a tenth | Irregular | 1 term | 4 | 1

Mandatory

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Hochbruck
### 7.153 Module: Spatial Stochastics [M-MATH-102903]

- **Responsible:** Prof. Dr. Günter Last
- **Organisation:** KIT Department of Mathematics
- **Part of:** Mathematical Methods (Stochastics)
  Elective Field

<table>
<thead>
<tr>
<th>Credits</th>
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<td>Each winter term</td>
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#### Mandatory

| T-MATH-105867 | Spatial Stochastics | 8 CR | Hug, Last, Winter |

#### Prerequisites

none

#### Competence Goal

The students are familiar with some basic spatial stochastic processes. They do not only understand how to deal with general properties of distributions, but also know how to describe and apply specific models (Poisson process, Gaussian random fields). They know how to work self-organised and self-reflexive.

#### Content

- Point processes
- Random measures
- Poisson processes
- Gibbs point processes
- Ralm distributions
- Spatial ergodic theorem
- Spectral Theory of random fields
- Gaussian fields

#### Recommendation

It is recommended to attend the following modules beforehand: Probability Theory
### Module: Special Functions and Applications in Potential Theory [M-MATH-101335]

<table>
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<th>Responsible:</th>
<th>Prof. Dr. Andreas Kirsch</th>
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<td>KIT Department of Mathematics</td>
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<tr>
<td>T-MATH-102274</td>
<td>Special Functions and Applications in Potential Theory</td>
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</table>

### Prerequisites
None
## 7.155 Module: Special Topics of Numerical Linear Algebra [M-MATH-102920]

**Responsible:** Prof. Dr. Marlis Hochbruck  
**Organisation:** KIT Department of Mathematics  
**Part of:** Mathematical Methods (Analysis or Applied and Numerical Mathematics, Optimization)  
**Elective Field**

<table>
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### Mandatory

| T-MATH-105891 | Special Topics of Numerical Linear Algebra | 8 CR | Grimm, Hochbruck, Neher |

**Prerequisites**  
none
**7.156 Module: Spectral Theory [M-MATH-101768]**

<table>
<thead>
<tr>
<th>Responsible</th>
<th>Prof. Dr. Dorothee Frey</th>
</tr>
</thead>
<tbody>
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**Recommendation**

It is recommended to attend the module 'Functional Analysis' previously.
# Module: Spin Manifolds, Alpha Invariant and Positive Scalar Curvature [M-MATH-102958]

**Responsible:** Prof. Dr. Wilderich Tuschmann  
**Organisation:** KIT Department of Mathematics  
**Part of:** Mathematical Methods (Algebra and Geometry) Elective Field

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**Responsible:** Prof. Dr. Tobias Jahnke

**Organisation:** KIT Department of Mathematics

**Part of:** Mathematical Methods (Analysis or Applied and Numerical Mathematics, Optimization)

**Elective Field**

<table>
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**Prerequisites**

None
**7.159 Module: Statistical Learning [M-MATH-105840]**

**Responsible:** Prof. Dr. Mathias Trabs  
**Organisation:** KIT Department of Mathematics  
**Part of:** Mathematical Methods (Stochastics)  
**Elective Field**

<table>
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<td>Statistical Learning</td>
<td>8 CR</td>
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</table>

**Competence Certificate**  
The module will be completed with an oral exam (approx. 30 min).

**Prerequisites**  
none

**Competence Goal**  
The students will

- know the fundamental principles and problems of machine learning and can relate learning methods to these principles,
- be able to explain how certain learning methods work and can apply them,
- be able to develop and to discuss a statistical analysis of certain learning methods,
- be able to understand independently and to apply new learning methods.

**Content**  
1 Regression  
1.1 Empirical risk minimization  
1.2 Lasso  
1.3 Random forests  
1.4 Neuronal networks  
2 Classification  
2.1 Bayes classifier  
2.2 Logistic regression  
2.3 Discriminant analysis  
2.4 k nearest neighbour  
2.5 Support vector machines  
3 Unsupervised learning  
3.1 Principal component analysis  
3.2 Generative networks

**Module grade calculation**  
The grade of the module is the grade of the oral exam.

**Workload**  
Total effort: 240 hours  
The workload consists of:

- attendance time in lectures (including the exam): 90 hours  
- self-study (including preparation and post-processing of lectures, solving of weekly exercises, preparation for the exam): 150 hours

**Recommendation**  
The module "Probability Theory" is strongly recommended. The module "Statistics" (M-MATH-103220) is recommended.
7.160 Module: Steins Method with Applications in Statistics [M-MATH-105579]

Responsible: Dr. rer. nat. Bruno Ebner
Organisation: KIT Department of Mathematics
Part of: Mathematical Methods (Stochastics)
Elective Field

Credits | Grading scale | Recurrence | Duration | Level | Version
---|---|---|---|---|---
4 | Grade to a tenth | Irregular | 1 term | 4 | 1

Mandatory

T-MATH-111187 Steins Method with Applications in Statistics 4 CR Ebner, Hug

Prerequisites
None
7.161 Module: Stochastic Control [M-MATH-102908]

**Responsible:** Prof. Dr. Nicole Bäuerle

**Organisation:** KIT Department of Mathematics

**Part of:** Mathematical Methods (Stochastics)

**Elective Field**

<table>
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<td>4</td>
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**Mandatory**

| T-MATH-105871 | Stochastic Control | 4 CR | Bäuerle |

**Prerequisites**

none
### 7.162 Module: Stochastic Differential Equations [M-MATH-102881]

**Responsible:** Prof. Dr. Dorothee Frey  
**Organisation:** KIT Department of Mathematics  
**Part of:** Mathematical Methods (Analysis or Applied and Numerical Mathematics, Optimization)  
**Elective Field**

<table>
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<td>T-MATH-105852</td>
<td>Stochastic Differential Equations</td>
<td>8 CR Frey, Schnaubelt</td>
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</tbody>
</table>

**Content**

- Brownian motion
- Martingales and Martingal inequalities
- Stochastic integrals and Ito's formula
- Existence and uniqueness of solutions for systems of stochastic differential equations
- Perturbation and stability results
- Application to equations in financial mathematics, physics and engineering
- Connection with diffusion equations and potential theory
Module: Stochastic Evolution Equations [M-MATH-102942]

**Responsible:** Prof. Dr. Lutz Weis

**Organisation:** KIT Department of Mathematics

**Part of:**
- Mathematical Methods (Stochastics)
- Mathematical Methods (Analysis or Applied and Numerical Mathematics, Optimization)
- Elective Field

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<td>T-MATH-105910</td>
<td>Stochastic Evolution Equations</td>
<td>8 CR</td>
<td>Weis</td>
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**Prerequisites**
none
7.164 Module: Stochastic Geometry [M-MATH-102865]

Responsible: Prof. Dr. Daniel Hug
Organisation: KIT Department of Mathematics
Part of: Mathematical Methods (Stochastics)
Mathematical Methods (Algebra and Geometry)
Elective Field

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Mandatory

| T-MATH-105840 | Stochastic Geometry | 8 CR | Hug, Last, Winter |

Competence Goal

The students

- know the fundamental geometric models and characteristics in stochastic geometry,
- are familiar with properties of Poisson processes of geometric objects,
- know examples of applications of models of stochastic geometry,
- know how to work self-organised and self-reflexive.

Content

- Random Sets
- Geometric Point Processes
- Stationarity and Isotropy
- Germ Grain Models
- Boolean Models
- Foundations of Integral Geometry
- Geometric densities and characteristics
- Random Tessellations

Recommendation

It is recommended to attend the module 'Spatial Stochastics' beforehand.
7.165 Module: Stochastic Optimization [M-WIWI-103289]

Responsible: Prof. Dr. Steffen Rebennack
Organisation: KIT Department of Economics and Management
Part of: Operations Management - Data Analysis - Informatics
Elective Field

Credits: 9
Grading scale: Grade to a tenth
Recurrence: Each term
Duration: 1 term
Language: German/English
Level: 4
Version: 10

Compulsory Elective Courses (Election: between 1 and 2 items)

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<td>T-WIWI-106548</td>
<td>Advanced Stochastic Optimization</td>
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<td>Large-scale Optimization</td>
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Supplementary Courses (Election: at most 1 item)

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<td>Graph Theory and Advanced Location Models</td>
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<td>Mixed Integer Programming I</td>
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Competence Certificate
The assessment is carried out as partial exams (according to § 4(2), 1 of the examination regulation) of the single courses of this module, whose sum of credits must meet the minimum requirement of credits of this module.

The assessment procedures are described for each course of the module separately.

The overall grade of the module is the average of the grades for each course weighted by the credits and truncated after the first decimal.

Prerequisites
At least one of the courses "Advanced Stochastic Optimization", "Large-scale Optimization" or "Introduction to Stochastic Optimization" has to be taken.

Competence Goal
The student
- names and describes basic notions for advanced stochastic optimization methods, in particular, ways to algorithmically exploit the special model structures,
- knows the indispensable methods and models for quantitative analysis of stochastic optimization problems,
- models and classifies stochastic optimization problems and chooses the appropriate solution methods to solve also challenging stochastic optimization problems independently and, if necessary, with the aid of a computer,
- validates, illustrates and interprets the obtained solutions,
- identifies drawbacks of the solution methods and, if necessary, is able to makes suggestions to adapt them to practical problems.

Content
The module focuses on the modeling as well as the imparting of theoretical principles and solution methods for optimization problems with special structure, which occur for example in the stochastic optimization.

Annotation
The courses are sometimes offered irregularly. The curriculum, planned for three years in advance, can be found on the Internet at http://sop.ior.kit.edu/28.php.
Workload
The total workload for this module is approximately 270 hours (9 credits). The allocation is made according to the credit points of the courses of the module. The total number of hours per course is determined by the amount of time spent attending the lectures and exercises, as well as the exam times and the time required to achieve the module's learning objectives for an average student for an average performance.

Recommendation
It is recommended to listen to the lecture "Introduction to Stochastic Optimization" before the lecture "Advanced Stochastic Optimization" is visited.
### Competence Certificate
oral exam of ca. 30 min

### Prerequisites
None

### Competence Goal
After successfully taking part in the module's classes and the exam, students will be acquainted with sampling-based computational tools used to analyze systems with uncertainty arising in engineering, physics, chemistry, and economics. Specifically, by the end of this course, students will be able to analyze the convergence of sampling algorithms and implement the discussed sampling methods for different stochastic processes as computer codes. Understanding the advantages and disadvantages of different sampling-based methods, the students can, in particular, choose appropriate stochastic simulation techniques and propose efficient sampling methods for a specific stochastic problem. In particular, they can name and discuss essential theoretical concepts, and understand the structure of the sampling-based computational methods. Finally, the course prepares students to write a thesis in the field of Uncertainty Quantification.

### Content
The course covers mathematical concepts and computational tools used to analyze systems with uncertainty arising across various application domains. First, we will address stochastic modelling strategies to represent uncertainty in such systems. Then we will discuss sampling-based methods to assess uncertain system outputs via stochastic simulation techniques. The focus of this course will be on the theoretical foundations of the discussed techniques, as well as their methodological realization as efficient computational tools. Topics covered include:

- Random variable generation
- Simulation of random processes
- Simulation of Gaussian random fields
- Monte Carlo method; output analysis
- Variance reduction techniques
- Rare event simulations
- Quasi Monte Carlo methods
- Markov Chain Monte Carlo methods (Metropolis-Hasting, Gibbs sampler)

### Module grade calculation
The grade of the module is the grade of the oral exam.

### Workload
total workload: 150 hours

### Recommendation
The contents of the modules 'M-MATH-101321 - Introduction to Stochastics' and 'M-MATH-103214 – Numerical Mathematics 1+2' are recommended.
Module: Structural Graph Theory [M-MATH-105463]

Responsible: Prof. Dr. Maria Aksenovich
Organisation: KIT Department of Mathematics
Part of: Mathematical Methods (Algebra and Geometry)
    Elective Field

Credits 4       Grading scale Grade to a tenth       Recurrence Irregular       Duration 1 term       Language English       Level 4       Version 1

Mandatory
T-MATH-111004 Structural Graph Theory                   4 CR Aksenovich

Prerequisites
None

Competence Goal
After successful completion of the course, the participants should be able to present and analyse main results in Structural Graph Theory. They should be able to establish connections between graph minors and other graph parameters, give examples, and apply fundamental results to related problems.

Content
The purpose of this course is to provide an introduction to some of the central results and methods of structural graph theory. Our main point of emphasis will be on graph minor theory and the concepts devised in Robertson and Seymour's intricate proof of the Graph Minor Theorem: in every infinite set of graphs there are two graphs such that one is a minor of the other.

Our second point of emphasis (time permitting) will be on Hadwiger's conjecture: that every graph with chromatic number at least \( r \) has a \( K_r \) minor. We shall survey what is known about this conjecture, including some very recent progress.

Recommendation
A solid background in the fundamentals of graph theory.
Module: The Riemann Zeta Function [M-MATH-102960]

**Responsible:** Dr. Fabian Januszewski  
**Organisation:** KIT Department of Mathematics  
**Part of:** Mathematical Methods (Algebra and Geometry)  
**Elective Field:**

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4 CR Januszewski
### 7.169 Module: Time Series Analysis [M-MATH-102911]

**Responsible:** PD Dr. Bernhard Klar  
**Organisation:** KIT Department of Mathematics  
**Part of:** Mathematical Methods (Stochastics)  
**Elective Field**

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**Prerequisites**

None
### 7.170 Module: Topological Data Analysis [M-MATH-105487]

**Responsible:** Prof. Dr. Tobias Hartnick  
Prof. Dr. Roman Sauer

**Organisation:** KIT Department of Mathematics

**Part of:**  
- Mathematical Methods (Stochastics)  
- Mathematical Methods (Analysis or Applied and Numerical Mathematics, Optimization)  
- Mathematical Methods (Algebra and Geometry)  
- Elective Field

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<th>Hartnick, Sauer</th>
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### 7.171 Module: Topological Genomics [M-MATH-106064]

**Responsible:** Dr. Andreas Ott

**Organisation:** KIT Department of Mathematics

**Part of:**
- Mathematical Methods (Stochastics)
- Mathematical Methods (Analysis or Applied and Numerical Mathematics, Optimization)
- Mathematical Methods (Algebra and Geometry)

**Elective Field**

**Credits:** 3

**Grading scale:** Grade to a tenth

**Recurrence:** Irregular

**Duration:** 1 term

**Language:** German

**Level:** 4

**Version:** 1

**Mandatory**

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**Competence Certificate**

oral exam of ca. 20 min

**Prerequisites**

None

**Module grade calculation**

The grade of the module is the grade of the oral exam.

**Workload**

total workload: 90 hours
## 7.172 Module: Topological Groups [M-MATH-105323]

**Responsible:** Dr. rer. nat. Rafael Dahmen  
Prof. Dr. Wilderich Tuschmann

**Organisation:** KIT Department of Mathematics

**Part of:** Mathematical Methods (Algebra and Geometry)  
Elective Field

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### Mandatory

| CR | T-MATH-110802 | Topological Groups | 5 CR | Dahmen, Tuschmann |

**Prerequisites**

None
7.173 Module: Translation Surfaces [M-MATH-105973]

**Responsible:** Prof. Dr. Frank Herrlich

**Organisation:** KIT Department of Mathematics

**Part of:** Mathematical Methods (Algebra and Geometry)

**Elective Field**

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**Mandatory**

| T-MATH-112128 | Translation Surfaces | 8 CR | Herrlich |

**Prerequisites**

None
Module: Traveling Waves [M-MATH-102927]

### Competence Certificate

The module examination takes place in form of an oral exam of about 30 minutes. Please see under “Modulnote” for more information about the bonus regulation.

### Prerequisites

none

### Competence Goal

After successful completion of this module students:

- can explain the significance of traveling waves and their dynamic stability;
- know basic methods to study the existence of traveling waves;
- outline the main steps in a stability analysis and address potential complications;
- have acquired several mathematical tools to compute or approximate the spectrum;
- master several techniques to derive (in)stability of the wave from spectral information;
- understand how spectrum and stability might depend on the class of perturbations.

### Content

Traveling waves are solutions to nonlinear partial differential equations (PDEs) that propagate over time with a fixed speed without changing their profiles. These special solutions arise in many applied problems where they model, for instance, water waves, nerve impulses in axons or light in optical fibers. Therefore, their existence and the naturally associated question of their dynamic stability is of interest, because only those waves which are stable can be observed in practice.

The first step in the stability analysis is to linearize the underlying PDE about the wave and compute the associated spectrum, which is in general a nontrivial task. To approximate spectra associated with various waves, such as fronts, pulses and periodic wave trains, we introduce the following tools:

- Sturm-Liouville theory
- exponential dichotomies
- Fredholm theory
- the Evans function
- parity arguments
- essential spectrum, point spectrum and absolute spectrum
- exponential weights

The next step is to derive useful bounds on the linear solution operator, or semigroup, based on the spectral information. A complicating factor is that any non-constant traveling wave possesses spectrum up to the imaginary axis. For various dissipative PDEs, such as reaction-diffusion systems, we employ the bounds on the linear solution operator to close a nonlinear argument via iterative estimates on the Duhamel formula. For traveling waves in Hamiltonian PDEs, such as the NLS or KdV equation, we describe a different route towards stability based on the variational arguments of Grillakis, Shatah and Strauss.

### Module grade calculation

After passing the oral exam at the end of the semester, the final grade is \( \min(0.7X + 0.3Y, X) \), where \( X \) is the grade for the oral exam and \( Y \) is the grade obtained by voluntarily working out and presenting a model problem during one of the exercise classes.

### Recommendation

The following background is strongly recommended: Analysis 1-4.

### Literature

7 MODULES

7.175 Module: Uncertainty Quantification [M-MATH-104054]

**Responsible:** Prof. Dr. Martin Frank

**Organisation:** KIT Department of Mathematics

**Part of:** Mathematical Methods (Analysis or Applied and Numerical Mathematics, Optimization)

Elective Field

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**Mandatory**

| T-MATH-108399 | Uncertainty Quantification | 4 CR | Frank |

**Prerequisites**

None

**Competence Goal**

After successfully taking part in the module's classes and exams, students have gained knowledge and abilities as described in the "Inhalt" section.

Specifically, students know several parametrization methods for uncertainties. Furthermore, students are able to describe the basics of several solution methods (stochastic collocation, stochastic Galerkin, Monte-Carlo). Students can explain the so-called curse of dimensionality.

Students are able to apply numerical methods to solve engineering problems formulated as algebraic or differential equations with uncertainties. They can name the advantages and disadvantages of each method. Students can judge whether specific methods are applicable to the specific problem and discuss their results with specialists and colleagues. Finally, students are able to implement the above methods in computer codes.

**Content**

In this class, we learn to propagate uncertain input parameters through differential equation models, a field called Uncertainty Quantification (UQ). Given uncertain input (parameter values, initial or boundary conditions), how uncertain is the output? The first part of the course ("how to do it") gives an overview on techniques that are used. Among these are:

- Sensitivity analysis
- Monte-Carlo methods
- Spectral expansions
- Stochastic Galerkin method
- Collocation methods, sparse grids

The second part of the course ("why to do it like this") deals with the theoretical foundations of these methods. The so-called "curse of dimensionality" leads us to questions from approximation theory. We look back at the very standard numerical algorithms of interpolation and quadrature, and ask how they perform in many dimensions.

**Recommendation**

Numerical methods for differential equations
### 7.176 Module: Variational Methods [M-MATH-105093]

**Responsible:** Prof. Dr. Wolfgang Reichel  
**Organisation:** KIT Department of Mathematics  
**Part of:** Mathematical Methods (Analysis or Applied and Numerical Mathematics, Optimization)  
**Elective Field**

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<td>Variational Methods</td>
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7.177 Module: Wave Propagation in Periodic Waveguides [M-MATH-105462]

**Responsible:** Prof. Dr. Roland Griesmaier

**Organisation:** KIT Department of Mathematics

**Part of:** Mathematical Methods (Analysis or Applied and Numerical Mathematics, Optimization)

**Elective Field**

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**Mandatory**

| T-MATH-111002 | Wave Propagation in Periodic Waveguides | 8 CR | Griesmaier |

**Prerequisites**

None
7.178 Module: Wavelets [M-MATH-102895]

**Responsible:** Prof. Dr. Andreas Rieder

**Organisation:** KIT Department of Mathematics

**Part of:** Mathematical Methods (Analysis or Applied and Numerical Mathematics, Optimization)

**Elective Field**

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**Mandatory**

| T-MATH-105838 | Wavelets | 8 CR | Rieder |

**Prerequisites**

none
8 Courses

8.1 Course: Adaptive Finite Element Methods [T-MATH-105898]

**Responsible:** Prof. Dr. Willy Dörfler

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-102900 - Adaptive Finite Element Methods

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**Events**

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**Prerequisites**

none
8.2 Course: Advanced Empirical Asset Pricing [T-WIWI-110513]

**Responsible:** TT-Prof. Dr. Julian Thimme

**Organisation:** KIT Department of Economics and Management

**Part of:**
- M-WIWI-101483 - Finance 2
- M-WIWI-101483 - Finance 2

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<th>2 SWS</th>
<th>Lecture / Online</th>
<th>Thimme</th>
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<tr>
<td>WT 22/23</td>
<td>2530570</td>
<td>Übung zu Advanced Empirical Asset Pricing</td>
<td>1 SWS</td>
<td>Practice / On-Site</td>
<td>Thimme</td>
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**Legend:** Online, 🧩 Blended (On-Site/Online), 🏨 On-Site, ❌ Canceled

**Competence Certificate**

The success control takes place in form of a written examination (60 min) during the semester break. If the number of participants is low, an oral examination may also be offered. The examination is offered every semester and can be repeated at any regular examination date.

A bonus can be acquired by submitting exercise solutions to 80% of the assigned exercise tasks. If the grade of the written examination is between 4.0 and 1.3, the bonus improves the grade by up to one grade level (0.3 or 0.4). Details will be announced in the lecture.

**Recommendation**

We strongly recommend knowledge of the basic topics in investments (bachelor course), which will be necessary to be able to follow the course. In addition, prior participation in the Asset Pricing Master course is strongly recommended.

**Annotation**

New course from winter semester 2019/2020.

**Below you will find excerpts from events related to this course:**

### Advanced Empirical Asset Pricing

**2530569, WS 22/23, 2 SWS, Language: English, Open in study portal**

**Lecture (V)**

**Blended (On-Site/Online)**

**Content**

In this course we will discuss the fundamentals of Asset Pricing and how to test them. Although this is an Empirical Asset Pricing course, we deal with some concepts from Asset Pricing Theory that we can test afterwards (CAPM, ICAPM, CCAPM, recursive utility). Besides, the course will cover the most important empirical methods to do so. For that purpose, we will discuss the overarching tool Generalized Method of Moments, and the special cases of OLS and FMB regressions. Every second week, we will meet for a programing session, in which we will look at the data to draw our own conclusions. An introduction to the software MATLAB will be given at the beginning of the course. Students should bring a laptop to these sessions. Programing skills are not required but helpful.

We start with a review of the Stochastic Discount Factor, which is already known from the course „Asset Pricing“. We then derive the CAPM and the Consumption-CAPM as special cases from the general consumption-savings optimization problem of the rational investor. In the first part of the course we discuss the CAPM and, as natural extensions, models with multiple factors. Prominent phenomena such as the value premium and momentum are discussed. In the second part of the lecture we will study extensions of Consumption-CAPM and study the implications of exotic preferences.

**Organizational issues**

Veranstaltung findet montags um 9:45-11:15, aber nur in der ersten Semesterhälfte statt. Der Veranstaltungsort ist der Raum 320 im Geb. 09.21 (Blücherstraße).
Literature

Basisliteratur


zur Vertiefung/ Wiederholung

8 COURSES

8.3 Course: Advanced Game Theory [T-WIWI-102861]

Responsible:
- Prof. Dr. Karl-Martin Ehrhart
- Prof. Dr. Clemens Puppe
- Prof. Dr. Johannes Philipp Reiß

Organisation:
- KIT Department of Economics and Management

Part of:
- M-WIWI-101500 - Microeconomic Theory
- M-WIWI-101502 - Economic Theory and its Application in Finance
- M-WIWI-102970 - Decision and Game Theory

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<td>Each winter term</td>
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Competence Certificate
The assessment consists of a written exam (60 minutes) (following §4(2), 1 of the examination regulation). The exam takes place in every semester. Re-examinations are offered at every ordinary examination date.

Prerequisites
None

Recommendation
Basic knowledge of mathematics and statistics is assumed.

Below you will find excerpts from events related to this course:

- **Advanced Game Theory**
  - WT 22/23 2500037
  - Language: English
  - Open in study portal

- **Übung zu Advanced Game Theory**
  - WT 22/23 2500038
  - Language: English

Legends:
- 🖥 Online
- 🧩 Blended (On-Site/Online)
- 🔊 On-Site
- ❌ Cancelled
8.4 Course: Advanced Inverse Problems: Nonlinearity and Banach Spaces [T-MATH-105927]

**Responsible:** Prof. Dr. Andreas Rieder

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-102955 - Advanced Inverse Problems: Nonlinearity and Banach Spaces

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**Prerequisites**
none
8 COURSES

Course: Advanced Lab Blockchain Hackathon (Master) [T-WIWI-111126]

8.5 Course: Advanced Lab Blockchain Hackathon (Master) [T-WIWI-111126]

**Responsible:** Prof. Dr. Ali Sunyaev

**Organisation:** KIT Department of Economics and Management

**Part of:** M-WIWI-101472 - Informatics

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**Events**

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<th>Practical course / 🖥 Sunyaev, Kannengießer, Sturm, Beyene</th>
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<td>Practical course / 🖥</td>
<td>Sunyaev, Kannengießer, Sturm, Beyene</td>
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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 👤 On-Site, ✗ Cancelled

**Competence Certificate**
The alternative exam assessment consists of:

- a practical work
- a presentation and
- a written seminar thesis

Practical work, presentation and written thesis are weighted according to the course.

**Prerequisites**
None
### 8.6 Course: Advanced Lab Informatics (Master) [T-WIWI-110548]

**Responsible:** Professorenschaft des Instituts AIFB  
**Organisation:** KIT Department of Economics and Management  
**Part of:** M-WIWI-101472 - Informatics

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**Events**

ST 2022

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<td>Practical course</td>
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<td>2512401</td>
<td>3 SWS</td>
<td>Development of Sociotechnical Information Systems (Master)</td>
<td>Practical course</td>
<td>Sunyaev, Pandl, Goram</td>
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<td>Practical course</td>
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<td>3 SWS</td>
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<td>Practical course</td>
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<td>3 SWS</td>
<td>Praktikum Security, Usability and Society (Master)</td>
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<td>2512603</td>
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<td>2512501</td>
<td>3 SWS</td>
<td>Practical Course Cognitive automobiles and robots (Master)</td>
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<td>Practical Course Security (Master)</td>
<td>Practical course</td>
<td>Baumgart, Volkamer, Mayer</td>
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<td>2512600</td>
<td>3 SWS</td>
<td>Project lab Information Service Engineering (Master)</td>
<td>Practical course</td>
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**Legend:** 🖥 Online, 🧩 Blended (On-Site/Online), 🔴 On-Site, ☑ Cancelled

#### Competence Certificate

The alternative exam assessment consists of:

- a practical work
- a presentation and
- a written seminar thesis

Practical work, presentation and written thesis are weighted according to the course.

#### Prerequisites

None

#### Annotation

The title of this course is a generic one. Specific titles and the topics of offered seminars will be announced before the start of a semester in the internet at https://portal.wiwi.kit.edu.
Below you will find excerpts from events related to this course:

**Lab Realisation of innovative services (Master)**
2512205, SS 2022, 3 SWS, Language: German, Open in study portal

**Content**
As part of the lab, the participants should work together in small groups to realize innovative services (mainly for students). Further information can be found on the ILIAS page of the lab.

**Organizational issues**
Die genauen Termine und Informationen zur Anmeldung werden auf der Veranstaltungsseite bekannt gegeben.

**Lab Automation in Everyday Life (Master)**
2512207, SS 2022, 3 SWS, Language: German, Open in study portal

**Content**
As part of the lab, various topics on everyday automation are offered. During the lab, the participants will gain an insight into problem-solving oriented project work and work on a project together in small groups. Further information can be found on the ILIAS page of the lab.

**Organizational issues**
Die genauen Termine und Informationen zur Anmeldung werden auf der Veranstaltungsseite bekannt gegeben.

**Development of Sociotechnical Information Systems (Master)**
2512401, SS 2022, 3 SWS, Language: German/English, Open in study portal

**Content**
The aim of the lab is to get to know the development of socio-technical information systems in different application areas. In the event framework, you should develop a suitable solution strategy for your problem alone or in group work, collect requirements, and implement a software artifact based on it (for example, web platform, mobile apps, desktop application). Another focus of the lab is on the subsequent quality assurance and documentation of the implemented software artifact.

Registration information will be announced on the course page.

**Project Lab Machine Learning**
2512500, SS 2022, 3 SWS, Language: German/English, Open in study portal

**Content**
The lab is intended as a practical supplement to lectures such as "Machine Learning". The theoretical basics are applied in the lab course. The aim of the lab course is that the participants work together to design, develop and evaluate a subsystem from the field of robotics and cognitive systems using one or more procedures from the field of AI/ML.

In addition to the scientific objectives involved in the investigation and application of the methods, aspects of project-specific teamwork in research (from specification to presentation of the results) are also developed in this practical course.

The individual projects require the analysis of the task at hand, selection of suitable procedures, specification and implementation and evaluation of the approach taken. Finally, the chosen solution has to be documented and presented in a short presentation.

**Learning objectives:**
- Students can practically apply knowledge from the Machine Learning lecture in a selected field of current research in robotics or cognitive automobiles.
- Students master the analysis and solution of corresponding problems in a team.
- Students can evaluate, document and present their concepts and results.

**Recommendations:**
Attendance of the lecture machine learning, C/C++ knowledge, Python knowledge

**Workload:**
The workload of 4.5 credit points consists of the time spent in the lab for practical implementation of the selected solution, as well as the time spent on literature research and planning/specifying the proposed solution. In addition, a short report and a presentation of the work carried out will be prepared.
Organizational issues
Anmeldung und weitere Informationen sind im Wiwi-Portal zu finden.
Registration and further information can be found in the WiWi-portal.

Praktikum Security, Usability and Society (Master)
2512555, SS 2022, 3 SWS, Language: German/English, Open in study portal

Content
The internship Security, Usability and Society will cover topics both of usable security and privacy programming, and how to conduct user studies. To reserve a place, please, register on the WiWi portal and send an email with your chosen topic, plus a back-up one, to mattia.mossano@kit.edu before the kick-off. You can find a better description of the topics in ILIAS (link below). Topics are assigned first-come-first-served until all of them are filled. Topics in italics have been already assigned.
ILIAS link: https://ilias.studium.kit.edu/goto.php?target=crs_1792110&client_id=produktiv

Important dates:
- Kick-off: 19.04.2022, 9:00-10:00 CET Uhr Online Microsoft Teams - Link
- Report + code submission: 09.09.2022, 23:59 CET
- Presentation deadline: 25.09.2022, 23:59 CET
- Presentation day: 28.09.2022, 16:00 CET

Topics:

Programming Usable Security Intervention
In this subject, students develop a part of coding, an extension, or another programming task dealing with various usable security interventions, e.g., an extension. E.g., TORPEDO ( https://secuso.aifb.kit.edu/english/TORPEDO.php ) or PassSec + ( https://secuso.aifb.kit.edu/english/PassSecPlus.php ). Just as before, students are provided with a point list of goals, containing both basic features mandatory to pass the course and more advanced ones that heighten the final grade.

- Portfolio Graphical Recognition-Based Passwords with Gamepads
- Improving the PassSec+ browser extension by investigating a security vulnerability in Mozilla Firefox Relay
- Development of a tool for the automated search for tweets on the topic of “phishing”
- Hacking TORPEDO
- Restructuring TORPEDO
- Authenticating on AR glasses: Implementing an authentication scheme for the Google Glass

Designing Security User studies (online studies only)
These topics are related to how to set up and conducting user studies of various types. This year, due to the Corona outbreak, we decided to conduct online studies only; otherwise, interviews and in lab studies would have been possible. At the end of the semester, the students present a report / paper and a talk in which they present their results.

- Investigate brainwaves authentication
- Replication and extension of “What is this URL’s destination?”

Please note that registration is not required to participate in the kick-off meeting.

Project Course Coding da Vinci - Cultural Heritage Hackathon (Master)
2512603, SS 2022, 3 SWS, Language: English, Open in study portal

Econmathematics M.Sc.
Module Handbook as of 06/09/2022
Content
Cultural heritage includes tangible and intangible heritage assets inherited from past generations. Cultural heritage data are usually stored in galleries, museums, archives and libraries (GLAM institutions) and in recent years, efforts by culture domain experts and computer scientists have begun to make this data more findable, accessible, interoperable and reusable by the general public, but also by researchers in the domains of history, social science, etc. This seminar follows up on these efforts by having student groups participate in the official Coding da Vinci culture hackathon with guidance and coaching by the course tutors.

The culture hackathon Coding da Vinci has brought together the cultural sector with creative technology communities to explore the creative potential of digital cultural heritage. Over a sprint of seven weeks the hackathon teams, together with representatives of cultural institutions, develop working prototypes that show surprising and inspiring new ways to make use of institutions' collections and artifacts in the digital age.

As part of this "Projektpraktikum", the students will take part in the official hackathon "Coding da Vinci Baden-Württemberg" (https://codingdavinci.de/index.php/de/events/baden-wuerttemberg-2022). They will form groups and implement their own interesting culture project by using the dataset(s) provided by Coding da Vinci. The goal is to create a project that is useful for the culture community and helps to explore and experience cultural heritage data in an interesting, innovative and fun way.

This "Projektpraktikum" is furthermore a chance to network with the community of culture enthusiasts and developers while creating a working application that adds value to the community. The groups will present their work at the official Codings da Vinci kick-off event and the award ceremony.

Contributions of the students:
The students will form groups of 3-4 people. They will be expected to first get familiar with datasets presented in the event, the technologies and methods they will utilize and will develop their own project idea. Each group will present their project idea on May 07, 2022 at the Coding da Vinci BW kick-off and will officially start the implementation of their project. On June 24, 2022, each group will present their final project at the official Coding da Vinci BW award ceremony. Following the event, each group will prepare a scientific seminar paper of not more than 16 pages.

Implementation:
Each group will implement their project idea based on the datasets given in the event using open source software and will publish their code using an open license via github.

Learning Goals:
- Basic understanding of knowledge graphs and Natural Language Processing
- Independent and self-organized realization of a group project
- Planning and execution of design, implementation and quality assurance of the group project
- Preparation of a scientific seminar paper for the group project of 16 pages
- Presentation of the group project in a comprehensible and structured manner

Registration:
The registration period for this course lasts from 01.02.2022 until 22.04.2022. The places are expected to be allocated on 25.04.2022 and must be accepted by the student within two days.
If you have any questions regarding the registration or course content, please contact tabea.tietz@kit.edu and oleksandra.bruns@kit.edu.

Modules: Informatik

Timeline:
20.04.2022 Plenary meeting: Introduction and Course Organization
27.04.2022 Plenary meeting: Forming of student groups and discussion of datasets
07.05.2022 Official Coding da Vinci Kick-off Event: Presentation of group idea
11.05.2022 Individual group sessions: Fixing a project plan and timeline
18.05.2022 Individual group sessions: Weekly progress meeting
25.05.2022 Individual group sessions: Weekly progress meeting
01.06.2022 Individual group sessions: Weekly progress meeting
08.06.2022 Individual group sessions: Weekly progress meeting
15.06.2022 Individual group sessions: Weekly progress meeting
22.06.2022 Individual group sessions: Weekly progress meeting
24.06.2022 Official Coding da Vinci Award Ceremony: Final Presentation
17.08.2022 Seminar paper submission and finalization (and documentation) of the code

Organizational issues
Considering the then current pandemic situation and in coordination with the participants the course will mostly take place as online course with potentially a few "live" events (cf further description below).
Lab Realisation of innovative services (Master)
2512205, WS 22/23, 3 SWS, Language: German, Open in study portal

**Content**
As part of the lab, the participants should work together in small groups to realize innovative services (mainly for students).
Further information can be found on the ILIAS page of the lab.

**Organizational issues**
Die genauen Termine und Informationen zur Anmeldung werden auf der Veranstaltungsseite bekannt gegeben.

Practical Course Cognitive automobiles and robots (Master)
2512501, WS 22/23, 3 SWS, Language: German, Open in study portal

**Content**
The lab is intended as a practical supplement to lectures such as "Machine Learning". The theoretical basics are applied in the lab course. The aim of the lab course is that the participants work together to design, develop and evaluate a subsystem from the field of robotics and cognitive systems using one or more procedures from the field of AI/ML.

In addition to the scientific objectives involved in the investigation and application of the methods, aspects of project-specific teamwork in research (from specification to presentation of the results) are also developed in this practical course.

The individual projects require the analysis of the task at hand, selection of suitable procedures, specification and implementation and evaluation of the approach taken. Finally, the chosen solution has to be documented and presented in a short presentation.

**Learning objectives:**
- Students can practically apply knowledge from the Machine Learning lecture in a selected field of current research in robotics or cognitive automobiles.
- Students master the analysis and solution of corresponding problems in a team.
- Students can evaluate, document and present their concepts and results.

**Recommendations:**
Attendance of the lecture machine learning, C/C++ knowledge, Python knowledge

**Workload:**
The workload of 4.5 credit points consists of the time spent in the lab for practical implementation of the selected solution, as well as the time spent on literature research and planning/specifying the proposed solution. In addition, a short report and a presentation of the work carried out will be prepared.

**Organizational issues**
Anmeldung und weitere Informationen sind im Wiwi-Portal zu finden.
Registration and further information can be found in the WiWi-portal.

Practical Course Security (Master)
2512557, WS 22/23, 4 SWS, Language: German, Open in study portal

**Content**
The lab deals with the IT security of everyday utensils. Implemented security mechanisms are first theoretically investigated and put to the test with practical attacks. Finally, countermeasures and suggestions for improvement are worked out. The lab is offered within the competence center for applied security technologies (KASTEL) and is supervised by several institutes.

The success control takes the form of a final presentation, a thesis and the handing over of the developed code.

More information on ILIAS.
Content
The ISE project lab is based on the summer semester lecture "Information Service Engineering". Goal of the course is to work on a given research problem in small groups (3-4 students) related to the ISE lecture topics, i.e. Natural Language Processing, Knowledge Graphs, and Machine Learning. The solution of the given research problem requires the development of a software implementation.

The project will be worked on in teams of 3-4 students each, guided by a tutor from the teaching staff.

Required coursework includes:
- Mid term presentation (5-10 min)
- Final presentation (10-15 min)
- Course report (c. 20 pages)
- Participation and contribution of the students during the course
- Software development and delivery

Notes:
The ISE project lab can also be credited as a seminar (if necessary).

The project will be worked on in teams of 3-4 students each, guided by a tutor from the teaching staff.

Participation will be restricted to 15 students.

Participation in the lecture "Information Service Engineering" (summer semester) is required. There are video recordings on our youtube channel.

ISE Tutor Team:
- M. Sc. Russa Biswas
- M. Sc. Genet Asefa Gesese
- M. Sc. Oleksandra Bruns
- M. Sc. Yiyi Chen
- M. Sc. Mary Ann Tan
- B. Sc. Tabea Tietz

Literature
ISE video channel on youtube: https://www.youtube.com/channel/UCjkkhNSNuXrJpMYZoeSBw6Q/
8.7 Course: Advanced Lab Security [T-WIWI-109786]

**Responsible:** Prof. Dr. Melanie Volkamer

**Organisation:** KIT Department of Economics and Management

**Part of:** M-WIWI-101472 - Informatics

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<td>Each winter term</td>
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**Events**

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<th>Practical course /</th>
<th>Baumgart, Volkamer, Mayer</th>
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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), ⬛ On-Site, ✗ Cancelled

**Competence Certificate**

The alternative exam assessment consists of:

- a practical work
- a presentation and possibly
- a written seminar thesis

Practical work, presentation and written thesis are weighted according to the course.

**Prerequisites**

None

**Recommendation**

Knowledge from the lecture "Information Security" is recommended.

_Below you will find excerpts from events related to this course:_

**Practical Course Security (Master)**

2512557, WS 22/23, 4 SWS, Language: German, Open in study portal

**Content**

The lab deals with the IT security of everyday utensils. Implemented security mechanisms are first theoretically investigated and put to the test with practical attacks. Finally, countermeasures and suggestions for improvement are worked out. The lab is offered within the competence center for applied security technologies (KASTEL) and is supervised by several institutes.

The success control takes the form of a final presentation, a thesis and the handing over of the developed code.

More information on ILIAS.
8 COURSES
Course: Advanced Lab Security, Usability and Society [T-WIWI-108439]

8.8 Course: Advanced Lab Security, Usability and Society [T-WIWI-108439]

**Responsible:** Prof. Dr. Melanie Volkamer
**Organisation:** KIT Department of Economics and Management
**Part of:** M-WIWI-101472 - Informatics

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**Events**

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<th>Credits</th>
<th>Practical course</th>
<th>Instructors</th>
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<td>ST 2022</td>
<td>2612554</td>
<td>Practical lab Security, Usability and Society (Bachelor)</td>
<td>3 SWS</td>
<td>Practical course</td>
<td>Volkamer, Strufe, Mayer, Berens, Mossano, Düzgün, Hennig, Veit</td>
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<tr>
<td>WT 22/23</td>
<td>2512554</td>
<td>Praktikum Security, Usability and Society (Bachelor)</td>
<td>3 SWS</td>
<td>Practical course</td>
<td>Volkamer, Mayer, Berens, Mossano, Düzgün, Veit, Hennig</td>
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<td>WT 22/23</td>
<td>2512555</td>
<td>Praktikum Security, Usability and Society (Master)</td>
<td>3 SWS</td>
<td>Practical course</td>
<td>Volkamer, Mayer, Berens, Mossano, Düzgün, Veit, Hennig</td>
</tr>
</tbody>
</table>

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

**Competence Certificate**
The alternative exam assessment consists of:
- a practical work
- a presentation and possibly
- a written seminar thesis

Practical work, presentation and written thesis are weighted according to the course.

**Prerequisites**
None

**Recommendation**
Knowledge from the lecture "Information Security" is recommended.

**Annotation**
The course is expected to be offered from winter term 2018/2019.

**Contents:**
In the course of the programming lab, changing topics from the field of Human Factors in Security und Privacy will be worked on.

**Learning goals:**
The student
- can apply the basics of information security
- is able to implement appropriate measures to achieve different protection goals
- can structure a software project in the field of information security
- can use the Human Centred Security and Privacy by Design technique to develop user-friendly software
- can explain and present technical facts and the results of the programming lab in oral and written form

Below you will find excerpts from events related to this course:

**Practical lab Security, Usability and Society (Bachelor)**
2612554, SS 2022, 3 SWS, Language: German/English, Open in study portal

**Practical course (P)**
Online
Content
The internship Security, Usability and Society will cover topics both of usable security and privacy programming, and how to conduct user studies. To reserve a place, please, register on the WiWi portal and send an email with your chosen topic, plus a backup one, to mattia.mossano@kit.edu before the kick-off. You can find a better description of the topics in ILIAS (link below). Topics are assigned first-come-first-served until all of them are filled. Topics in italics have been already assigned.

ILIAS link: https://ilias.studium.kit.edu/goto.php?target=crs_1792110&client_id=produktiv

Important dates:
Kick-off: 19.04.2022, 9:00-10:00 CET Uhr Microsoft Teams - - Link
Report + code submission: 09.09.2022, 23:59 CET
Presentation deadline: 25.09.2022, 23:59 CET
Presentation day: 28.09.2022, 16:00 CET

Topics:
Programming Usable Security Intervention

In this subject, students develop a part of coding, an extension, or another programming task dealing with various usable security interventions, eg as an extension. Eg TORPEDO (https://secuso.aifb.kit.edu/english/TORPEDO.php) or PassSec+ (https://secuso.aifb.kit.edu/english/PassSecPlus.php). Just as before, students are provided with a point list of goals, containing both basic features mandatory to pass the course and more advanced ones that heighten the final grade.

- Portfolio Graphical Recognition-Based Passwords with Gamepads
- Improving the PassSec+ browser extension by investigating a security vulnerability in Mozilla Firefox Relay
- Development of a tool for the automated search for tweets on the topic of “phishing”
- Hacking TORPEDO
- Restructuring TORPEDO

Please, note that registration is not required to participate in the kick-off meeting.

This event counts towards the KASTEL certificate. Further information on how to obtain the certificate can be found on the SECUSO website https://secuso.aifb.kit.edu/Studium_und_Lehre.php.
Content
The Praktikum "Security, Usability and Society" will cover topics both of usable security and privacy programming, and how to conduct user studies. To reserve a place, please, register on the WiWi portal and send an email with your chosen topic, plus a backup one, to anne.hennig@kit.edu. Topics are assigned first-come-first-served until all of them are filled. The deadline for the first round is 18.07.2022. Topics in italics have been already assigned.

Important dates:
- Kick-off: 13.10.2022, 10:00 AM CET in Big Blue Button - Link
- Report + code submission: 30.01.2023 23:59 CET
- Presentation deadline: 30.01.2023, 23:59 CET
- Presentation day: 01.02.2023

Topics:

Programming Usable Security Intervention
In this subject, students develop a part of coding, an extension, or another programming task dealing with various usable security interventions, eg as an extension. Eg TORPEDO (https://secuso.aifb.kit.edu/english/TORPEDO.php) or PassSec + (https://secuso.aifb.kit.edu/english/PassSecPlus.php). Just as before, students are provided with a point list of goals, containing both basic features mandatory to pass the course and more advanced ones that heighten the final grade.

Title: Portfolio Graphical Recognition-Based PWDs with Gamepads
Number of students: 2 Bachelor or Master level
Description: Graphical passwords use graphical elements as passwords and they are usually easier to remember than textual passwords. Moreover, they can be combined with "portfolio authentication" techniques to make them shoulder surfing resistant. The goal of this topic is to implement a graphical portfolio authentication scheme for gamepads, based on previous textual schemes implementations.

Title: Development of a secure web interface with a ticket system for the Hashcat Password Cracker
Number of students: 2 Bachelor or Master level
Description: Hashcat is a console application which allows to crack passwords using a given wordlist or password pattern. In order to allow multiple not necessarily trustworthy users to register a password cracking job with the specified parameters in parallel, a web platform with a ticket system should be developed within the framework of this laboratory topic. Therefore a frontend and backend should be implemented separately and a clear description of the interface between is essential part of this work. Python with Flask Web Framework can be used to implement the backend. Good knowledge in programming, APIs and web security are required.

Designing Security User studies
These topics are related to how to set up and conducting user studies of various types. This year, due to the Corona outbreak, we decided to conduct online studies only; otherwise, interviews and in lab studies would have been possible. At the end of the semester, the students present a report / paper and a talk in which they present their results.

Title: NoPhish Cardgame
Number of students: 1/2 Bachelor level
Description: Das NoPhish Konzept findet bereits in vielen Formen Anwendung. Es hilft dabei betrügerische Nachrichten von legitemen zu Unterscheiden. Die neueste Form ist ein Cardgame bei dem man spielerisch lernen kann Phishing zu erkennen. Hierbei wird sowohl grundlegendes Wissen, als auch konkretes Wissen vermittelt. Aufgabe: Erheben von Daten (Studiendesign ist bereits vorhanden) und Auswertung bestehender Daten mit neu erhobenen Daten

Title: Analysing the perceptions on email subject extensions like 'Caution' - This e-mail is sent from someone outside the company'
Number of students: 1/2 Bachelor or Master level
Description: Email subject extensions are used in many organisations to reduce the risk to become a victim of a phishing email - why should your boss e.g. send you an external email? Likely to be a phish! The idea is to develop the study protocol and to collect first data which should be analysed.

Title: Benutzerstudie zur Erkennung von Angriffen auf die E-Mail Absicherung mit S/MIME-Zertifikaten
Number of students: 2 Bachelor or Master level

Title: Evaluation of the Sudoku Privacy Friendly App usability for users with rheumatoid arthritis (English only)
Number of students: 1 Bachelor or Master level
Description: The Privacy Friendly Apps are a set of applications developed by the SECSUO group that do not contain any advertisement or tracking mechanism, hence preserving the privacy of their users (https://secuso.aifb.kit.edu/english/105.php). One of these apps is "Sudoku", available for Android on both the Google Store and F-Droid. Although the app is friendlier to privacy that other alternatives, it requires multiple tactile interactions with the mobile device. This can be an issue for users with reduced hand mobility, such as those suffering from rheumatoid arthritis. To approximate the reduced mobility caused by reumatoid arthritis in healthy users, it is common to use arthritis simulation gloves (e.g., https://idarinstitute.com/products/arthritis-simulation-gloves). The task of the student is to design a lab study involving arthritis simulation gloves that evaluates the Sudoku app usability for users suffering from rheumatoid arthritis.
Title: Replication and extension of "What is this URL's destination?" (English only)
Number of students: 1 Bachelor level
Description: Replication of studies is a fundamental part of the scientific process: it allows to confirm or deny experimental results and can open new lines of research. This topic is a replication of the study presented in Albakry, S., Vaniea, K. & Wolters, M.K. (2020) What is this URL's destination? Empirical Evaluation of Users' URL Reading” (https://doi.org/10.1145/3313831.3376168). The student will re-implement the study following the precise description from the original authors, run it and then compare the results with the previous iteration.

Title: Password Generator Defaults
Number of students: 2 Bachelor or Master level
Description: Password Managers are useful tools that help the use of complex passwords and avoid the password recycle practice. Moreover, they support users by providing password generator tools, that create random password of specific length. However, the defaults settings might be at odds with the password policies of popular website, e.g., they can contain forbidden characters or be too long/short. Moreover, we need to understand if Password Managers users change the default settings to generate passwords, in how many cases and for what reasons. The students task is therefore two-folds; (1) compare the default settings of several Password Managers to the privacy policies of popular websites; (2) design and implement a survey to collect the behavior of Password Managers users with regard to the password generator tools.

Title: Benutzerstudie zur Auswertung der PassSec+ Browser Extension mittels Eye-Tracking
Number of students: 1/2 Bachelor or Master level

This event counts towards the KASTEL certificate. Further information on how to obtain the certificate can be found on the SECUSO website https://secuso.aifb.kit.edu/Studium_und_Lehre.php.

Praktikum Security, Usability and Society (Master)
2512555, WS 22/23, 3 SWS, Language: German/English, Open in study portal
Content
The Praktikum "Security, Usability and Society" will cover topics both of usable security and privacy programming, and how to conduct user studies. To reserve a place, please, register on the WiWi portal and send an email with your chosen topic, plus a back-up one, to anne.hennig@kit.edu. Topics are assigned first-come-first-served until all of them are filled. The deadline for the first round is 18.07.2022. Topics in italics have been already assigned.

WiWi portal: https://portal.wiwi.kit.edu/ys/6273

Important dates:
Kick-off: 13.10.2022, 10:00 AM CET in Big Blue Button - Link
Report + code submission: 30.01.2023 23:59 CET
Presentation deadline: 30.01.2023, 23:59 CET

Presentation day: 01.02.2023

Topics:

Programming Usable Security Intervention
In this subject, students develop a part of coding, an extension, or another programming task dealing with various usable security interventions, eg as an extension. Eg TORPEDO (https://secuso.aifb.kit.edu/english/TORPEDO.php) or PassSec + (https://secuso.aifb.kit.edu/english/PassSecPlus.php). Just as before, students are provided with a point list of goals, containing both basic features mandatory to pass the course and more advanced ones that heighten the final grade.

Title: Portfolio Graphical Recognition-Based PWDs with Gamepads
Number of students: 2 Bachelor or Master level
Description: Graphical passwords use graphical elements as passwords and they are usually easier to remember than textual passwords. Moreover, they can be combined with "portfolio authentication" techniques to make them shoulder surfing resistant. The goal of this topic is to implement a graphical portfolio authentication scheme for gamepads, based on previous textual schemes implementations.

Title: Development of a secure web interface with a ticket system for the Hashcat Password Cracker
Number of students: 2 Bachelor or Master level
Description: Hashcat is a console application which allows to crack passwords using a given wordlist or password pattern. In order to allow multiple not necessarily trustworthy users to register a password cracking job with the specified parameters in parallel, a web platform with a ticket system should be developed within the framework of this laboratory topic. Therefore a frontend and backend should be implemented separately and a clear description of the interface between is essential part of this work. Python with Flask Web Framework can be used to implement the backend. Good knowledge in programming, APIs and web security are required.

Designing Security User studies
These topics are related to how to set up and conducting user studies of various types. This year, due to the Corona outbreak, we decided to conduct online studies only; otherwise, interviews and in lab studies would have been possible. At the end of the semester, the students present a report / paper and a talk in which they present their results.

Title: Analysing the perceptions on email subject extensions like 'Caution - This e-mail is sent from someone outside the company'
Number of students: 1/2 Bachelor or Master level
Description: Email subject extensions are used in my organizations to reduce the risk to become a victim of a phishing email - why should your boss e.g. send you an external email? Likely to be a phish! The idea is to develop the study protocol and to collect first data which should be analysed.

Title: Benutzerstudie zur Erkennung von Angriffen auf die E-Mail Absicherung mit S/MIME-Zertifikaten
Number of students: 2 Bachelor or Master level

Title: Evaluation of the Sudoku Privacy Friendly App usability for users with rheumatoid arthritis (English only)
Number of students: 1 Bachelor or Master level
Description: The Privacy Friendly Apps are a set of applications developed by the SECUSO group that do not contain any advertisement or tracking mechanism, hence preserving the privacy of their users (https://secuso.aifb.kit.edu/english/105.php). One of these apps is "Sudoku", available for Android on both the Google Store and F-Droid. Although the app is friendlier to privacy that other alternatives, it requires multiple tactile interactions with the mobile device. This can be an issue for users with reduced hand mobility, such as those suffering from rheumatoid arthritis. To approximate the reduced mobility caused by reumatoid arthritis in healthy users, it is common to use arthritis simulation gloves (e.g., https://idarinstitute.com/products/arthritis-simulation-gloves). The task of the student is to design a lab study involving arthritis simulation gloves that evaluates the Sudoku app usability for users suffering from rheumatoid arthritis.
Title: Password Generator Defaults
Number of students: 2 Bachelor or Master level
Description: Password Managers are useful tools that help the use of complex passwords and avoid the password recycle practice. Moreover, they support users by providing password generator tools, that create random password of specific length. However, the defaults settings might be at odds with the password policies of popular website, e.g., they can contain forbidden characters or be too long/short. Moreover, we need to understand if Password Managers users change the default settings to generate passwords, in how many cases and for what reasons. The students task is therefore two-folds; (1) compare the default settings of several Password Managers to the privacy policies of popular websites; (2) design and implement a survey to collect the behavior of Password Managers users with regard to the password generator tools.

Title: Benutzerstudie zur Auswertung der PassSec+ Browser Extension mittels Eye-Tracking
Number of students: 1/2 Bachelor or Master level

Title: User study on user’s knowledge about brainwaves verification
Number of students: 1 Master level
Description: Brainwaves can be used to authenticate users. However, several questions are left unanswered regarding the users’ stance on this: What is the prior knowledge of users about verification and brainwaves? Are they comfortable wearing a device to record their brainwaves? How are they feeling regarding storing their brainwaves samples? Which kind of information can be extracted from the samples? How secure would such an authentication scheme be? The task of the student is to design, implement an pre-test a user study investigating these questions.

This event counts towards the KASTEL certificate. Further information on how to obtain the certificate can be found on the SECUSO website https://secuso.aifb.kit.edu/Studium_und_Lehre.php.
8 COURSES

Course: Advanced Lab Sociotechnical Information Systems Development (Master) [T-WIWI-111125]

8.9 Course: Advanced Lab Sociotechnical Information Systems Development (Master) [T-WIWI-111125]

Responsible: Prof. Dr. Ali Sunyaev
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101472 - Informatics

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Events

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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ❌ Cancelled

Competence Certificate
The alternative exam assessment consists of:

- a practical work
- a presentation and
- a written seminar thesis

Practical work, presentation and written thesis are weighted according to the course.

Prerequisites
None
8.10 Course: Advanced Machine Learning and Data Science [T-WIWI-111305]

**Responsible:** Prof. Dr. Maxim Ulrich

**Organisation:** KIT Department of Economics and Management

**Part of:** M-WIWI-105659 - Advanced Machine Learning and Data Science

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<td>Practical course</td>
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**Competence Certificate**

The assessment is carried out in form of a written thesis based on the course "Advanced Machine Learning and Data Science".

**Annotation**

The course is targeted to students with a major in Data Science and/or Machine Learning. It offers students the opportunity to develop hands-on knowledge on new developments in data science and machine learning. Please apply via the link: [https://portal.wiwi.kit.edu/forms/form/fbv-ulrich-msc-project](https://portal.wiwi.kit.edu/forms/form/fbv-ulrich-msc-project).

An online meetup will be offered at 14:00 on Tuesday of the first week of summer semester 2022 (i.e., 19.04.2022).

*Below you will find excerpts from events related to this course:*

**Advanced Machine Learning and Data Science**

2530357, SS 2022, 4 SWS, Language: English, [Open in study portal](https://portal.wiwi.kit.edu/forms/form/fbv-ulrich-msc-project)

**Content**

The course is targeted to students with a major in Data Science and/or Machine Learning. It offers students the opportunity to develop hands-on knowledge on new developments in data science and machine learning.

**Organizational issues**

Location: Räume des Lehrstuhls, Blücherstraße 17, E-008

**Literature**

Literatur wird in der ersten Vorlesung bekannt gegeben.
8.11 Course: Advanced Statistics [T-WIWI-103123]

**Responsible:** Prof. Dr. Oliver Grothe  
**Organisation:** KIT Department of Economics and Management  
**Part of:** M-WIWI-101637 - Analytics and Statistics

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Legend: 🖥️ Online, 🧩 Blended (On-Site/Online), 🗣️ On-Site, ❌ Cancelled

**Competence Certificate**

The assessment of this course is a written examination (60 min) according to §4(2), 1 of the examination regulation. The exam is offered every semester. Re-examinations are offered only for repeaters.

**Prerequisites**

None

*Below you will find excerpts from events related to this course:*

**Advanced Statistics**

2550552, WS 22/23, 2 SWS, Language: German, [Open in study portal]

**Literature**

Skript zur Vorlesung
8.12 Course: Advanced Stochastic Optimization [T-WIWI-106548]

**Responsible:** Prof. Dr. Steffen Rebennack

**Organisation:** KIT Department of Economics and Management

**Part of:**
- M-WIWI-101473 - Mathematical Programming
- M-WIWI-103289 - Stochastic Optimization

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**Competence Certificate**
The assessment consists of a written exam (60 minutes) according to Section 4(2), 1 of the examination regulation. The exam takes place in every the semester.

**Prerequisites**
None.
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**Competence Certificate**

The assessment consists of a written exam (60min) (following §4(2), 1 of the examination regulation) at the end of the lecture period or at the beginning of the following semester.

**Prerequisites**

None

**Recommendation**

This course is designed for advanced Master students with a strong interest in economic theory and mathematical models. Bachelor students who would like to participate are free to do so, but should be aware that the level is much more advanced than in other courses of their curriculum.

**Below you will find excerpts from events related to this course:**

**Advanced Topics in Economic Theory**

2520527, SS 2022, 2 SWS, Language: English, [Open in study portal](#)

**Literature**

Die Veranstaltung wird in englischer Sprache angeboten:

The course is based on the excellent textbook "Microeconomic Theory" (Chapters 1-5, 10, 13-20) by A.Mas-Colell, M.D.Whinston, and J.R.Green.
### 8 COURSES

8.14 Course: Algebra [T-MATH-102253]

**Responsible:** Prof. Dr. Frank Herrlich  
PD Dr. Stefan Kühnlein

**Organisation:** KIT Department of Mathematics  
**Part of:** M-MATH-101315 - Algebra

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**Version:** 2

**Events**

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**Legend:**  
🖥 Online, 🤴 Blended (On-Site/Online), 🗂 On-Site, ✗ Cancelled  

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### 8.15 Course: Algebraic Geometry [T-MATH-103340]

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**Responsible:** Prof. Dr. Frank Herrlich  
PD Dr. Stefan Künnlein  

**Organisation:** KIT Department of Mathematics  

**Part of:** M-MATH-101724 - Algebraic Geometry
### 8.16 Course: Algebraic Number Theory [T-MATH-103346]

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<th><strong>Responsible:</strong></th>
<th>PD Dr. Stefan Kühnlein</th>
</tr>
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<tr>
<td><strong>Part of:</strong></td>
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8.17 Course: Algebraic Topology [T-MATH-105915]

**Responsible:** TT-Prof. Dr. Manuel Krannich
Prof. Dr. Roman Sauer

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-102948 - Algebraic Topology

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**Prerequisites**
none
8.18 Course: Algebraic Topology II [T-MATH-105926]

- **Responsible:** Prof. Dr. Roman Sauer
- **Organisation:** KIT Department of Mathematics
- **Part of:** M-MATH-102953 - Algebraic Topology II

**Prerequisites**
none
### 8.19 Course: Analytical and Numerical Homogenization [T-MATH-111272]

<table>
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<tr>
<th>Responsible</th>
<th>Prof. Dr. Marlis Hochbruck</th>
</tr>
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**Prerequisites**

none
8.20 Course: Applications of Topological Data Analysis [T-MATH-111290]

**Responsible:** Dr. Andreas Ott
**Organisation:** KIT Department of Mathematics
**Part of:** M-MATH-105651 - Applications of Topological Data Analysis

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**Prerequisites**
none
Course: Applied Econometrics [T-WIWI-111388]

**8.21 Course: Applied Econometrics [T-WIWI-111388]**

**Responsible:** Prof. Dr. Melanie Schienle

**Organisation:** KIT Department of Economics and Management

**Part of:** M-WIWI-101638 - Econometrics and Statistics I

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<td>2520020</td>
<td>Applied Econometrics</td>
<td>2 SWS</td>
<td>Lecture / Online</td>
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<td>Krüger</td>
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<td>2520021</td>
<td>Tutorial in Applied Econometrics</td>
<td>2 SWS</td>
<td>Practice / Online</td>
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<td>Krüger, Koster</td>
<td></td>
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</table>

**Competence Certificate**

The assessment of this course is a written examination (90 min) according to §4(2), 1 of the examination regulation.

**Prerequisites**

None

**Below you will find excerpts from events related to this course:**

**Applied Econometrics**

2520020, WS 22/23, 2 SWS, Language: English, [Open in study portal]

**Content**

**Content:**

The course covers two econometric topics: (1) Conditional expectation and regression, and (2) Causal inference. Part (1) reviews foundations like the best linear predictor, least squares estimation, and robust covariance estimation. Part (2) introduces the potential outcomes framework for studying causal, what-if type questions such as ‘How does an internship affect a person’s future wage?’. It then presents research strategies like randomized trials, instrumental variables, and regression discontinuity.

For each part, we discuss econometric methods and theory, empirical examples (including recent research papers), and R implementation.

**Learning goal:**

Students are able to assess the properties of various econometric estimators and research designs, and to implement econometric estimators using R software.

**Workload:**

Total workload for 4.5 CP: approx. 135 hours

Attendance: 30 hours

Independent Study: 105 hours

**Literature**


**Responsible:** Prof. Dr. Ali Sunyaev  
**Organisation:** KIT Department of Economics and Management  
**Part of:** M-WIWI-101472 - Informatics

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<td>ST 2022</td>
<td>2511032</td>
<td>Applied Informatics - Principles of Internet Computing: Foundations for Emerging Technologies and Future Services</td>
<td>2 SWS</td>
<td>Lecture / 🗣 Sunyaev</td>
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<td>ST 2022</td>
<td>2511033</td>
<td>Übungen zu Angewandte Informatik - Internet Computing</td>
<td>1 SWS</td>
<td>Practice / 🖥 Sunyaev, Teigeler, Beyene</td>
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Legend: 🖥 Online, ☑️ Blended (On-Site/Online), 🗣 On-Site, ⬻ Canceled

**Competence Certificate**

The assessment consists of a written exam (60 min) according to Section 4(2), 1 of the examination regulation. The successful completion of the exercises is recommended for the written exam, which is offered at the end of the winter semester and at the end of the summer semester.

Successful participation in the exercise by submitting correct solutions to 50% of the exercises can earn a grade bonus. If the grade of the written exam is at least 4.0 and at most 1.3, the bonus will improve it by one grade level (i.e. by 0.3 or 0.4).

**Prerequisites**

None

**Annotation**

Replaces from winter semester 2019/2020 T-WIWI-109445 "Applied Informatics - Internet Computing".

*Below you will find excerpts from events related to this course:*
Content
The lecture Applied Computer Science - Internet Computing provides insights into fundamental concepts and future technologies of distributed systems and Internet computing. Students should be able to select, design and apply the presented concepts and technologies. The course first introduces basic concepts of distributed systems (e.g. design of architectures for distributed systems, Internet architectures, web services, middleware).

In the second part of the course, emerging technologies of Internet computing will be examined in depth. These include, among others:

- Cloud Computing
- Edge & Fog Computing
- Internet of Things
- Blockchain
- Artificial Intelligence

Learning objectives:
The student learns about basic concepts and emerging technologies of distributed systems and Internet computing. Practical topics will be deepened in lab classes.

Recommendations:
Knowledge of content of the module [WI1INFO].

Workload:
The total workload for this course is approximately 135-150 hours.

Literature
Wird in der Vorlesung bekannt gegeben
8.23 Course: Applied material flow simulation [T-MACH-112213]

Responsible: Dr.-Ing. Marion Baumann
Organisation: KIT Department of Mechanical Engineering

Part of: M-WIWI-102805 - Service Operations
M-WIWI-102832 - Operations Research in Supply Chain Management

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Events

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<td>2117054</td>
<td>Applied material flow simulation</td>
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<td>Lecture / On-Site</td>
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Legend: 🖥 Online, 🕰 Blended (On-Site/Online), 🗄 On-Site, ✗ Cancelled

Competence Certificate

The assessment consists of an oral exam (20 min.) taking place in the recess period according to § 4 paragraph 2 Nr. 2 of the examination regulation.

Prerequisites

None

Recommendation

- Basic statistical knowledge and understanding
- Knowledge of a common programming language (Java, Python, ...)
- Recommended course: T-WIWI-102718 - Discrete Event Simulation in Production and Logistics

Below you will find excerpts from events related to this course:

**Applied material flow simulation**

2117054, WS 22/23, 2 SWS, Language: German, [Open in study portal](#)
Content

Learning Content:

- Methods of modeling a simulation such as:
  - Discrete-event simulation
  - Agent based simulation
- Design of a simulation model of a material flow system
- Data exchange in simulation models
- Verification and validation of simulation models
- Execution of simulation studies
- Statistical evaluation and parameter study

This is an application-oriented course in which the course contents are applied and deepened using the Anylogic software.

Learning Goals:
Students are able to:

- select the appropriate simulation modeling method depending on a modeling objective and build a suitable simulation model for material flow systems,
- extend a simulation model in a meaningful way with data import and export,
- verify and validate a simulation model,
- conduct a simulation study efficiently and with meaningful results, and
- design and conduct a parameter study and statistically analyze and evaluate the results.

Recommendations:

- Basic statistical skills
- Prior knowledge of a common programming language (Java, Python, ...).
- Recommended course: T-WIWI-102718 - Discrete Event Simulation in Production and Logistics

Workload for 4,5 ECTS (135 h):

- regular attendance: 21 hours
- self-study: 114 hours

Literature


8.24 Course: Asset Pricing [T-WIWI-102647]

**Responsible:** Prof. Dr. Martin Ruckes  
Prof. Dr. Marliese Uhrig-Homburg

**Organisation:** KIT Department of Economics and Management

**Part of:**  
- M-WIWI-101480 - Finance 3  
- M-WIWI-101482 - Finance 1  
- M-WIWI-101483 - Finance 2  
- M-WIWI-101502 - Economic Theory and its Application in Finance

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**Events**

| ST 2022 | 2530555 | Asset Pricing | 2 SWS | Lecture / 🗣 | Uhrig-Homburg, Thimme |
| ST 2022 | 2530556 | Übung zu Asset Pricing | 1 SWS | Practice / 🗣 | Uhrig-Homburg, Böll |

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

**Competence Certificate**

Depending on further pandemic developments, the examination will be offered either as a 60-minute written examination or as an open-book examination (alternative exam assessment).

A bonus can be earned by correctly solving at least 50% of the posed bonus exercises. If the grade of the written examination is between 4.0 and 1.3, the bonus improves the grade by up to one grade level (0.3 or 0.4). Details will be announced in the lecture.

**Prerequisites**

None

**Recommendation**

We strongly recommend knowledge of the basic topics in investments (bachelor course), which will be necessary to be able to follow the course.

Below you will find excerpts from events related to this course:

**Asset Pricing**

2530555, SS 2022, 2 SWS, Language: German, [Open in study portal](#)

**Literature**

**Basisliteratur**


**Zur Wiederholung/Vertiefung**

8.25 Course: Auction Theory [T-WIWI-102613]

**Responsibility:** Prof. Dr. Karl-Martin Ehrhart

**Organisation:** KIT Department of Economics and Management

**Part of:**
- M-WIWI-101500 - Microeconomic Theory
- M-WIWI-102970 - Decision and Game Theory

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**Events**

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<td>2520409</td>
<td>Übungen zu Auktionstheorie</td>
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<td>Practice</td>
<td>Ehrhart</td>
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</table>

**Competence Certificate**

The assessment of this course is a written examination (following §4(2), 1 SPO) of 60 mins. The exam is offered each semester.

**Prerequisites**

None

Below you will find excerpts from events related to this course:

**Auktionstheorie**

2520408, WS 22/23, 2 SWS, Open in study portal

**Literature**

- Ausubel, L.M. and P. Cramton: Demand Reduction and Inefficiency in Multi-Unit Auctions, University of Maryland, 1999
8.26 Course: Bifurcation Theory [T-MATH-106487]

Responsible: Dr. Rainer Mandel
Organisation: KIT Department of Mathematics
Part of: M-MATH-103259 - Bifurcation Theory

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Prerequisites
None
8.27 Course: Blockchains & Cryptofinance [T-WIWI-108880]

**Responsible:** Dr. Philipp Schuster  
Dr. Philipp Schuster  
Prof. Dr. Marliese Uhrig-Homburg

**Organisation:** KIT Department of Economics and Management

**Part of:**  
M-WIWI-101480 - Finance 3  
M-WIWI-101483 - Finance 2

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**Competence Certificate**
The examination is offered for the last time in winter semester 20/21 for first-time writers and then again for second attempts. The assessment consists of a written exam (75 min).

A bonus can be earned by correctly solving at least 50% of the posed bonus exercises. If the grade of the written examination is between 4.0 and 1.3, the bonus improves the grade by up to one grade level (0.3 or 0.4). Details will be announced in the lecture.

Depending on further pandemic developments, the examination will be offered as an open-book examination (alternative exam assessment).

**Prerequisites**
None

**Recommendation**
None

**Annotation**
The lecture is currently not offered.


8.28 Course: Bond Markets [T-WIWI-110995]

**Responsible:** Prof. Dr. Marliese Uhrig-Homburg

**Organisation:** KIT Department of Economics and Management

**Part of:**
- M-WIWI-101480 - Finance 3
- M-WIWI-101483 - Finance 2

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**Legend:** 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

**Competence Certificate**

The assessment consists of a written exam (75min.)

A bonus can be earned by correctly solving at least 50% of the posed bonus exercises. If the grade of the written examination is between 4.0 and 1.3, the bonus improves the grade by up to one level (0.3 or 0.4). The examination is offered in each semester and can be repeated at any regular examination date.

Depending on further pandemic developments, the examination will be offered as an open-book examination (alternative exam assessment).

**Annotation**

This course will be held in English.

*Below you will find excerpts from events related to this course:*

**Bond Markets**

2530560, WS 22/23, 3 SWS, Language: English, [Open in study portal](#)

**Content**

The lecture “Bond Markets” deals with the national and international bond markets, which are an important source of financing for companies, as well as for the public sector. After an overview of the most important bond markets, different yield definitions are discussed. Based on this, the concept of the yield curve is presented. In addition, the theoretical and empirical relationships between ratings, default probabilities and spreads are analyzed. The focus will then be on questions regarding the valuation, measurement, management and control of credit risks.

The total workload for this course is approximately 135 hours (4.5 credits).

The assessment consists of a written exam (75min.) (according to §4(2), 1 SPO). A bonus can be earned by correctly solving at least 50% of the posed bonus exercises. If the grade of the written examination is between 4.0 and 1.3, the bonus improves the grade by up to one level (0.3 or 0.4). The examination is offered in each semester and can be repeated at any regular examination date.

Students deepen their knowledge of national and international bond markets. They gain knowledge of the traded instruments and their key figures for describing default risk such as ratings, default probabilities or credit spreads.

**Organizational issues**

wird als Blockveranstaltung angeboten, Termine werden gesondert bekannt gegeben.
8.29 Course: Bond Markets - Models & Derivatives [T-WIWI-110997]

**Responsible:** Prof. Dr. Marliese Uhrig-Homburg

**Organisation:** KIT Department of Economics and Management

**Part of:**
- M-WIWI-101480 - Finance 3
- M-WIWI-101483 - Finance 2

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**Events**

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<td>2530565</td>
<td>Bond Markets - Models &amp; Derivatives</td>
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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

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**Competence Certificate**

The assessment of success consists in equal parts of a written thesis and an oral exam including a discussion of one's own work. The main examination is offered once a year, re-examinations every semester.

**Recommendation**

Knowledge of "Bond Markets" and "Derivatives" courses is very helpful.

**Annotation**

This course will be held in English.

---

Below you will find excerpts from events related to this course:

**Content**

- **Competence Certificate:** The assessment of success consists in equal parts of a written thesis and an oral exam (according to §4(2), 3 SPO) including a discussion of one's own work. The main examination is offered once a year, re-examinations every semester.
- **Competence Goal:** Students deepen their knowledge of national and international bond markets. They are able to apply the knowledge they have gained about traded instruments and common valuation models for pricing derivative financial instruments.
- **Prerequisites:**
- **Content:** The lecture "Bond Markets – Models & Derivatives" deepens the content of the lecture "Bond Markets". The modelling of the dynamics of yield curves and the management of credit risks forms the theoretical foundation for the valuation of interest rate and credit derivatives to be discussed. In this course, students deal intensively with selected topics and acquire the relevant knowledge on their own.
- **Recommendation:** Knowledge of "Bond Markets" and "Derivatives" courses is very helpful.
- **Workload:** The total workload for this course is approximately 90 hours (3.0 credits).

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**Organizational issues**

Termine werden gesondert bekannt gegeben.
8.30 Course: Bond Markets - Tools & Applications [T-WIWI-110996]

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Competence Certificate
The assessment consists of an empirical case study with written elaboration and presentation. The main examination is offered once a year, re-examinations every semester.

Recommendation
Knowledge of the "Bond Markets" course is very helpful.

Annotation
This course will be held in English.

Below you will find excerpts from events related to this course:

Content
- **Competence Certificate:** The assessment consists of an empirical case study with written elaboration and presentation (according to §4(2), 3 SPO). The main examination is offered once a year, re-examinations every semester.
- **Competence Goal:** The students apply various methods in practice within the framework of a project-related case study. They are able to deal with empirical data and analyze them in a targeted manner.
- **Content:** The course "Bond Markets – Tools & Applications" includes a hands-on project in the field of national and international bond markets. Using empirical datasets, the students have to apply practical methods in order to analyze the data in a targeted manner.
- **Recommendation:** Knowledge of the "Bond Markets" course is very helpful.
- **Workload:** The total workload for this course is approximately 45 hours (1.5 credits).

Organizational issues
Termine werden gesondert bekannt gegeben
8.31 Course: Bott Periodicity [T-MATH-108905]

**Responsible:** Prof. Dr. Wilderich Tuschmann

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-104349 - Bott Periodicity

<table>
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<td>Grade to a third</td>
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**Prerequisites**

none
8.32 Course: Boundary and Eigenvalue Problems [T-MATH-105833]

**Responsible:** Prof. Dr. Dorothee Frey  
Prof. Dr. Dirk Hundertmark  
Prof. Dr. Tobias Lamm  
Prof. Dr. Michael Plum  
Prof. Dr. Wolfgang Reichel  
Prof. Dr. Roland Schnaubelt

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-102871 - Boundary and Eigenvalue Problems

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**Events**

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<td>Tutorial for 0157500 Boundary and Eigenvalue Problems</td>
<td>2</td>
<td>Practice</td>
<td>Lamm</td>
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</table>
8.33 Course: Boundary Element Methods [T-MATH-109851]

**Responsible:** PD Dr. Tilo Arens

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-103540 - Boundary Element Methods

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**Prerequisites**
none
8.34 Course: Brownian Motion [T-MATH-105868]

**Responsible:**
- Prof. Dr. Nicole Bäuerle
- Prof. Dr. Vicky Fasen-Hartmann
- Prof. Dr. Günter Last

**Organisation:**
KIT Department of Mathematics

**Part of:**
M-MATH-102904 - Brownian Motion

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**Prerequisites**
none
**8.35 Course: Business Intelligence Systems [T-WIWI-105777]**

**Responsible:** Prof. Dr. Alexander Mädche  
Mario Nadj  
Dr. Peyman Toreini

**Organisation:** KIT Department of Economics and Management  
**Part of:** M-WIWI-104068 - Information Systems in Organizations

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**Events**

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<td>Lecture / 🧩</td>
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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Canceled

**Competence Certificate**

Alternative exam assessment. The assessment consists of a one-hour exam and the implementation of a Capstone project. Details will be announced at the beginning of the course.

**Prerequisites**

None

**Recommendation**

Basic knowledge on database systems is helpful.

**Below you will find excerpts from events related to this course:**

**Content**

In most modern enterprises, Business Intelligence & Analytics (BI&A) Systems represent a core enabler of decision-making in that they are supplying up-to-date and accurate information about all relevant aspects of a company’s planning and operations: from stock levels to sales volumes, from process cycle times to key indicators of corporate performance. Modern BI&A systems leverage beyond reporting and dashboards also advanced analytical functions. Thus, today they also play a major role in enabling data-driven products and services. The aim of this course is to introduce theoretical foundations, concepts, tools, and current practice of BI&A Systems from a managerial and technical perspective.

The course is complemented with an engineering capstone project, where students work in a team with real-world use cases and data in order to create running Business intelligence & Analytics system prototypes.

**Learning objectives**

- Understand the theoretical foundations of key Business Intelligence & Analytics concepts supporting decision-making
- Explore key capabilities of state-of-the-art Business Intelligence & Analytics Systems
- Learn how to successfully implement and run Business Intelligence & Analytics Systems from multiple perspectives, e.g. architecture, data management, consumption, analytics
- Get hands-on experience by working with Business Intelligence & Analytics Systems with real-world use cases and data

**Prerequisites**

This course is limited to a capacity of 50 places. The capacity limitation is due to the attractive format of the accompanying engineering capstone project. Strong analytical abilities and profound skills in SQL as well as Python and/or R are required. Students have to apply with their CV and transcript of records. All organizational details and the underlying registration process of the lecture and the capstone project will be presented in the first lecture. The teaching language is English.
Literature

- Economist Intelligence Unit. 2015 "Big data evolution: Forging new corporate capabilities for the long term"

Further literature will be made available in the lecture.
8.36 Course: Business Process Modelling [T-WIWI-102697]

Responsible: Prof. Dr. Andreas Oberweis
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101472 - Informatics

Type: Written examination
Credits: 4,5
Grading scale: Grade to a third
Recurrence: Each winter term
Version: 2

Events

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<td>Lecture / On-Site</td>
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<td>1 SWS</td>
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Legend: 🖥 Online, ☐ Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

Competence Certificate
The assessment of this course is a written examination (60 min) according to §4(2), 1 of the examination regulation in the first week after lecture period.

Prerequisites
None

Below you will find excerpts from events related to this course:

Business Process Modelling
2511210, WS 22/23, 2 SWS, Language: German, Open in study portal

Content
The proper modeling of relevant aspects of business processes is essential for an efficient and effective design and implementation of processes. This lecture presents different classes of modeling languages and discusses the respective advantages and disadvantages of using actual application scenarios. For that simulative and analytical methods for process analysis are introduced. In the accompanying exercise the use of process modeling tools is practiced.

Learning objectives:
Students
- describe goals of business process modeling and apply different modeling languages,
- choose the appropriate modeling language according to a given context,
- use suitable tools for modeling business processes,
- apply methods for analysing and assessing process models to evaluate specific quality characteristics of the process model.

Recommendations:
Knowledge of course Applied Informatics I - Modelling is expected.

Workload:
- Lecture 30h
- Exercise 15h
- Preparation of lecture 24h
- Preparation of exercises 25h
- Exam preparation 40h
- Exam 1h

Literature

Weitere Literatur wird in der Vorlesung bekannt gegeben.
8.37 Course: Business Strategies of Banks [T-WIWI-102626]

**Responsible:** Prof. Dr. Wolfgang Müller

**Organisation:** KIT Department of Economics and Management

**Part of:**
- M-WIWI-101480 - Finance 3
- M-WIWI-101483 - Finance 2

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**Competence Certificate**
The lecture will be offered for the last time in the winter semester 2021/22. The exam will take place for the last time in the summer semester 2022 (only for repeaters).

**Prerequisites**
None

**Recommendation**
None

**Annotation**
The lecture will be offered for the last time in the winter semester 2021/22.
8 COURSES

Course: Challenges in Supply Chain Management [T-WIWI-102872]

**Responsible:** Esther Mohr

**Organisation:** KIT Department of Economics and Management

**Type:** Examination of another type

**Credits:** 4.5

**Grading scale:** Grade to a third

**Recurrence:** Each summer term

**Version:** 2

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**Events**

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<th>Lecture / Blended (On-Site/Online)</th>
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**Legend:** 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

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**Competence Certificate**

The assessment consists of a written paper and an oral exam of ca. 30-40 min.

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**Prerequisites**

None

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**Recommendation**

Basic knowledge as conveyed in the module "Introduction to Operations Research" is assumed.

---

**Annotation**

The number of course participants is limited to 12 participants due to joint work in BASF project teams. Due to these capacity restrictions, registration before course start is required. For further information see the webpage of the course.

The course is offered irregularly. The planned lectures and courses for the next three years are announced online.

---

Below you will find excerpts from events related to this course:

**Challenges in Supply Chain Management**

2550494, SS 2022, 3 SWS, Language: German, [Open in study portal](#)

**Lecture (V)**

Blended (On-Site/Online)

---

**Content**

The course consists of case studies of BASF which cover future challenges of supply chain management. Thus, the course aims at a case-study based presentation, critical evaluation and exemplary discussion of recent questions in supply chain management. The focus lies on future challenges and trends, also with regard to their applicability in practical cases (especially in the chemical industry).

The main part of the course is working on a project together with BASF in Ludwigshafen. The students get in touch with scientific working: The in-depth work with a special scientific topic makes the students familiar with scientific literature research and argumentation methods. As a further aspect of scientific work, especially for Master students the emphasis is put on a critical discussion of the project topic.

This course will include working on cutting edge supply chain topics like Industry 4.0 / "Internet of Everything in production", supply chain analytics, risk management, procurement and production in SCM. The team essays / project reports will be linked to industry-related challenges as well as to upcoming theoretical concepts. The topics of the seminar will be announced at the beginning of the term in a preliminary meeting.

---

**Organizational issues**

Bewerbung bis 31.03.22 über das WiWi-Portal möglich: [http://go.wiwi.kit.edu/ChallengesSCM](http://go.wiwi.kit.edu/ChallengesSCM)

---

**Literature**

Wird in Abhängigkeit vom Thema in den Projektteams bekanntgegeben.
8.39 Course: Classical Methods for Partial Differential Equations [T-MATH-105832]

**Responsible:**
Prof. Dr. Dorothee Frey  
Prof. Dr. Dirk Hundertmark  
Prof. Dr. Tobias Lamm  
Prof. Dr. Michael Plum  
Prof. Dr. Wolfgang Reichel  
Prof. Dr. Roland Schnaubelt

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-102870 - Classical Methods for Partial Differential Equations

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<td>0105310</td>
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<td>Practice</td>
<td>Hundertmark</td>
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### 8.40 Course: Combinatorics [T-MATH-105916]

**Responsible:** Prof. Dr. Maria Aksenovich  
**Organisation:** KIT Department of Mathematics  
**Part of:** M-MATH-102950 - Combinatorics

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**Prerequisites**  
none

**Annotation**  
The course is offered every second year.
### 8.41 Course: Commutative Algebra [T-MATH-108398]

**Responsible:** Prof. Dr. Frank Herrlich  
**Organisation:** KIT Department of Mathematics  
**Part of:** M-MATH-104053 - Commutative Algebra

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**Prerequisites**  
none

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Module Handbook as of 06/09/2022  
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**Prerequisites**
Keine

**Responsible:** Prof. Dr. Wilderich Tuschmann

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-102940 - Comparison Geometry
### 8.43 Course: Comparison of Numerical Integrators for Nonlinear Dispersive Equations [T-MATH-109040]

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<tr>
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**Prerequisites**
none
8.44 Course: Complex Analysis [T-MATH-105849]

**Responsible:**
- PD Dr. Gerd Herzog
- Prof. Dr. Michael Plum
- Prof. Dr. Wolfgang Reichel
- Dr. Christoph Schmoeger
- Prof. Dr. Roland Schnaubelt

**Organisation:**
- KIT Department of Mathematics

**Part of:**
- M-MATH-102878 - Complex Analysis

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8 COURSES

8.45 Course: Compressive Sensing [T-MATH-105894]

Responsible: Prof. Dr. Andreas Rieder
Organisation: KIT Department of Mathematics
Part of: M-MATH-102935 - Compressive Sensing

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Course: Computational Economics [T-WIWI-102680]

Responsible: apl. Prof. Dr. Pradyumn Kumar Shukla
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101472 - Informatics

Type: Written examination
Credits: 4.5
Grading scale: Grade to a third
Recurrence: Each winter term
Version: 3

Events

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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

Competence Certificate
The assessment consists of a written exam (60 min) (according to §4(2), 1 of the examination regulation). By successful completion of the exercises (§4 (2), 3 SPO 2007 respectively §4 (3) SPO 2015) a bonus can be obtained. If the grade of the written exam is at least 4.0 and at most 1.3, the bonus will improve it by one grade level (i.e. by 0.3 or 0.4). The bonus only applies to the first and second exam of the semester in which it was obtained.

Prerequisites
None

Annotation
The credits have been changed to 5 starting summer term 2016.

Below you will find excerpts from events related to this course:

Content
Examining complex economic problems with classic analytical methods usually requires making numerous simplifying assumptions, for example that agents behave rationally or homogeneously. Recently, widespread availability of computing power gave rise to a new field in economic research that allows the modeling of heterogeneity and forms of bounded rationality: Computational Economics. Within this new discipline, computer based simulation models are used for analyzing complex economic systems. In short, an artificial world is created which captures all relevant aspects of the problem under consideration. Given all exogenous and endogenous factors, the modelled economy evolves over time and different scenarios can be analyzed. Thus, the model can serve as a virtual testbed for hypothesis verification and falsification.

Learning objectives:

The student
- understands the methods of Computational Economics and applies them on practical issues,
- evaluates agent models considering bounded rational behaviour and learning algorithms,
- analyses agent models based on mathematical basics,
- knows the benefits and disadvantages of the different models and how to use them,
- examines and argues the results of a simulation with adequate statistical methods,
- is able to support the chosen solutions with arguments and can explain them.
Literature


Weiterführende Literatur:


**Responsible:** Prof. Dr. Michael Plum

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-102883 - Computer-Assisted Analytical Methods for Boundary and Eigenvalue Problems

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</table>
8.48 Course: Continuous Time Finance [T-MATH-105930]

**Responsible:** Prof. Dr. Nicole Bäuerle  
Prof. Dr. Vicky Fasen-Hartmann  
Prof. Dr. Mathias Trabs

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-102860 - Continuous Time Finance

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<td>Finanzmathematik in stetiger Zeit</td>
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8.49 Course: Control Theory [T-MATH-105909]

**Responsible:** Prof. Dr. Roland Schnaubelt  
**Organisation:** KIT Department of Mathematics  
**Part of:** M-MATH-102941 - Control Theory

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**Prerequisites**
none
8.50 Course: Convex Analysis [T-WIWI-102856]

Responsible: Prof. Dr. Oliver Stein
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101473 - Mathematical Programming

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Competence Certificate
The assessment of the lecture is a written examination (60 minutes) according to §4(2), 1 of the examination regulation. The successful completion of the exercises is required for admission to the written exam.
The examination is held in the semester of the lecture and in the following semester.

Prerequisites
None

Recommendation
It is strongly recommended to visit at least one lecture from the Bachelor program of this chair before attending this course.

Annotation
The lecture is offered irregularly. The curriculum of the next three years is available online (www.ior.kit.edu).
8.51 Course: Convex Geometry [T-MATH-105831]

**Responsible:** Prof. Dr. Daniel Hug

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-102864 - Convex Geometry

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<th>Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oral examination</td>
<td>8</td>
<td>Grade to a third</td>
<td>1</td>
</tr>
</tbody>
</table>
8.52 Course: Corporate Financial Policy [T-WIWI-102622]

Responsible: Prof. Dr. Martin Ruckes
Organisation: KIT Department of Economics and Management
Part of:
- M-WIWI-101480 - Finance 3
- M-WIWI-101483 - Finance 2
- M-WIWI-101502 - Economic Theory and its Application in Finance

<table>
<thead>
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<th>Recurrence</th>
<th>Version</th>
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<td>Grade to a third</td>
<td>Each summer term</td>
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</table>

Events

| ST 2022    | 2530214 | Corporate Financial Policy | 2 SWS | Lecture / 🗣 | Ruckes |
| ST 2022    | 2530215 | Übungen zu Corporate Financial Policy | 1 SWS | Practice / 🗣 | Ruckes, Hoang |

Legend: 🖥 Online, 🕒 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

Competence Certificate
The assessment of this course is a written examination (following §4(2), 1 SPO) of 60 mins.
The exam is offered each semester.

Prerequisites
None

Below you will find excerpts from events related to this course:

V Corporate Financial Policy
2530214, SS 2022, 2 SWS, Language: English, Open in study portal

Lecture (V) On-Site

Content
The course develops the foundations for the management and financing of firms in imperfect markets.

The course covers the following topics:

- Measures of good corporate governance
- Corporate finance
- Liquidity management
- Executive compensation and incentives
- Corporate takeovers

Learning outcomes: The students

- are able to explain the importance of information asymmetry for the contract design of firms,
- are capable to evaluate measures for the reduction of information asymmetry,
- are in the position to analyze contracts with regard to their incentive and communication effects.
8.53 Course: Corporate Risk Management [T-WIWI-109050]

**Responsible:** Prof. Dr. Martin Ruckes

**Organisation:** KIT Department of Economics and Management

**Part of:**
- M-WIWI-101480 - Finance 3
- M-WIWI-101483 - Finance 2
- M-WIWI-101502 - Economic Theory and its Application in Finance

<table>
<thead>
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<td>4.5</td>
<td>Grade to a third</td>
<td>Each summer term</td>
<td>2</td>
</tr>
</tbody>
</table>

**Competence Certificate**
The assessment consists of a written exam (60 min.) according to § 4 paragraph 2 Nr. 1 of the examination regulation. If there are only a small number of participants registered for the exam, we reserve the right to hold an oral examination instead of a written one.

Please note that the exam is only offered in the semester of the lecture as well as in the following semester.

**Prerequisites**
None

**Recommendation**
None

**Annotation**
The course will be held again in the summer term 2023 at the earliest. Please pay attention to the announcements on our website.
### 8.54 Course: Critical Information Infrastructures [T-WWI-109248]

**Responsible:** Prof. Dr. Ali Sunyaev  
**Organisation:** KIT Department of Economics and Management  
**Part of:** M-WWI-101472 - Informatics

<table>
<thead>
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<table>
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<th>Type</th>
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<th>Lecturer</th>
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<tr>
<td>WT 22/23</td>
<td>Critical Information Infrastructures</td>
<td>2 SWS</td>
<td>Lecture</td>
<td>Sunyaev, Dehling, Lins</td>
<td></td>
</tr>
<tr>
<td>WT 22/23</td>
<td>Exercises to Critical Information Infrastructures</td>
<td>1 SWS</td>
<td>Practice</td>
<td>Sunyaev, Dehling, Lins</td>
<td></td>
</tr>
</tbody>
</table>

**Competence Certificate**

The alternative exam assessment consists of

- the preparation of a written elaboration as well as
- an oral examination as part of a presentation of the work.

Details of the grades will be announced at the beginning of the course.

The examination is only offered to first-time students in the winter semester, but can be repeated in the following summer semester.

**Prerequisites**

None.

**Annotation**

**Course: Database Systems and XML [T-WIWI-102661]**

**Responsible:** Prof. Dr. Andreas Oberweis  
**Organisation:** KIT Department of Economics and Management  
**Part of:** M-WIWI-101472 - Informatics

**Type**  
Written examination

**Credits**  
4.5

**Grading scale**  
Grade to a third

**Recurrence**  
Each winter term

**Version**  
2

**Events**

<table>
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<tr>
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<th>Type</th>
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<th>Recurrence</th>
<th>Version</th>
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<td>2511202</td>
<td>Database Systems and XML</td>
<td>2 SWS</td>
<td>Lecture / 🗣</td>
<td>1</td>
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<td>WT 22/23</td>
<td>2511203</td>
<td>Exercises Database Systems and XML</td>
<td>1 SWS</td>
<td>Practice / 🗣</td>
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</tbody>
</table>

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Canceled

**Competence Certificate**

The assessment consists of a written exam (60 minutes) (following §4(2) of the examination regulation). The exam takes place in every semester. Re-examinations are offered at every ordinary examination date. Depending on the respective pandemic situation, the exam may be offered as an open book exam (alternative exam assessment, following §4(2), 3 of the examination regulation).

**Prerequisites**

None

**Below you will find excerpts from events related to this course:**

**V Database Systems and XML**

| 2511202, WS 22/23, 2 SWS, Language: German, Open in study portal |

**Lecture (V) On-Site**

**Content**

Databases are a proven technology for managing large amounts of data. The oldest database model, the hierarchical model, was replaced by different models such as the relational or the object-oriented data model. The hierarchical model became particularly more important with the emergence of the extensible Markup Language XML. XML is a data format for structured, semi-structured, and unstructured data. In order to store XML documents consistently and reliably, databases or extensions of existing database systems are required. Among other things, this lecture covers the data model of XML, concepts of XML query languages, aspects of storage of XML documents, and XML-oriented database systems.

**Learning objectives:**

Students

- know the basics of XML and generate XML documents,
- are able to use XML database systems and to formulate queries to XML documents,
- know to assess the use of XML in operational practice in different application contexts.

**Workload:**

- Lecture 30h  
- Exercise 15h  
- Preparation of lecture 24h  
- Preparation of exercises 25h  
- Exam preparation 40h  
- Exam 1h

**Literature**

- W. Kazakos, A. Schmidt, P. Tomchyk: Datenbanken und XML. Springer-Verlag 2002  
- G. Vossen: Datenbankmodelle, Datenbanksprachen und Datenbankmanagementsysteme. Oldenbourg 2008

Weitere Literatur wird in der Vorlesung bekannt gegeben.
8.56 Course: Demand-Driven Supply Chain Planning [T-WIWI-110971]

**Responsible:** Josef Packowski  
**Organisation:** KIT Department of Economics and Management  
**Part of:** M-WIWI-102805 - Service Operations

<table>
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<th>Version</th>
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<td>Grade to a third</td>
<td>Each winter term</td>
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</table>

**Competence Certificate**  
The assessment consists of a written exam.

**Annotation**  
Due to capacity restrictions, registration before course start is required. For further information see the webpage of the course. The course is planned to be held every winter term. The planned lectures and courses for the next three years are announced online.
8 COURSES

Course: Derivatives [T-WIWI-102643]

8.57 Course: Derivatives [T-WIWI-102643]

- **Responsible:** Prof. Dr. Marliese Uhrig-Homburg
- **Organisation:** KIT Department of Economics and Management
- **Part of:** M-WIWI-101480 - Finance 3
  - M-WIWI-101482 - Finance 1
  - M-WIWI-101483 - Finance 2

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<td>Each summer term</td>
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**Events**

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<th>Type</th>
<th>Lecturer</th>
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<td>ST 2022</td>
<td>2530550</td>
<td>Derivatives</td>
<td>2</td>
<td>Lecture / 🗣️</td>
<td>Thimme, Uhrig-Homburg</td>
</tr>
<tr>
<td>ST 2022</td>
<td>2530551</td>
<td>Übung zu Derivate</td>
<td>1</td>
<td>Practice / 🗣️</td>
<td>Thimme, Eska, Uhrig-Homburg</td>
</tr>
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</table>

**Legend:** 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ☝️ Canceled

**Competence Certificate**

Depending on further pandemic developments, the examination will be offered either as a 60-minute written examination or as an open-book examination (alternative exam assessment).

A bonus can be earned by correctly solving at least 50% of the posed bonus exercises. If the grade of the written examination is between 4.0 and 1.3, the bonus improves the grade by up to one grade level (0.3 or 0.4). Details will be announced in the lecture.

**Prerequisites**

None

**Recommendation**

None

Below you will find excerpts from events related to this course:

<table>
<thead>
<tr>
<th>V Derivatives</th>
<th>Lecture (V) On-Site</th>
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<tbody>
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<td>2530550, SS 2022, 2 SWS, Language: German, Open in study portal</td>
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**Literature**


**Weiterführende Literatur:**

Course: Designing Interactive Systems [T-WIWI-110851]

**Responsible:** Prof. Dr. Alexander Mädche

**Organisation:** KIT Department of Economics and Management

**Part of:** M-WIWI-104068 - Information Systems in Organizations

**Events**

<table>
<thead>
<tr>
<th>Event</th>
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<th>Grading scale</th>
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<td>2540558</td>
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<td>4.5</td>
<td>Grade to a third</td>
<td>Each summer term</td>
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</table>

**Competence Certificate**

Alternative exam assessment. The assessment consists of a one-hour exam and the implementation of a Capstone project. Details will be announced at the beginning of the course.

**Annotation**

The course is held in english.

**Below you will find excerpts from events related to this course:**

**Content**

**Description**

Computers have evolved from batch processors towards highly interactive systems. This offers new possibilities but also challenges for the successful design of the interaction between human and computer. Interactive system are socio-technical systems in which users perform tasks by interacting with technology in a specific context in order to achieve specified goals and outcomes.

The aim of this course is to introduce advanced concepts and theories, interaction technologies as well as current practice of contemporary interactive systems.

The course is complemented with a design capstone project, where students in a team select and apply design methods & techniques in order to create an interactive prototype

**Learning objectives**

- Get an advanced understanding of conceptual foundations of interactive systems from a human and computer perspective
- explore the theoretical grounding of Interactive Systems leveraging theories from reference disciplines such as psychology
- know specific design principles for the design of advanced interactive systems
- get hands-on experience in conceptualizing and designing advanced Interactive Systems to solve a real-world challenge from an industry partner by applying the lecture contents.

**Prerequisites**

No specific prerequisites are required for the lecture
Literatur
Die Vorlesung basiert zu einem großen Teil auf


Weiterführende Literatur wird in der Vorlesung bereitgestellt.
### 8.59 Course: Differential Geometry [T-MATH-102275]

**Responsible:** Dr. Sebastian Grensing  
Prof. Dr. Enrico Leuzinger  
Prof. Dr. Wilderich Tuschmann

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-101317 - Differential Geometry

<table>
<thead>
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<th>Version</th>
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**Events**

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<th>4 SWS</th>
<th>Lecture</th>
<th>Tuschmann</th>
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<tbody>
<tr>
<td>ST 2022</td>
<td>0100310</td>
<td>Tutorial for 0100300 (Differential Geometry)</td>
<td>2 SWS</td>
<td>Practice</td>
<td>Tuschmann, Kupper</td>
</tr>
</tbody>
</table>
8.60 Course: Digital Health [T-WIWI-109246]

**Responsible:** Prof. Dr. Ali Sunyaev  
**Organisation:** KIT Department of Economics and Management  
**Part of:** M-WIWI-101472 - Informatics

<table>
<thead>
<tr>
<th>Type</th>
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<tbody>
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<td>Examination of another type</td>
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<td>Grade to a third</td>
<td>Each winter term</td>
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**Events**

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<th>Type</th>
<th>Contact hours</th>
<th>Lecturer(s)</th>
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<tr>
<td>WT 22/23</td>
<td>2511402</td>
<td>Digital Health</td>
<td>2 SWS Lecture</td>
<td>Sunyaev, Thiebes, Schmidt-Kraepelin</td>
</tr>
</tbody>
</table>

**Competence Certificate**

Alternative exam assessment (written elaboration, presentation, peer review, oral participation) according to §4(2),3 of the examination regulation. Details of the grading will be announced at the beginning of the course. The examination is only offered to first-time writers in the winter semester, but can be repeated in the following summer semester.

**Prerequisites**

None.
8.61 Course: Digital Marketing and Sales in B2B [T-WIWI-106981]

**Responsible:** Prof. Dr. Martin Klarmann
Anja Konhäuser

**Organisation:** KIT Department of Economics and Management

**Part of:** M-WIWI-105312 - Marketing and Sales Management

<table>
<thead>
<tr>
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**Events**

<table>
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<th>ST 2022</th>
<th>2571156</th>
<th>Digital Marketing and Sales in B2B</th>
<th>1 SWS</th>
<th>Others (sons / 🗣)</th>
<th>Konhäuser</th>
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</thead>
</table>

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

**Competence Certificate**

Alternative exam assessment according to § 4 paragraph 2 Nr. 3 of the examination regulation. (team presentation of a case study with subsequent discussion totalling 30 minutes).

**Prerequisites**

None.

**Annotation**

Participation requires an application. The application period starts at the beginning of the semester. More information can be obtained on the website of the research group Marketing and Sales (marketing.iism.kit.edu). Access to this course is restricted. Typically all students will be granted the attendance of one course with 1.5 ECTS. Nevertheless attendance can not be guaranteed. For further information please contact Marketing and Sales Research Group (marketing.iism.kit.edu). Please note that only one of the 1.5-ECTS courses can be attended in this module.

*Below you will find excerpts from events related to this course:*

**Digital Marketing and Sales in B2B**

<table>
<thead>
<tr>
<th>2571156, SS 2022, 1 SWS, Language: English, Open in study portal</th>
<th>Others (sonst.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>On-Site</td>
<td></td>
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</tbody>
</table>
Content

Learning Sessions:
The class gives insights into digital marketing strategies as well as the effects and potential of different channels (e.g., SEO, SEA, Social Media). After an overview of possible activities and leverages in the digital marketing field, including their advantages and limits, the focus will turn to the B2B markets. There are certain requirements in digital strategy specific to the B2B market, particularly in relation to the value chain, sales management and customer support. Therefore, certain digital channels are more relevant for B2B marketing than for B2C marketing.

Once the digital marketing and tactics for the B2B markets are defined, further insights will be given regarding core elements of a digital strategy: device relevance (mobile, tablet), usability concepts, website appearance, app decision, market research and content management. A major advantage of digital marketing is the possibility of being able to track many aspects of user reactions and user behaviour. Therefore, an overview of key performance indicators (KPIs) will be discussed and relationships between these KPIs will be explained. To measure the effectiveness of digital activities, a digital report should be set up and connected to the performance numbers of the company (e.g. product sales) – within the course the setup of the KPI dashboard and combination of digital and non-digital measures will be shown to calculate the Return on Investment (RoI).

Presentation Sessions:
After the learning sessions, the students will form groups and work on digital strategies within a case study format. The presentation of the digital strategy will be in front of the class whereas the presentation will take 20 minutes followed by 10 minutes questions and answers.

- Understand digital marketing and sales approaches for the B2B sector
- Recognise important elements and understand how-to-setup of digital strategies
- Become familiar with the effectiveness and usage of different digital marketing channels
- Understand the effect of digital sales on sales management, customer support and value chain
- Be able to measure and interpret digital KPIs
- Calculate the Return on Investment (RoI) for digital marketing by combining online data with company performance data

time of presentness = 15 hrs.
private study = 30 hrs.

Organizational issues
Blockveranstaltung, Raum 115, Geb. 20.21, Termine werden noch bekannt gegeben

Literature
-
# 8.62 Course: Discrete Dynamical Systems [T-MATH-110952]

**Responsible:** PD Dr. Gerd Herzog  
**Organisation:** KIT Department of Mathematics  
**Part of:** M-MATH-105432 - Discrete Dynamical Systems

<table>
<thead>
<tr>
<th>Type</th>
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## Events

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<td>Diskrete dynamische Systeme</td>
<td>2 SWS</td>
<td>Lecture / 🗣️</td>
<td>Herzog</td>
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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣️ On-Site, ☑️ Cancelled

**Prerequisites**

None
8 COURSES

Course: Discrete Time Finance [T-MATH-105839]

8.63 Course: Discrete Time Finance [T-MATH-105839]

**Responsible:** Prof. Dr. Nicole Bäuerle
Prof. Dr. Vicky Fasen-Hartmann
Prof. Dr. Mathias Trabs

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-102919 - Discrete Time Finance

<table>
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**Events**

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<th>0108400</th>
<th>Finanzmathematik in diskreter Zeit</th>
<th>4 SWS</th>
<th>Lecture / 🗣</th>
<th>Fasen-Hartmann</th>
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</thead>
<tbody>
<tr>
<td>WT 22/23</td>
<td>0108500</td>
<td>Übungen zu 0108400</td>
<td>2 SWS</td>
<td>Practice / 🗣</td>
<td>Fasen-Hartmann</td>
</tr>
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</table>

**Prerequisites**
none

**Legend:** 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled
8.64 Course: Discrete-Event Simulation in Production and Logistics [T-WIWI-102718]

**Responsible:** Dr. Sven Spieckermann

**Organisation:** KIT Department of Economics and Management

**Part of:**
- M-WIWI-102805 - Service Operations
- M-WIWI-102832 - Operations Research in Supply Chain Management

<table>
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<th>Credits</th>
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<th>Recurrence</th>
<th>Version</th>
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<td>Examination of another type</td>
<td>4,5</td>
<td>Grade to a third</td>
<td>Each summer term</td>
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**Events**

| ST 2022 | 2550488 | Ereignisdiskrete Simulation in Produktion und Logistik | 3 SWS | Lecture / 🗣 | Spieckermann |

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, x Cancelled

**Competence Certificate**
The assessment consists of a written paper and an oral exam of about 30-40 min (alternative exam assessment).

**Prerequisites**
None

**Recommendation**
Basic knowledge as conveyed in the module "Introduction to Operations Research" is assumed.

**Annotation**
Due to capacity restrictions, registration before course start is required. For further information see the webpage of the course.
The course is planned to be held every summer term.
The planned lectures and courses for the next three years are announced online.

**Below you will find excerpts from events related to this course:**

**Ereignisdiskrete Simulation in Produktion und Logistik**

| 2550488, SS 2022, 3 SWS, Language: German, Open in study portal |
| Lecture (V) On-Site |

**Content**
Simulation of production and logistics systems is an interdisciplinary subject connecting expert knowledge from production management and operations research with mathematics/statistics as well as computer science and software engineering. With completion of this course, students know statistical foundations of discrete simulation, are able to classify and apply related software applications, and know the relation between simulation and optimization as well as a number of application examples. Furthermore, students are enabled to structure simulation studies and are aware of specific project scheduling issues.

**Organizational issues**
Den Bewerbungszeitraum finden Sie auf der Veranstaltungswebseite im Lehre-Bereich unter dol.io.r.kit.edu

**Literature**
8.65 Course: Dispersive Equations [T-MATH-109001]

**Responsible:** Prof. Dr. Wolfgang Reichel

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-104425 - Dispersive Equations

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**Prerequisites**
none
8.66 Course: Dynamic Macroeconomics [T-WIWI-109194]

**Responsible:** Prof. Dr. Johannes Brumm  
**Organisation:** KIT Department of Economics and Management  
**Part of:**  
- M-WIWI-101478 - Innovation and Growth  
- M-WIWI-101496 - Growth and Agglomeration

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**Events**

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<th>2 SWS</th>
<th>Lecture / 🗣️</th>
<th>Brumm</th>
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<tr>
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<td>2560403</td>
<td>Übung zu Dynamic Macroeconomics</td>
<td>1 SWS</td>
<td>Practice / 🗣️</td>
<td>Hußmann</td>
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</table>

**Competence Certificate**  
The assessment is a written exam (60 min.).

**Prerequisites**  
None.

**Below you will find excerpts from events related to this course:**

**Dynamic Macroeconomics**  
2560402, WS 22/23, 2 SWS, Language: English, [Open in study portal](#)  
Lecture (V)  
On-Site

**Content**  
This course addresses macroeconomic questions on an advanced level. The main focus of this course is on dynamic programming and its fundamental role in modern macroeconomics. In the first part of the course, the necessary mathematical tools are introduced as well as basic applications in labor economics, economic growth and business cycle analysis. In the second part of the course, these basic models are expanded to incorporate household heterogeneity in various forms: Models of economic inequality to analyze the distributional impact of tax policies and models of overlapping generations to analyze the impact of social security reforms or changes in government debt. Finally, advanced methods based on sparse grids or neural nets are introduced to solve high-dimensional models. The course pursues a hands-on approach so that students not only gain theoretical insights but also learn numerical tools to solve dynamic economic models using the programming language Python.

**Literature**  
Literatur und Skripte werden in der Veranstaltung angegeben.
8.67 Course: Dynamical Systems [T-MATH-106114]

**Responsible:** Prof. Dr. Jens Rottmann-Matthes

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-103080 - Dynamical Systems

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**Prerequisites**
none
8 COURSES
Course: Efficient Energy Systems and Electric Mobility [T-WIWI-102793]

T 8.68 Course: Efficient Energy Systems and Electric Mobility [T-WIWI-102793]

| Responsible: | PD Dr. Patrick Jochem |
| Organisation: | KIT Department of Economics and Management |
| Part of: | M-WIWI-101452 - Energy Economics and Technology |

| Type | Written examination |
| Credits | 3.5 |
| Grading scale | Grade to a third |
| Recurrence | Each summer term |
| Version | 1 |

**Competence Certificate**
The assessment consists of a written exam (60 minutes) (following §4(2) of the examination regulation). The exam takes place in every semester. Re-examinations are offered at every ordinary examination date. Depending on the respective pandemic situation, the exam may be offered as an open book exam (alternative exam assessment, following §4(2), 3 of the examination regulation).

**Prerequisites**
None

**Recommendation**
None

Below you will find excerpts from events related to this course:

**Efficient Energy Systems and Electric Mobility**
2581006, SS 2022, 2 SWS, Language: English, Open in study portal

**Content**
This lecture series combines two of the most central topics in the field of energy economics at present, namely energy efficiency and electric mobility. The objective of the lecture is to provide an introduction and overview to these two subject areas, including theoretical as well as practical aspects, such as the technologies, political framework conditions and broader implications of these for national and international energy systems.

- Understand the concept of energy efficiency as applied to specific systems
- Obtain an overview of the current trends in energy efficiency
- Be able to determine and evaluate alternative methods of energy efficiency improvement
- Overview of technical and economical stylized facts on electric mobility
- Judging economical, ecological and social impacts through electric mobility

**Organizational issues**
s. Institutsaushang

**Literature**
Wird in der Vorlesung bekanntgegeben.
8.69 Course: eFinance: Information Systems for Securities Trading [T-WIWI-110797]

**Responsible:** Prof. Dr. Christof Weinhardt

**Organisation:** KIT Department of Economics and Management

**Part of:**
- M-WIWI-101480 - Finance 3
- M-WIWI-101483 - Finance 2

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<td>1 SWS</td>
<td>Practice / 🗣️</td>
<td>Jaquart</td>
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**Legend:** 🖥 Online, 🎫 Blended (On-Site/Online), 🗣️ On-Site, ✗ Canceled

**Competence Certificate**

Success is monitored by means of ongoing elaborations and presentations of tasks and an examination (60 minutes) at the end of the lecture period. The scoring scheme for the overall evaluation will be announced at the beginning of the course.

**Annotation**

The course "eFinance: Information Systems for Securities Trading" covers different actors and their function in the securities industry in-depth, highlighting key trends in modern financial markets, such as Distributed Ledger Technology, Sustainable Finance, and Artificial Intelligence. Security prices evolve through a large number of bilateral trades, performed by market participants that have specific, well-regulated and institutionalized roles. Market microstructure is the subfield of financial economics that studies the price formation process. This process is significantly impacted by regulation and driven by technological innovation. Using the lens of theoretical economic models, this course reviews insights concerning the strategic trading behaviour of individual market participants, and models are brought market data. Analytical tools and empirical methods of market microstructure help to understand many puzzling phenomena in securities markets.

Below you will find excerpts from events related to this course:

**eFinance: Information Systems for Securities Trading**

2540454, WS 22/23, 2 SWS, Language: English, Open in study portal

**Literature**


**Weiterführende Literatur:**

8.70 Course: Emerging Trends in Digital Health [T-WIWI-110144]

**Responsible:** Prof. Dr. Ali Sunyaev  
**Organisation:** KIT Department of Economics and Management  
**Part of:** M-WIWI-101472 - Informatics

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<tr>
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Legend: 🖥️ Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Canceled

**Competence Certificate**
The alternative exam assessment consists of a final thesis.

**Prerequisites**
None.

**Annotation**
The course is usually held as a block course.
8.71 Course: Emerging Trends in Internet Technologies [T-WIWI-110143]

**Responsible:** Prof. Dr. Ali Sunyaev

**Organisation:** KIT Department of Economics and Management

**Part of:** M-WIWI-101472 - Informatics

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<td>Seminar Emerging Trends in Internet Technologies (Master)</td>
<td>2</td>
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</table>

**Competence Certificate**
The alternative exam assessment consists of a final thesis.

**Prerequisites**
None.

**Annotation**
The course is usually held as a block course.
8.72 Course: Energy and Environment [T-WIWI-102650]

**Responsible:** Ute Karl  
**Organisation:** KIT Department of Economics and Management  
**Part of:** M-WIWI-101452 - Energy Economics and Technology

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**Events**

| ST 2022 | 2581003 | Energy and Environment | 2 SWS | Lecture / 🗣️ | Karl |
| ST 2022 | 2581004 | Übungen zu Energie und Umwelt | 1 SWS | Practice / 🗣️ | Langenmayr, Fichtner, Kraft |

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣️ On-Site, ✗ Cancelled

**Competence Certificate**

The assessment consists of a written exam (60 minutes) (following §4(2) of the examination regulation). The exam takes place in every semester. Re-examinations are offered at every ordinary examination date. Depending on the respective pandemic situation, the exam may be offered as an open book exam (alternative exam assessment, following §4(2), 3 of the examination regulation).

**Prerequisites**

None.

Below you will find excerpts from events related to this course:

**Energy and Environment**  
2581003, SS 2022, 2 SWS, Language: German, Open in study portal

**Lecture (V)**  
On-Site

**Content**

The lecture focuses on the environmental impacts arising from fossil fuels use and on the methods for the evaluation of such impacts. The first part of the lecture describes the environmental impacts of air pollutants and greenhouse gases as well as technical measures for emission control. The second part covers methods of impact assessment and their use in environmental communication as well as methods for the scientific support of emission control strategies.

The topics include:

- Fundamentals of energy conversion
- Formation of air pollutants during combustion
- Technical measures to control emissions from fossil-fuel combustion processes
- External effects of energy supply (life cycle analyses of selected energy systems)
- Environmental communication on energy services (e.g. electricity labelling, carbon footprint)
- Integrated Assessment Modelling to support the European Clean Air Strategy
- Cost-effectiveness analyses and cost-benefit analyses for emission control strategies
- Monetary valuation of external effects (external costs)

**Literature**

Die Literaturhinweise sind in den Vorlesungsunterlagen enthalten (vgl. ILIAS)
8.73 Course: Energy Market Engineering [T-WIWI-107501]

Responsible: Prof. Dr. Christof Weinhardt
Organisation: KIT Department of Economics and Management
         M-WIWI-103720 - eEnergy: Markets, Services and Systems

<table>
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Events

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<td>1 SWS</td>
<td>Practice / Semmelmann</td>
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Competence Certificate
The assessment consists of a written exam (60 min) (according to §4(2), 1 of the examination regulations). By successful completion of the exercises (§4 (2), 3 SPO 2007 respectively §4 (3) SPO 2015) a bonus can be obtained. If the grade of the written exam is at least 4.0 and at most 1.3, the bonus will improve it by one grade level (i.e. by 0.3 or 0.4).

Prerequisites
None

Recommendation
None

Annotation
Former course title until summer term 2017: T-WIWI-102794 "eEnergy: Markets, Services, Systems".
The lecture has also been added in the IIP Module Basics of Liberalised Energy Markets.

Below you will find excerpts from events related to this course:

Energy Market Engineering
2540464, SS 2022, 2 SWS, Language: German, Open in study portal

Literature
8.74 Course: Energy Networks and Regulation [T-WIWI-107503]

**Responsible:** Prof. Dr. Christof Weinhardt

**Organisation:** KIT Department of Economics and Management

**Part of:** M-WIWI-103720 - eEnergy: Markets, Services and Systems

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**Legend:** 🖥 Online, 🧩 Blended (On-Site/Online), 🗓 On-Site, x Cancelled

**Competence Certificate**
The assessment consists of a written exam according to Section 4 (2), 1 of the examination regulation. The exam is offered every semester. Re-examinations are offered on every ordinary examination date.

**Prerequisites**
None

**Recommendation**
None

**Annotation**
Former course title until summer term 2017: T-WIWI-103131 "Regulatory Management and Grid Management - Economic Efficiency of Network Operation"

**Below you will find excerpts from events related to this course:**

**Energy Networks and Regulation**
2540494, WS 22/23, 2 SWS, Language: German, [Open in study portal](#)
Content

Learning Goals

The student,

- understands the business model of a network operator and knows its central tasks in the energy supply system,
- has a holistic overview of the interrelationships in the network economy,
- understands the regulatory and business interactions,
- is in particular familiar with the current model of incentive regulation with its essential components and understands its implications for the decisions of a network operator
- is able to analyse and assess controversial issues from the perspective of different stakeholders.

Content of teaching

The lecture "Energy Networks and Regulation" provides insights into the regulatory framework of electricity and gas. It touches upon the way the grids are operated and how regulation affects almost all grid activities. The lecture also addresses approaches of grid companies to cope with regulation on a managerial level. We analyze how the system influences managerial decisions and strategies such as investment or maintenance. Furthermore, we discuss how the system affects the operator’s abilities to deal with the massive challenges lying ahead ("Energiewende", redispatch, European grid integration, electric vehicles etc.). Finally, we look at current developments and major upcoming challenges, e.g., the smart meter rollout. Covered topics include:

- Grid operation as a heterogeneous landscape: big vs. small, urban vs. rural, TSO vs. DSO
- Objectives of regulation: Fair price calculation and high standard access conditions
- The functioning of incentive regulation
- First major amendment to the incentive regulation: its merits, its flaws
- The revenue cap and how it is adjusted according to certain exogenous factors
- Grid tariffs: How are they calculated, what is the underlying rationale, do we need a reform (and which)?
- Exogenous costs shifted (arbitrarily?) into the grid, e.g. feed-in tariffs for renewable energy or decentralized supply.

Literature


## 8.75 Course: Energy Systems Analysis [T-WIWI-102830]

**Responsible:** Dr. Armin Ardone  
Prof. Dr. Wolf Fichtner

**Organisation:** KIT Department of Economics and Management  
**Part of:** M-WIWI-101452 - Energy Economics and Technology

<table>
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<th>Version</th>
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**Events**

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<td>Energy Systems Analysis</td>
<td>2 SWS</td>
<td>Lecture</td>
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Legend: 🕹️ Online, 🧩 Blended (On-Site/Online), ⌚️ On-Site, Ⓞ Cancelled

### Competence Certificate

The assessment consists of a written exam (60 minutes) (following §4(2) of the examination regulation). The exam takes place in every semester. Re-examinations are offered at every ordinary examination date. Depending on the respective pandemic situation, the exam may be offered as an open book exam (alternative exam assessment, following §4(2), 3 of the examination regulation).

### Prerequisites

None

### Recommendation

None

### Annotation

Since 2011 the lecture is offered in winter term. Exams can still be taken in summer term.

**Below you will find excerpts from events related to this course:**

### Energy Systems Analysis

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<td>Fichtner, Ardone, Dengiz, Yilmaz</td>
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</table>

**Lecture (V) On-Site**

### Content

1. Overview and classification of energy systems modelling approaches
2. Usage of scenario techniques for energy systems analysis
3. Unit commitment of power plants
4. Interdependencies in energy economics
5. Scenario-based decision making in the energy sector
6. Visualisation and GIS techniques for decision support in the energy sector

**Learning goals:**

The student

- has the ability to understand and critically reflect the methods of energy system analysis, the possibilities of its application in the energy industry and the limits and weaknesses of this approach
- can use select methods of the energy system analysis by her-/himself

### Organizational issues

Blockveranstaltung, Termine s. Institutsaushang
Literature
Weiterführende Literatur:

8 COURSES

Course: Energy Trading and Risk Management [T-WIWI-112151]

Responsible: N.N.
Organisation: KIT Department of Economics and Management

Type: Written examination
Credits: 3
Grading scale: Grade to a third
Recurrence: Each summer term
Version: 1

Competence Certificate
The lecture “Energiehandel und Risikomanagement” will be held in English under the title “Energy Trading and Risk Management” from the summer semester 2022. The examination for the English-language lecture will be offered in English from the summer semester 2022.
The assessment consists of a written exam (60 minutes). The exam takes place in every semester. Re-examinations are offered at every ordinary examination date. Depending on the respective pandemic situation, the exam may be offered as an open book exam (alternative exam assessment).

Prerequisites
None

Recommendation
None

Below you will find excerpts from events related to this course:

Energy Trading and Risk Management
2581020, SS 2022, 2 SWS, Language: English, Open in study portal

Content
1. Introduction to Markets, Mechanisms and Interaction
2. Electricity Trading (platforms, products, mechanisms)
4. Coal Markets (reserves, supply, demand, and transport)
5. Investments and Capacity Markets
6. Oil and Gas Markets (supply, demand, trade, and players)
7. Trading Game
8. Risk Management in Energy Trading

Literature
Weiterführende Literatur:
www.riskglossary.com
## 8.77 Course: Evolution Equations [T-MATH-105844]

**Responsible:**  
Prof. Dr. Dorothee Frey  
apl. Prof. Dr. Peer Kunstmann  
Prof. Dr. Roland Schnaubelt

**Organisation:**  
KIT Department of Mathematics

**Part of:**  
M-MATH-102872 - Evolution Equations

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<td>Übungen zu 0156800</td>
<td>2 SWS</td>
<td>Practice</td>
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<td>(Evolutionsgleichungen)</td>
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</table>
8 COURSES

Course: Experimental Economics [T-WIWI-102614]

8.78 Course: Experimental Economics [T-WIWI-102614]

**Responsible:** Prof. Dr. Christof Weinhardt

**Organisation:** KIT Department of Economics and Management

**Part of:**
- M-WIWI-101505 - Experimental Economics
- M-WIWI-102970 - Decision and Game Theory

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<td>Each winter term</td>
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**Events**

| WT 22/23 | 2540489 | Experimental Economics | 2 SWS | Lecture / 🗣 | Knierim, Peukert |
| WT 22/23 | 2540493 | Übung zu Experimental Economics | 1 SWS | Practice / 🗣 | Greif-Winzrieth, Knierim, Peukert |

Legend: 🖥 Online, 🐦 Blended (On-Site/Online), 🗣 On-Site, ❌ Cancelled

**Competence Certificate**

The assessment consists of a written exam (60 min).

By successful completion of 70% of the maximum number of points in the exercise(s) a bonus can be obtained.

If the grade of the written exam is at least 4.0 and at most 1.3, the bonus will improve it by one grade level (i.e. by 0.3 or 0.4). The exact criteria for the award of a bonus will be announced at the beginning of the lecture.

**Prerequisites**

None

**Below you will find excerpts from events related to this course:**

<table>
<thead>
<tr>
<th>V</th>
<th>Experimental Economics</th>
<th>2540489, WS 22/23, 2 SWS, Language: German, Open in study portal</th>
<th>Lecture (V)</th>
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</table>

**Literature**

- Strategische Spiele; S. Berninghaus, K.-M. Ehrhart, W. Güth; Springer Verlag, 2. Aufl. 2006.
- Experimental Methods: A Primer for Economists; D. Friedman, S. Sunder; Cambridge University Press, 1994.
8.79 Course: Exponential Integrators [T-MATH-107475]

**Responsible:** Prof. Dr. Marlis Hochbruck  
Prof. Dr. Tobias Jahnke

**Organisation:** KIT Department of Mathematics  
**Part of:** M-MATH-103700 - Exponential Integrators

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**Prerequisites**  
none
## 8.80 Course: Extremal Graph Theory [T-MATH-105931]

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<tr>
<th>Responsible:</th>
<th>Prof. Dr. Maria Aksenovich</th>
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**Prerequisites**

none
**8.81 Course: Extreme Value Theory [T-MATH-105908]**

- **Responsible:** Prof. Dr. Vicky Fasen-Hartmann
- **Organisation:** KIT Department of Mathematics
- **Part of:** M-MATH-102939 - Extreme Value Theory

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<td>0155600</td>
<td>Extremwerttheorie</td>
<td>2 SWS</td>
<td>Lecture</td>
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<td>0155610</td>
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<td>1 SWS</td>
<td>Practice</td>
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Economathematics M.Sc.
Module Handbook as of 06/09/2022


8 COURSES

Course: Facility Location and Strategic Supply Chain Management [T-WIWI-102704]

8.82 Course: Facility Location and Strategic Supply Chain Management [T-WIWI-102704]

Responsible: Prof. Dr. Stefan Nickel
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101413 - Applications of Operations Research
M-WIWI-101414 - Methodical Foundations of OR

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Events

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<td>2550487</td>
<td>Übungen zu Standortplanung und strategisches SCM</td>
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<td>Practice / 🖥</td>
<td>Pomes, Linner</td>
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Legend: 🖥 Online, ☺ Blended (On-Site/Online), 🗣 On-Site, ✗ Canceled

Competence Certificate

The assessment consists of a written exam (60 min) according to Section 4 (2), 1 of the examination regulation. The exam takes place in every semester.
Prerequisite for admission to examination is the successful completion of the online assessments.

Prerequisites

Prerequisite for admission to examination is the successful completion of the online assessments.

Recommendation

None

Annotation

The lecture is held in every winter term. The planned lectures and courses for the next three years are announced online.

Below you will find excerpts from events related to this course:

Facility Location and Strategic Supply Chain Management
2550486, WS 22/23, 2 SWS, Language: German, [Open in study portal]

Lecture (V)

Literature

Weiterführende Literatur:

- Love, Morris, Wesolowsky: Facilities Location: Models and Methods, North Holland, 1988
Course: Financial Analysis [T-WIWI-102900]

**8.83 Course: Financial Analysis [T-WIWI-102900]**

- **Responsible:** Dr. Torsten Luedecke
- **Organisation:** KIT Department of Economics and Management
- **Part of:**
  - M-WIWI-101480 - Finance 3
  - M-WIWI-101483 - Finance 2

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**Events**

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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ❌ Cancelled

**Competence Certificate**

See German version.

**Prerequisites**

None

**Recommendation**

Basic knowledge in corporate finance, accounting, and valuation is required.

**Below you will find excerpts from events related to this course:**

**Financial Analysis**

2530205, SS 2022, 2 SWS, Language: German, [Open in study portal](#)

**Literature**

8.84 Course: Financial Econometrics [T-WIWI-103064]

Responsible: Prof. Dr. Melanie Schienle
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101638 - Econometrics and Statistics I 
M-WIWI-101639 - Econometrics and Statistics II

Events

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<td>Übungen zu Financial Econometrics</td>
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<td>Schienle, Görgen, Buse</td>
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</table>

Competence Certificate
The assessment consists of a written exam (90 minutes) (following §4(2), 1 of the examination regulation).

Prerequisites
The course T-MATH-105874 "Time Series Analysis" may not be chosen.

Recommendation
Knowledge of the contents covered by the course “Economics III: Introduction in Econometrics” [2520016]

Annotation
The next lecture will take place in the winter semester 2022/23.

Below you will find excerpts from events related to this course:

Financial Econometrics
2520022, WS 22/23, 2 SWS, Language: English, Open in study portal
Lecture (V) Blended (On-Site/Online)

Content
Learning objectives:
The student

- shows a broad knowledge of financial econometric estimation and testing techniques
- is able to apply his/her technical knowledge using software in order to critically assess empirical problems

Content:
ARMA, ARIMA, ARFIMA, (non)stationarity, causality, cointegration, ARCH/GARCH, stochastic volatility models, computer based exercises

Requirements:
It is recommended to attend the course Economics III: Introduction to Econometrics [2520016] prior to this course.

Workload:
Total workload for 4.5 CP: approx. 135 hours
Attendance: 30 hours
Preparation and follow-up: 65 hours
Exam preparation: 40 hours
Literature
Additional literature will be discussed in the lecture.
8.85 Course: Financial Econometrics II [T-WIWI-110939]

**Responsible:** Prof. Dr. Melanie Schienle  
**Organisation:** KIT Department of Economics and Management  
**Part of:**  
- M-WIWI-101638 - Econometrics and Statistics I  
- M-WIWI-101639 - Econometrics and Statistics II

**Type**  
Examination of another type  
**Credits**  
4,5  
**Grading scale**  
Grade to a third  
**Recurrence**  
Each summer term  
**Version**  
2

**Competence Certificate**  
Alternative exam assessment (Takehome Exam). Details will be announced at the beginning of the course.

**Prerequisites**  
None

**Recommendation**  
Knowledge of the contents covered by the course "Financial Econometrics"

**Annotation**  
Course language is English  
The next lecture will take place in the summer semester of 2023.
8.86 Course: Financial Intermediation [T-WIWI-102623]

**Responsible:** Prof. Dr. Martin Ruckes

**Organisation:** KIT Department of Economics and Management

**Part of:**
- M-WIWI-101480 - Finance 3
- M-WIWI-101483 - Finance 2
- M-WIWI-101502 - Economic Theory and its Application in Finance

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**Events**

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**Legend:** 🌐 Online, 🧩 Blended (On-Site/Online), 📚 On-Site, ❌ Cancelled

**Competence Certificate**
The assessment of this course is a written examination (following §4(2), 1 SPO) of 60 mins. The exam is offered each semester.

**Prerequisites**
None

**Recommendation**
None

**Below you will find excerpts from events related to this course:**

**Financial Intermediation**
2530232, WS 22/23, 2 SWS, Language: German, [Open in study portal]

**Literature**
Weiterführende Literatur:

8.87 Course: Finite Element Methods [T-MATH-105857]

**Responsible:**
- Prof. Dr. Willy Dörfler
- Prof. Dr. Marlis Hochbruck
- Prof. Dr. Tobias Jahnke
- Prof. Dr. Andreas Rieder
- Prof. Dr. Christian Wieners

**Organisation:**
KIT Department of Mathematics

**Part of:**
M-MATH-102891 - Finite Element Methods

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8.88 Course: Finite Group Schemes [T-MATH-106486]

**Responsible:** Dr. Fabian Januszewski

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-103258 - Finite Group Schemes

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**Course: Forecasting: Theory and Practice [T-MATH-105928]**

**Responsible:** Prof. Dr. Tilmann Gneiting

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-102956 - Forecasting: Theory and Practice

**Type:** Oral examination

**Credits:** 8

**Grading scale:** Grade to a third

**Version:** 2
**8.90 Course: Foundations of Continuum Mechanics [T-MATH-107044]**

**Responsible:** Prof. Dr. Christian Wieners  
**Organisation:** KIT Department of Mathematics  
**Part of:** M-MATH-103527 - Foundations of Continuum Mechanics

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**Prerequisites**

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8.92 Course: Fourier Analysis and its Applications to PDEs [T-MATH-109850]

 Responsible: TT-Prof. Dr. Xian Liao
 Organisation: KIT Department of Mathematics
 Part of: M-MATH-104827 - Fourier Analysis and its Applications to PDEs

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Prerequisites
none
8.93 Course: Fractal Geometry [T-MATH-111296]

**Responsible:** PD Dr. Steffen Winter

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-105649 - Fractal Geometry

**Type**
- Oral examination

**Credits**
- 6

**Grading scale**
- Grade to a third

**Recurrence**
- Irregular

**Version**
- 1

**Prerequisites**
- none
8.94 Course: Functional Analysis [T-MATH-102255]

**Responsible:** Prof. Dr. Dorothee Frey  
PD Dr. Gerd Herzog  
Prof. Dr. Dirk Hundertmark  
Prof. Dr. Tobias Lamm  
Prof. Dr. Michael Plum  
Prof. Dr. Wolfgang Reichel  
Dr. Christoph Schmoeger  
Prof. Dr. Roland Schnaubelt

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-101320 - Functional Analysis

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<td>2 SWS</td>
<td>Practice / On-Site</td>
<td>Liao</td>
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Legend: 🖥 Online, Blended (On-Site/Online), 🗑 On-Site, ❌ Cancelled
8.95 Course: Functions of Matrices [T-MATH-105906]

**Responsible:** PD Dr. Volker Grimm  
**Organisation:** KIT Department of Mathematics  
**Part of:** M-MATH-102937 - Functions of Matrices

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<td>Grade to a third</td>
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</table>

**Prerequisites**
none
8.96 Course: Functions of Operators [T-MATH-105905]

Organisation: KIT Department of Mathematics
Part of: M-MATH-102936 - Functions of Operators

<table>
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**Responsible:** Prof. Dr. Maxim Ulrich

**Organisation:** KIT Department of Economics and Management

**Part of:** M-WIWI-105894 - Foundations for Advanced Financial -Quant and -Machine Learning Research

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<th>Recurrence</th>
<th>Version</th>
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<td>Lecture / 👤</td>
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**Competence Certificate**

The module examination is an alternative exam assessment with a maximum score of 100 points to be achieved. These points are distributed over 4 worksheets to be submitted during the semester. The worksheets cover the respective material of the module and are handed out, worked on and assessed in lecture weeks 3 (10 points), 6 (20 points), 9 (30 points) and 12 (40 points).

The module-wide exam (all 4 worksheets) must be taken in the same semester.

The worksheets are a mixture of analytical tasks and programming tasks with financial data.

**Recommendation**

- Strongly recommended to have good knowledge in financial econometrics (MLE, OLS, GLS, ARMA-GARCH), mathematics (differential equations, difference equations and optimization), investments (CAPM, factor models), asset pricing (SDF, SDF pricing), derivatives (Black-Scholes, risk-neutral pricing), and programming of statistical concepts (Java or R or Python or Matlab or C or ...)
- Strongly recommended to have a strong interest for interdisciplinary research work in statistics, programming, applied math and financial economics.
- Students lacking the prior knowledge might find the resources of the Chair helpful: www.youtube.com/c/cram-kit.

**Annotation**

The course is offered every second year.
### 8.98 Course: Generalized Regression Models [T-MATH-105870]

**Responsible:** Dr. rer. nat. Bruno Ebner  
Prof. Dr. Vicky Fasen-Hartmann  
PD Dr. Bernhard Klar  
Prof. Dr. Mathias Trabs

**Organisation:** KIT Department of Mathematics  
**Part of:** M-MATH-102906 - Generalized Regression Models

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**Events**

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<td>Generalisierte Regressionsmodelle</td>
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<td>Lecture</td>
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<td>0161410</td>
<td>Übungen zu 0161400 (generalisierte Regressionsmodelle)</td>
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<td>Practice</td>
<td>Ebner</td>
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</table>
8 COURSES

Course: Geometric Group Theory [T-MATH-105842]

8.99 Course: Geometric Group Theory [T-MATH-105842]

Responsible: Prof. Dr. Frank Herrlich
Prof. Dr. Enrico Leuzinger
Dr. Gabriele Link
Prof. Dr. Roman Sauer
Prof. Dr. Wilderich Tuschmann

Organisation: KIT Department of Mathematics

Part of: M-MATH-102867 - Geometric Group Theory

Type: Written examination
Credits: 8
Grading scale: Grade to a third
Recurrence: Irregular
Version: 1
8.100 Course: Geometric Numerical Integration [T-MATH-105919]

**Responsible:** Prof. Dr. Marlis Hochbruck
Prof. Dr. Tobias Jahnke

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-102921 - Geometric Numerical Integration

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</table>

**Course: Geometry of Schemes [T-MATH-105841]**

**Responsible:** Prof. Dr. Frank Herrlich  
PD Dr. Stefan Kühnlein

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-102866 - Geometry of Schemes
<table>
<thead>
<tr>
<th><strong>T</strong> 8.102 Course: Global Differential Geometry [T-MATH-105885]</th>
</tr>
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</table>
| **Responsible:** Dr. Sebastian Grensing  
|                  Prof. Dr. Wilderich Tuschmann                  |
| **Organisation:** KIT Department of Mathematics              |
| **Part of:**      M-MATH-102912 - Global Differential Geometry|

<table>
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**Prerequisites**
none
8.103 Course: Global Optimization I [T-WIWI-102726]

**Responsible:** Prof. Dr. Oliver Stein

**Organisation:** KIT Department of Economics and Management

**Part of:**
- M-WIWI-101413 - Applications of Operations Research
- M-WIWI-101414 - Methodical Foundations of OR
- M-WIWI-101473 - Mathematical Programming

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<td>Each summer term</td>
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</table>

**Events**

| ST 2022 | 2550134 | Global Optimization I | 2 SWS | Lecture /  | Stein           |

**Competence Certificate**

Success is in the form of a written examination (60 min.) (according to § 4(2), 1 SPO). The successful completion of the exercises is required for admission to the written exam.

The exam is offered in the lecture of semester and the following semester.

The success check can be done also with the success control for "Global optimization II". In this case, the duration of the written exam is 120 min.

**Prerequisites**

None

**Recommendation**

None

**Annotation**

Part I and II of the lecture are held consecutively in the **same** semester.

*Below you will find excerpts from events related to this course:*

### Global Optimization I

| V | Global Optimization I | 2550134, SS 2022, 2 SWS, Language: German, Open in study portal | Lecture (V) On-Site |

**Content**

In many optimization problems from economics, engineering and natural sciences, solution algorithms are only able to efficiently identify local optimizers, while it is much harder to find globally optimal points. This corresponds to the fact that by local search it is easy to find the summit of the closest mountain, but that the search for the summit of Mount Everest is rather elaborate.

The lecture treats methods for global optimization of convex functions under convex constraints. It is structured as follows:

- Introduction, examples, and terminology
- Existence results for optimal points
- Optimality in convex optimization
- Duality, bounds, and constraint qualifications
- Algorithms (Kelley’s cutting plane method, Frank-Wolfe method, primal-dual interior point methods)

The lecture is accompanied by exercises which, amongst others, offers the opportunity to implement and to test some of the methods on practically relevant examples.

**Remark:**

The treatment of **nonconvex** optimization problems forms the contents of the lecture "Global Optimization II". The lectures "Global Optimization I" and "Global Optimization II" are held consecutively in the **same** semester.

**Learning objectives:**

The student

- knows and understands the fundamentals of deterministic global optimization in the convex case,
- is able to choose, design and apply modern techniques of deterministic global optimization in the convex case in practice.
Literature

Weiterführende Literatur:

- W. Alt, Numerische Verfahren der konvexen, nichtglatten Optimierung, Teubner, 2004
- C.A. Floudas, Deterministic Global Optimization, Kluwer, 2000
8.104 Course: Global Optimization I and II [T-WIWI-103638]

**Responsible:** Prof. Dr. Oliver Stein

**Organisation:** KIT Department of Economics and Management

**Part of:**
- M-WIWI-101414 - Methodical Foundations of OR
- M-WIWI-101473 - Mathematical Programming

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**Events**

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<th>Language</th>
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<th>On-line</th>
<th>Blended</th>
<th>Recurrence</th>
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<td>ST 2022</td>
<td>2550134</td>
<td>Global Optimization I</td>
<td>Lecture</td>
<td>2 SWS</td>
<td>German</td>
<td>Stein</td>
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<td>ST 2022</td>
<td>2550135</td>
<td>Exercise to Global Optimization I and II</td>
<td>Practice</td>
<td>2 SWS</td>
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<td>Stein, Beck</td>
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<td>Global Optimization II</td>
<td>Lecture</td>
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<td>Stein</td>
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**Competence Certificate**

The assessment of the lecture is a written examination (120 minutes) according to §4(2), 1 of the examination regulation. The successful completion of the exercises is required for admission to the written exam. The examination is held in the semester of the lecture and in the following semester.

**Prerequisites**

None

**Recommendation**

None

**Annotation**

Part I and II of the lecture are held consecutively in the same semester.

**Below you will find excerpts from events related to this course:**

### Global Optimization I

**2550134, SS 2022, 2 SWS, Language: German, [Open in study portal](#)**

**Lecture (V)**

**On-Site**

**Content**

In many optimization problems from economics, engineering and natural sciences, solution algorithms are only able to efficiently identify local optimizers, while it is much harder to find globally optimal points. This corresponds to the fact that by local search it is easy to find the summit of the closest mountain, but that the search for the summit of Mount Everest is rather elaborate.

The lecture treats methods for global optimization of convex functions under convex constraints. It is structured as follows:

- Introduction, examples, and terminology
- Existence results for optimal points
- Optimality in convex optimization
- Duality, bounds, and constraint qualifications
- Algorithms (Kelley’s cutting plane method, Frank-Wolfe method, primal-dual interior point methods)

The lecture is accompanied by exercises which, amongst others, offers the opportunity to implement and to test some of the methods on practically relevant examples.

**Remark:**

The treatment of nonconvex optimization problems forms the contents of the lecture “Global Optimization II”. The lectures “Global Optimization I” and “Global Optimization II” are held consecutively in the same semester.

**Learning objectives:**

The student

- knows and understands the fundamentals of deterministic global optimization in the convex case,
- is able to choose, design and apply modern techniques of deterministic global optimization in the convex case in practice.
Global Optimization II
2550136, SS 2022, 2 SWS, Language: German, Open in study portal

Content
In many optimization problems from economics, engineering and natural sciences, solution algorithms are only able to efficiently identify local optimizers, while it is much harder to find globally optimal points. This corresponds to the fact that by local search it is easy to find the summit of the closest mountain, but that the search for the summit of Mount Everest is rather elaborate.

The lecture treats methods for global optimization of nonconvex functions under nonconvex constraints. It is structured as follows:

- Introduction and examples
- Convex relaxation
- Interval arithmetic
- Convex relaxation via alphaBB method
- Branch-and-bound methods
- Lipschitz optimization

The lecture is accompanied by exercises which, amongst others, offers the opportunity to implement and to test some of the methods on practically relevant examples.

Remark:
The treatment of convex optimization problems forms the contents of the lecture "Global Optimization I". The lectures "Global Optimization I" and "Global Optimization II" are held consecutively in the same semester.

Learning objectives:
The student

- knows and understands the fundamentals of deterministic global optimization in the nonconvex case,
- is able to choose, design and apply modern techniques of deterministic global optimization in the nonconvex case in practice.

Literature

Weiterführende Literatur:

- W. Alt, Numerische Verfahren der konvexen, nichtglatten Optimierung, Teubner, 2004
- C.A. Floudas, Deterministic Global Optimization, Kluwer, 2000
8.105 Course: Global Optimization II [T-WIWI-102727]

**Responsible:** Prof. Dr. Oliver Stein

**Organisation:** KIT Department of Economics and Management

**Part of:**
- M-WIWI-101414 - Methodical Foundations of OR
- M-WIWI-101473 - Mathematical Programming

<table>
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<td>Grade to a third</td>
<td>Each summer term</td>
<td>2</td>
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**Events**

| ST 2022 | 2550136 | Global Optimization II | 2 SWS | Lecture / 🗣️ | Stein |

Legend: 
- 🖥 Online
- 🧩 Blended (On-Site/Online)
- 🗣️ On-Site
- ❌ Cancelled

**Competence Certificate**

The assessment of the lecture is a written examination (60 minutes) according to §4(2), 1 of the examination regulation. The successful completion of the exercises is required for admission to the written exam.

The examination is held in the semester of the lecture and in the following semester.

The examination can also be combined with the examination of "Global optimization I". In this case, the duration of the written examination takes 120 minutes.

**Prerequisites**

None

**Annotation**

Part I and II of the lecture are held consecutively in the same semester.

**Below you will find excerpts from events related to this course:**

**Global Optimization II**

2550136, SS 2022, 2 SWS, Language: German, Open in study portal

**Lecture (V)**

On-Site

**Content**

In many optimization problems from economics, engineering and natural sciences, solution algorithms are only able to efficiently identify local optimizers, while it is much harder to find globally optimal points. This corresponds to the fact that by local search it is easy to find the summit of the closest mountain, but that the search for the summit of Mount Everest is rather elaborate.

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- Introduction and examples
- Convex relaxation
- Interval arithmetic
- Convex relaxation via alphaBB method
- Branch-and-bound methods
- Lipschitz optimization

The lecture is accompanied by exercises which, amongst others, offers the opportunity to implement and to test some of the methods on practically relevant examples.

**Remark:**

The treatment of convex optimization problems forms the contents of the lecture "Global Optimization I". The lectures "Global Optimization I" and "Global Optimization II" are held consecutively in the same semester.

**Learning objectives:**

The student

- knows and understands the fundamentals of deterministic global optimization in the nonconvex case,
- is able to choose, design and apply modern techniques of deterministic global optimization in the nonconvex case in practice.
Literature

Weiterführende Literatur:

- W. Alt, Numerische Verfahren der konvexen, nichtglatten Optimierung, Teubner, 2004
- C.A. Floudas, Deterministic Global Optimization, Kluwer, 2000
8.106 Course: Graph Theory [T-MATH-102273]

**Responsible:** Prof. Dr. Maria Aksenovich  
**Organisation:** KIT Department of Mathematics  
**Part of:** M-MATH-101336 - Graph Theory

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<td>8</td>
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**Prerequisites**  
None
8.107 Course: Graph Theory and Advanced Location Models [T-WIWI-102723]

Responsible: Prof. Dr. Stefan Nickel
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101473 - Mathematical Programming
M-WIWI-102832 - Operations Research in Supply Chain Management
M-WIWI-103289 - Stochastic Optimization

Competence Certificate
The assessment is a 60 minutes written examination (according to §4(2), 1 of the examination regulation).
The examination is held in the term of the lecture and the following lecture.

Prerequisites
None

Recommendation
Basic knowledge as conveyed in the module "Introduction to Operations Research" is assumed.

Annotation
The course is offered irregularly. Planned lectures for the next three years can be found in the internet at http://dol.ior.kit.edu/english/Courses.php.
8.108 Course: Group Actions in Riemannian Geometry [T-MATH-105925]

**Responsible:** Prof. Dr. Wilderich Tuschmann

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-102954 - Group Actions in Riemannian Geometry

**Type:** Oral examination

**Credits:** 5

**Grading scale:** Grade to a third

**Version:** 1

**Prerequisites**
none
8 COURSES

Course: Growth and Development [T-WIWI-111318]

8.109 Course: Growth and Development [T-WIWI-111318]

**Responsible:** Prof. Dr. Ingrid Ott

**Organisation:** KIT Department of Economics and Management

**Part of:**
- M-WIWI-101478 - Innovation and Growth
- M-WIWI-101496 - Growth and Agglomeration

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<td>Grade to a third</td>
<td>Each winter term</td>
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</table>

**Competence Certificate**
Depending on further pandemic developments, the examination will be offered either as an open-book examination or as a 60-minute written examination.

**Prerequisites**
None

**Recommendation**
Basic knowledge of micro- and macroeconomics is assumed, as taught in the courses Economics I [2600012], and Economics II [2600014]. In addition, an interest in quantitative-mathematical modeling is required.

**Annotation**
Due to the research semester of Prof. Dr. Ingrid Ott, the course will not be offered in the winter semester 2021/22. The exam will take place. Preparation materials can be found in IILIAS.
Course: Harmonic Analysis [T-MATH-111289]

Organisation: KIT Department of Mathematics
Part of: M-MATH-105324 - Harmonic Analysis

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<td>Grade to a third</td>
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Version 1
### 8.111 Course: Harmonic Analysis for Dispersive Equations [T-MATH-107071]

**Responsible:** apl. Prof. Dr. Peer Kunstmann  
**Organisation:** KIT Department of Mathematics  
**Part of:** M-MATH-103545 - Harmonic Analysis for Dispersive Equations

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<td>Grade to a third</td>
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**Prerequisites**  
none
8.112 Course: Heat Economy [T-WIWI-102695]

- **Responsible:** Prof. Dr. Wolf Fichtner
- **Organisation:** KIT Department of Economics and Management
- **Part of:** M-WIWI-101452 - Energy Economics and Technology

### Events

<table>
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<tr>
<th>ST 2022</th>
<th>2581001</th>
<th>Heat Economy</th>
<th>2 SWS</th>
<th>Lecture / Fichtner</th>
</tr>
</thead>
</table>

**Competence Certificate**

The lecture will be suspended in summer semester 2021. The assessment consists of a written (60 minutes) or oral exam (30 minutes) (following §4(2) of the examination regulation). The exam takes place in every semester. Re-examinations are offered at every ordinary examination date. Depending on the respective pandemic situation, the exam may be offered as an open book exam (alternative exam assessment, following §4(2), 3 of the examination regulation).

**Prerequisites**

None.

**Recommendation**

None.

**Annotation**

See German version.

Below you will find excerpts from events related to this course:

**Heat Economy**

2581001, SS 2022, 2 SWS, Language: German, [Open in study portal](#)

**Lecture (V)**

On-Site

**Organizational issues**

Block, Seminarraum Standort West - siehe Institutsaushang

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Economathematics M.Sc.
Module Handbook as of 06/09/2022
8.113 Course: Homotopy Theory [T-MATH-105933]

- **Responsible:** Prof. Dr. Roman Sauer
- **Organisation:** KIT Department of Mathematics
- **Part of:** M-MATH-102959 - Homotopy Theory

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<td>Oral examination</td>
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8.114 Course: Human Factors in Security and Privacy [T-WIWI-109270]

- **Responsible:** Prof. Dr. Melanie Volkamer
- **Organisation:** KIT Department of Economics and Management
- **Part of:** M-WIWI-101472 - Informatics

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**Events**

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<th>WT 22/23</th>
<th>2511554</th>
<th>Human Factors in Security and Privacy</th>
<th>2 SWS</th>
<th>Lecture / 🗣</th>
<th>Volkamer</th>
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<tbody>
<tr>
<td>WT 22/23</td>
<td>2511555</td>
<td>Übungen zu Human Factors in Security and Privacy</td>
<td>1 SWS</td>
<td>Practice / 🗣</td>
<td>Volkamer, Berens</td>
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</table>

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ CANCELLED

**Competence Certificate**

The assessment of this course is a written examination (60 min) according to §4(2), 1 of the examination regulation or an oral exam (30 min) following §4, Abs. 2, 2 of the examination regulation. Only those who have successfully participated in the exercises and the lecture will be admitted to the examination.

The exam takes place every semester and can be repeated at every regular examination date.

**Prerequisites**

Both need to be done:

- Pass Quiz on Paper for Graphical Passwords
- Presentation of Results Exercise 2

+ 9 of the following 11 need to be done:

- Submit ILIAS certificate until Oct 24
- Pass Quiz on InfoSec Lecture
- Active participation exercise 1 Part 1 - Evaluation and analyses methods
- Pass Quiz Paper Discussion 1 - User Behaviour and motivation theories
- Active participation exercise 1 Part 2
- Pass Quiz Paper Discussion 2 - User Behaviour and motivation theories
- Pass Quiz Paper Discussion 3 - Security Awareness
- Active participation exercise 1 Part 3
- Pass Quiz Paper Discussion 4 - Graphical Authentication
- Pass Quiz Paper Discussion 5 - Shoulder Surfing Authentication
- Active participation exercise 2

**Recommendation**

The prior attendance of the lecture "Information Security" is strongly recommended.

**Annotation**

The lecture will not be offered in winter semester 2020/21.

Some lectures are in English, some in German.

Below you will find excerpts from events related to this course:

- **Human Factors in Security and Privacy**
  - 2511554, WS 22/23, 2 SWS, Language: German/English, [Open in study portal](#)
Content
Please take a look at all the information provided before the first event (e.g. first slides)!

The event will be conducted with 3G. Accordingly, either a one-time proof of vaccination or an official proof of a negative test is required for each event.

Some lectures are in English, some in German.

To participate in the quizzes at the beginning of the event a charged device is needed e.g. laptop or cell phone.

To successfully pass the course, the following requirements must be met:

Both need to be done:
- Reading Paper, Active Participation & Pass Quiz on Paper for Graphical Passwords
- Presentation of Results Exercise 2

+ 9 of the following 11 need to be done:
- Submit ILIAS certificate until Oct 24
- Pass Quiz on InfoSec Lecture
- Active participation exercise 1 – Part 1
- Reading Paper, Active Participation & Pass Quiz “Users are not the enemy” Active participation exercise 1 – Part 2
- Reading Paper, Active Participation & Pass Quiz “Why Johnny can’t encrypt”
- Reading Paper, Active Participation & Pass Quiz “Put Your Warning Where Your Link Is: Improving and Evaluating Email Phishing Warnings”
- Active participation exercise 1 – Part 3
- Active participation exercise 1 – Part 4 Results
- Reading Paper, Active Participation & Pass Quiz “User-centered security” Active participation exercise 2 – Part 1

Here is a first preview of the topics planned for the lecture:

1. General Introduction
2. Self-Study: Knowledge of Information Security Lecture
3. Terminology + Basics
4. Evaluation and analyses methods
5. Risk Communication
6. Security Awareness
7. Security Indicators
8. Graphical Authentication
9. Shoulder Surfing Authentication
10. Usable Verifiable Electronic Voting
11. Q&A + Exam preparation

Literature

- Security and Usability: Designing Secure Systems that People Can Use von Lorrie Faith Cranor und Simson Garfinkel. 2005
### Course: Incentives in Organizations [T-WIWI-105781]

<table>
<thead>
<tr>
<th>Responsible</th>
<th>Prof. Dr. Petra Nieken</th>
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<tbody>
<tr>
<td>Organisation</td>
<td>KIT Department of Economics and Management</td>
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</tbody>
</table>
| Part of              | M-WIWI-101500 - Microeconomic Theory  
                       | M-WIWI-101505 - Experimental Economics |

#### Type
- Written examination

#### Credits
- 4.5

#### Grading scale
- Grade to a third

#### Recurrence
- Each summer term

#### Version
- 1

### Events

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<th>Grading scale</th>
<th>Recurrence</th>
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<td>Grade to a third</td>
<td>Each summer term</td>
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<th>Version</th>
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<tbody>
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<td>2 SWS</td>
<td>Lecture</td>
<td>Nieken</td>
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<tr>
<td>ST 2022</td>
<td>2 SWS</td>
<td>Practice</td>
<td>Nieken, Mitarbeiter</td>
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</table>

#### Competence Certificate
The assessment of this course is a written examination (60 min). The exam takes place in every semester. Re-examinations are offered at every ordinary examination date. In case of a small number of registrations, we might offer an oral exam instead of a written exam.

#### Prerequisites
None

#### Recommendation
Knowledge of microeconomics, game theory, and statistics is assumed.

Below you will find excerpts from events related to this course:

#### Incentives in Organizations
- 2573003, SS 2022, 2 SWS, Language: English, Open in study portal
  - Lecture (V) On-Site
Content
The students acquire profound knowledge about the design and the impact of different incentive and compensation systems. Topics covered are, for instance, performance based compensation, team work, intrinsic motivation, multitasking, and subjective performance evaluations. We will use microeconomic or behavioral models as well as empirical data to analyze incentive systems. We will investigate several widely used compensation schemes and their relationship with corporate strategy. Students will learn to develop practical implications which are based on the acquired knowledge of this course.

Aim
The student
- develops a strategic understanding about incentives systems and how they work.
- analyzes models from personnel economics.
- understands how econometric methods can be used to analyze performance and compensation data.
- knows incentive schemes that are used in companies and is able to evaluate them critically.
- can develop practical implications which are based on theoretical models and empirical data from companies.
- understands the challenges of managing incentive and compensation systems and their relationship with corporate strategy.

Workload
The total workload for this course is: approximately 135 hours.
Lecture: 32 hours
Preparation of lecture: 52 hours
Exam preparation: 51 hours

Literature
Slides, Additional case studies and research papers will be announced in the lecture.
Literature (complementary):
Behavioral Game Theory, Camerer, Russel Sage Foundation, 2003
Introduction to Econometrics, Wooldridge, Andover, 2014
Econometric Analysis of Cross Section and Panel Data, Wooldridge, MIT Press, 2010
8.116 Course: Information Service Engineering [T-WIWI-106423]

**Responsible:** Prof. Dr. Harald Sack  
**Organisation:** KIT Department of Economics and Management  
**Part of:** M-WIWI-101472 - Informatics

**Type** | **Credits** | **Grading scale** | **Recurrence** | **Version**  
---|---|---|---|---  
Written examination | 4.5 | Grade to a third | Each summer term | 2

**Events**

| ST 2022 | 2511606 | Information Service Engineering | 2 SWS | Lecture / Online | Sack  
| ST 2022 | 2511607 | Exercises to Information Service Engineering | 1 SWS | Practice / Online | Sack

Legend: 🔄 Online, 🧩 Blended (On-Site/Online), 🗺️ On-Site, ❌ Canceled

**Competence Certificate**
The assessment of this course is a written examination (60 min) according to §4(2), 1 of the examination regulation or an oral exam (20 min) following §4, Abs. 2, 2 of the examination regulation.
The exam takes place every semester and can be repeated at every regular examination date.

**Prerequisites**
None

Below you will find excerpts from events related to this course:

**Information Service Engineering**  
2511606, SS 2022, 2 SWS, Language: English, [Open in study portal](#)  
Lecture (V) Online
Content
- Information, Natural Language and the Web
- Natural Language Processing
  - NLP and Basic Linguistic Knowledge
  - NLP Applications, Techniques & Challenges
  - Evaluation, Precision and Recall
  - Regular Expressions and Automata
  - Tokenization
  - Language Model and N-Grams
  - Part-of-Speech Tagging
  - Distributional Semantics & Word Embeddings
- Knowledge Graphs
  - Knowledge Representations and Ontologies
  - Resource Description Framework (RDF) as simple Data Model
  - Creating new Models with RDFS
  - Querying RDF(S) with SPARQL
  - More Expressivity via Web Ontology Language (OWL)
  - From Linked Data to Knowledge Graphs
  - Wikipedia, DBpedia, and Wikidata
  - Knowledge Graph Programming
- Basic Machine Learning
  - Machine Learning Fundamentals
  - Evaluation and Generalization Problems
  - Linear Regression
  - Decision Trees
  - Unsupervised Learning
  - Neural Networks and Deep Learning
- ISE Applications
  - From Data to Knowledge
  - Data Mining, Information Visualization and Knowledge Discovery
  - Semantic Search
  - Exploratory Search
  - Semantic Recommender Systems

Learning objectives:
- The students know the fundamentals and measures of information theory and are able to apply those in the context of Information Service Engineering.
- The students have basic skills of natural language processing and are enabled to apply natural language processing technology to solve and evaluate simple text analysis tasks.
- The students have fundamental skills of knowledge representation with ontologies as well as basic knowledge of Semantic Web and Linked Data technologies. The students are able to apply these skills for simple representation and analysis tasks.
- The students have fundamental skills of information retrieval and are enabled to conduct and to evaluate simple information retrieval tasks.
- The students apply their skills of natural language processing, Linked Data engineering, and Information Retrieval to conduct and evaluate simple knowledge mining tasks.
- The students know the fundamentals of recommender systems as well as of semantic and exploratory search.

Literature
## 8.117 Course: Innovation Theory and Policy [T-WIWI-102840]

### Responsible
Prof. Dr. Ingrid Ott

### Organisation
KIT Department of Economics and Management

### Part of
M-WIWI-101478 - Innovation and Growth

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<th>Recurrence</th>
<th>Version</th>
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<td>Each summer term</td>
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### Events

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<th>Recurrence</th>
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<td>2 SWS</td>
<td>Innovation theory and policy</td>
<td>Lecture / 🗣️</td>
<td>Ott</td>
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<tr>
<td>ST 2022 2560237</td>
<td>1 SWS</td>
<td>Innovation theory and policy</td>
<td>Practice / 🗣️</td>
<td>Ott, Mirzoyan</td>
</tr>
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</table>

**Legend:** 🖥 Online, 🧩 Blended (On-Site/Online), 🗣️ On-Site, ✗ Cancelled

### Competence Certificate
Depending on further pandemic developments, the examination will be offered either as a 60-minute written examination (written examination according to SPO § 4 Abs. 2, Pkt. 1) or as an open-book examination (alternative exam assessment according to SPO § 4 Abs. 2, Pkt. 3).

### Prerequisites
None

### Recommendation
Basic knowledge of micro- and macroeconomics is assumed, as taught in the courses Economics I [2600012], and Economics II [2600014]. In addition, an interest in quantitative-mathematical modeling is required.

Below you will find excerpts from events related to this course:

### Innovation theory and policy

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<tr>
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<th>Type</th>
<th>Recurrence</th>
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</thead>
<tbody>
<tr>
<td>2 SWS</td>
<td>Innovation theory and policy</td>
<td>Lecture / 🗣️</td>
</tr>
</tbody>
</table>
Content
Learning objectives:
Students shall be given the ability to

- identify the importance of alternative incentive mechanisms for the emergence and dissemination of innovations
- understand the relationships between market structure and the development of innovation
- explain, in which situations market interventions by the state, for example taxes and subsidies, can be legitimized, and evaluate them in the light of economic welfare

Course content:
The course covers the following topics:

- Incentives for the emergence of innovations
- Patents
- Diffusion
- Impact of technological progress
- Innovation Policy

Recommendations:
Basic knowledge of micro- and macroeconomics is assumed, as taught in the courses Economics I [2600012], and Economics II [2600014]. In addition, an interest in quantitative-mathematical modeling is required.

Workload:
The total workload for this course is approximately 135.0 hours. For further information see German version.

Exam description:
The assessment consists of a written exam (60 min) according to Section 4(2), 1 of the examination regulation. The exam takes place in every semester. Re-examinations are offered at every ordinary examination date.

Students will be given the opportunity of writing and presenting a short paper during the lecture time to achieve a bonus on the exam grade. If the mandatory credit point exam is passed, the awarded bonus points will be added to the regular exam points. A deterioration is not possible by definition, and a grade does not necessarily improve, but is very likely to (not every additional point improves the total number of points, since a grade can not become better than 1). The voluntary elaboration of such a paper can not countervail a fail in the exam.

Literature
Auszug:

8.118 Course: Integral Equations [T-MATH-105834]

**Responsible:**  
PD Dr. Tilo Arens  
Prof. Dr. Roland Griesmaier  
PD Dr. Frank Hettlich

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-102874 - Integral Equations

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<td>1</td>
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Economathematics M.Sc.  
Module Handbook as of 06/09/2022
8 COURSES

Course: International Business Development and Sales [T-WIWI-110985]

### Responsible:
Erice Casenave
Prof. Dr. Martin Klarmann
Prof. Dr. Orestis Terzidis

### Organisation:
KIT Department of Economics and Management

### Part of:
M-WIWI-105312 - Marketing and Sales Management

### Type
Examination of another type

### Credits
6

### Grading scale
Grade to a third

### Recurrence
see Annotations

### Version
1

#### Events

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<th>International Business Development and Sales</th>
<th>4 SWS</th>
<th>Block / 🗣</th>
<th>Klarmann, Terzidis, Casenave</th>
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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Canceled

### Competence Certificate

Non exam assessment. The grade is based on the presentation, the subsequent discussion and the written elaboration.

### Annotation

Please note that currently it cannot be guaranteed that the course will take place in the winter term 22/23. Please contact the Marketing and Sales Research Group for further information.

Below you will find excerpts from events related to this course:

### Content

This course is offered as part of the EUCOR programme in cooperation with EM Strasbourg. Max. 10 students of KIT and max. 10 students of EM Strasbourg will develop a sales presentation in tandems (teams of 2). This is based on the value proposition of a business model.

- An application is required to participate in this event. The application phase usually takes place at the beginning of the lecture period. Further information on the application process can be found on the website of the Marketing and Sales Research Group (marketing.iism.kit.edu) shortly before the start of the lecture period.

Total workload for 6 ECTS: about 180 hours.
8 COURSES

Course: International Finance [T-WIWI-102646]

8.120 Course: International Finance [T-WIWI-102646]

| Responsible: | Prof. Dr. Marliese Uhrig-Homburg |
| Organisation: | KIT Department of Economics and Management |
| Part of: | M-WIWI-101480 - Finance 3  
M-WIWI-101483 - Finance 2 |

| Type | Written examination |
| Credits | 3 |
| Grading scale | Grade to a third |
| Recurrence | see Annotations |
| Version | 1 |

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Legend: 🖥 Online,🧩 Blended (On-Site/Online),🗣 On-Site, ✗ Cancelled

Competence Certificate
Depending on further pandemic developments, the examination will be offered either as a 60-minute written examination (written examination according to SPO § 4 Abs. 2, Pkt. 1) or as an open-book examination (alternative exam assessment according to SPO § 4 Abs. 2, Pkt. 3).

Prerequisites
None

Recommendation
None

Annotation
The course is offered as a 14-day or block course.

Below you will find excerpts from events related to this course:

V International Finance
2530570, SS 2022, 2 SWS, Language: German, Open in study portal

Organizational issues
Die Veranstaltung wird als Blockveranstaltung angeboten, nach dem Kickoff am 27.04. nach Absprache.

Literature
Weiterführende Literatur:

<table>
<thead>
<tr>
<th><strong>8.121 Course: Introduction into Particulate Flows [T-MATH-105911]</strong></th>
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<td><strong>Responsible:</strong></td>
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<td><strong>Organisation:</strong></td>
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<tr>
<td><strong>Part of:</strong></td>
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</table>

| **Type** | Oral examination |
| **Credits** | 3 |
| **Grading scale** | Grade to a third |
| **Version** | 1 |

**Prerequisites**
none
Course: Introduction to Aperiodic Order [T-MATH-110811]

Responsible: Prof. Dr. Tobias Hartnick
Organisation: KIT Department of Mathematics
Part of: M-MATH-105331 - Introduction to Aperiodic Order

Type: Oral examination
Credits: 3
Grading scale: Grade to a third
Recurrence: Irregular
Version: 1

Prerequisites: none
**8.123 Course: Introduction to Convex Integration [T-MATH-112119]**

<table>
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<tr>
<th>Responsible</th>
<th>Dr. Christian Zillinger</th>
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<tr>
<td>Organisation</td>
<td>KIT Department of Mathematics</td>
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<tr>
<td>Part of</td>
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**Competence Certificate**
oral examination of approx. 30 minutes

**Prerequisites**
none

**Recommendation**
The courses “Classical Methods for Partial Differential Equations” and “Functional Analysis” are recommended.
8.124 Course: Introduction to Fluid Dynamics [T-MATH-111297]

**Responsible:** Prof. Dr. Wolfgang Reichel

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-105650 - Introduction to Fluid Dynamics

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**Prerequisites**
none
8.125 Course: Introduction to Geometric Measure Theory [T-MATH-105918]

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<th>Responsible:</th>
<th>PD Dr. Steffen Winter</th>
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Prerequisites
none
8 COURSES

Course: Introduction to Homogeneous Dynamics [T-MATH-110323]

8.126 Course: Introduction to Homogeneous Dynamics [T-MATH-110323]

| Responsible:  | Prof. Dr. Tobias Hartnick |
| Organisation: | KIT Department of Mathematics |
| Part of:      | M-MATH-105101 - Introduction to Homogeneous Dynamics |

| Type          | Oral examination |
| Credits       | 6                |
| Grading scale | Grade to a third |
| Recurrence    | Irregular        |
| Version       | 1                |

Prerequisites
none
8.127 Course: Introduction to Kinetic Equations [T-MATH-111721]

**Responsible:** Dr. Christian Zillinger  
**Organisation:** KIT Department of Mathematics  
**Part of:** M-MATH-105837 - Introduction to Kinetic Equations

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<td>Grade to a third</td>
<td>Irregular</td>
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</table>

**Competence Certificate**
oral examination of circa 30 minutes

**Prerequisites**
none

**Recommendation**
The course “Classical Methods for Partial Differential Equations” should be studied beforehand.
8.128 Course: Introduction to Kinetic Theory [T-MATH-108013]

**Responsibility:** Prof. Dr. Martin Frank

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-103919 - Introduction to Kinetic Theory

### Events

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<td>Each winter term</td>
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<td>WT 22/23</td>
<td>1 SWS</td>
<td>Practice</td>
<td>Each winter term</td>
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</tbody>
</table>

**Prerequisites**

none

Below you will find excerpts from events related to this course:

**Introduction to Kinetic Theory**

0155450, WS 22/23, 2 SWS, Language: English, [Open in study portal]

**Lecture (V)**

**Content**

Kinetic descriptions play an important role in a variety of physical, biological, and even social applications, for instance, in the description of gases, radiations, bacteria or financial markets. Typically, these systems are described locally not by a finite set of variables but instead by a probability density describing the distribution of a microscopic state. Its evolution is typically given by an integro-differential equation. Unfortunately, the large phase space associated with the kinetic description has made simulations impractical in most settings in the past. However, recent advances in computer resources, reduced-order modeling and numerical algorithms are making accurate approximations of kinetic models more tractable, and this trend is expected to continue in the future. On the theoretical mathematical side, two rather recent Fields medals (Pierre-Louis Lions 1994, Cédric Villani 2010) also indicate the continuing interest in this field, which was already the subject of Hilbert’s sixth out of the 23 problems presented at the World Congress of Mathematicians in 1900.

This course gives an introduction to kinetic theory. Our purpose is to discuss the mathematical passage from a microscopic description of a system of particles, via a probabilistic description to a macroscopic view. This is done in a complete way for the linear case of particles that are interacting with a background medium. The nonlinear case of pairwise interacting particles is treated on a more phenomenological level.

An extremely broad range of mathematical techniques is used in this course. Besides mathematical modeling, we make use of statistics and probability theory, ordinary differential equations, hyperbolic partial differential equations, integral equations (and thus functional analysis) and infinite-dimensional optimization. Among the astonishing discoveries of kinetic theory are the statistical interpretation of the Second Law of Thermodynamics, induced by the Boltzmann-Grad limit, and the result that the macroscopic equations describing fluid motion (namely the Euler and Navier-Stokes equations) can be inferred from abstract geometrical properties of integral scattering operators.

**Organizational issues**

The lecture will be offered as live stream (Zoom). The link can be found in ILIAS.
8.129 Course: Introduction to Matlab and Numerical Algorithms [T-MATH-105913]

**Responsible:** Dr. Daniel Weiß  
Prof. Dr. Christian Wieners

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-102945 - Introduction to Matlab and Numerical Algorithms

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<tbody>
<tr>
<td>Written examination</td>
<td>5</td>
<td>Grade to a third</td>
<td>1</td>
</tr>
</tbody>
</table>

**Prerequisites**

none
8.130 Course: Introduction to Microlocal Analysis [T-MATH-111722]

**Responsible:** TT-Prof. Dr. Xian Liao  
**Organisation:** KIT Department of Mathematics  
**Part of:** M-MATH-105838 - Introduction to Microlocal Analysis

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<th>Recurrence</th>
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<td>3</td>
<td>Grade to a third</td>
<td>Irregular</td>
<td>1 terms</td>
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</table>

**Competence Certificate**  
oral examination of circa 30 minutes

**Prerequisites**  
none

**Recommendation**  
The courses “Classical Methods for Partial Differential Equations” and “Functional Analysis” should be studied beforehand.
## 8.131 Course: Introduction to Scientific Computing [T-MATH-105837]

**Responsible:**
- Prof. Dr. Willy Dörfler
- Prof. Dr. Marlis Hochbruck
- Prof. Dr. Tobias Jahnke
- Prof. Dr. Andreas Rieder
- Prof. Dr. Christian Wieners

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-102889 - Introduction to Scientific Computing

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<td>Lecture / 🗣</td>
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<td>ST 2022 0166000</td>
<td>Praktikum zu 0165000 (Einführung in das Wissenschaftliche Rechnen)</td>
<td>3 SWS</td>
<td>Practical course / 🗣</td>
<td>Jahnke</td>
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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled
### 8.132 Course: Introduction to Stochastic Differential Equations [T-MATH-112234]

<table>
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<tr>
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<th>Josef Janák</th>
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**Competence Certificate**

The module will be completed with an oral exam (approx. 30 min).

**Prerequisites**

none

**Recommendation**

The contents of the module "Probability Theory" are strongly recommended. The module "Continuous Time Finance" is recommended.
# Course: Introduction to Stochastic Optimization [T-WIWI-106546]

**Responsible:** Prof. Dr. Steffen Rebennack  
**Organisation:** KIT Department of Economics and Management

**Part of:**  
- M-WIWI-101414 - Methodical Foundations of OR  
- M-WIWI-102832 - Operations Research in Supply Chain Management  
- M-WIWI-103289 - Stochastic Optimization

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**Events**

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<tr>
<td>ST 2022</td>
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<td>Übung zur Einführung in die Stochastische Optimierung</td>
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<td>Practice</td>
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<td>ST 2022</td>
<td>2550474</td>
<td>Rechnerübungen zur Einführung in die Stochastische Optimierung</td>
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**Legend:** 🪄 Online, 🤗 Blended (On-Site/Online), 🗪 On-Site, ✗ Canceled

### Competence Certificate

The assessment consists of a written exam (60 minutes). The exam takes place in every semester.

### Prerequisites

None.
Course: Inverse Problems [T-MATH-105835]

**Responsible:**
- PD Dr. Tilo Arens
- Prof. Dr. Roland Griesmaier
- PD Dr. Frank Hettlich
- Prof. Dr. Andreas Rieder

**Organisation:**
- KIT Department of Mathematics

**Part of:**
- M-MATH-102890 - Inverse Problems

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<td>0105110</td>
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<td>2 SWS</td>
<td>Practice / Online</td>
<td>Hettlich</td>
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Legend: Online, Blended (On-Site/Online), On-Site, Cancelled
8.135 Course: Judgement and Decision Making [T-WIWI-111099]

Responsible: Prof. Dr. Benjamin Scheibehenne
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-105312 - Marketing and Sales Management

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Events

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Legend: Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Canceled

Competence Certificate

written exam (90min) at the end of the Semester

Annotation

The judgments and decisions that we make can have long ranging and important consequences for our (financial) well-being and individual health. Hence, the goal of this lecture is to gain a better understanding of how people make judgments and decisions and the factors that influence their behavior. We will look into simple heuristics and mental shortcuts that decision makers use to navigate their environment, in particular so in an economic context. Following this the lecture will provide an overview into social and emotional influences on decision making. In the second half of the semester we will look into some more specific topics including self-control, nudging, and food choice. The last part of the lecture will focus on risk communication and risk perception. We will address these questions from an interdisciplinary perspective at the intersection of Psychology, Behavioral Economics, Marketing, Cognitive Science, and Biology. Across all topics covered in class, we will engage with basic theoretical work as well as with groundbreaking empirical research and current scientific debates.

The workload of the class is 4.5 ECTS. This consists of 3 ETCS for the lecture and 1.5 ETCS for the Übung. Details about the Übung will be communicated at the first day of the class.

Below you will find excerpts from events related to this course:

Judgment and Decision Making

2540440, WS 22/23, 3 SWS, Language: English, Open in study portal

Lecture (V) Blended (On-Site/Online)

Content

In this lecture, students will be introduced to fundamental theories and key insights on human judgment and decision making. Topics include decision making under uncertainty, choice biases, simple heuristics, risk perception and -communication, as well as social and emotional influences on decision making, to name but a few. In the Wintersemester 20/21 this class will be held online. The lecture videos will be available for download and there will be regular online meetings to discuss the topics. The lecture will be held in English.
8.136 Course: Key Moments in Geometry [T-MATH-108401]

**Responsible:** Prof. Dr. Wilderich Tuschmann

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-104057 - Key Moments in Geometry

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**Prerequisites**
none
8.137 Course: Knowledge Discovery [T-WIWI-102666]

**Responsible:** Dr.-Ing. Michael Färber

**Organisation:** KIT Department of Economics and Management

**Part of:** M-WIWI-101472 - Informatics

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**Events**

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<td>Knowledge Discovery</td>
<td>2 SWS</td>
<td>Lecture / 🗣</td>
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<td>WT 22/23</td>
<td>2511303</td>
<td>Exercises to Knowledge Discovery</td>
<td>1 SWS</td>
<td>Practice / 🗣</td>
<td>Färber, Saier, Shao, Popovic</td>
<td></td>
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</table>

**Competence Certificate**
The assessment is a written exam (60 minutes).

1. Successful participation in the exercises can earn a grade bonus in two ways:
   - By handing in the answers to an exercise sheet and reaching or exceeding 80% correct answers.
   - By handing in the results of an implementation task related to machine learning, which reaches or exceeds a given evaluation value.

If the grade of the written exam is between 4.0 and 1.3, the bonus improves the grade by a maximum of one grade level (0.3 or 0.4).

**Prerequisites**
None

Below you will find excerpts from events related to this course:

**Knowledge Discovery**
2511302, WS 22/23, 2 SWS, Language: English, [Open in study portal]

**Content**
The lecture gives an overview of approaches of machine learning and data mining for knowledge discovery from large data sets. These are examined especially with respect to algorithms, applicability to different data representations and the use in real application scenarios.

Knowledge Discovery is an established research area with a large community that investigates methods for discovering patterns and regularities in large amounts of data, including unstructured text. A variety of methods exist to extract patterns and provide previously unknown insights. This information can be predictive or descriptive.

The lecture gives an overview of Knowledge Discovery. Specific techniques and methods, challenges and current and future research topics in this research area will be taught.

Contents of the lecture cover the entire machine learning and data mining process with topics on supervised and unsupervised learning and empirical evaluation. Covered learning methods range from classical approaches like decision trees, support vector machines and neural networks to selected approaches from current research. Learning problems considered include feature vector-based learning and text mining.

**Learning objectives:**
Students

- know fundamentals of Machine Learning, Data Mining and Knowledge Discovery.
- are able to design, train and evaluate adaptive systems.
- conduct Knowledge Discovery projects in regards to algorithms, representations and applications.

**Workload:**

- The total workload for this course is approximately 135 hours
- Time of presentness: 45 hours
- Time of preparation and postprocessing: 60 hours
- Exam and exam preparation: 30 hours
Literature

- M. Berhold, D. Hand (eds). Intelligent Data Analysis - An Introduction. 2003
- P. Tan, M. Steinbach, V. Kumar: Introduction to Data Mining, 2005, Addison Wesley

Exercises to Knowledge Discovery

2511303, WS 22/23, 1 SWS, Language: English, [Open in study portal]

Content

The exercises are based on the lecture Knowledge Discovery. Several exercises are covered, which take up and discuss in detail the topics covered in the lecture Knowledge Discovery. Practical examples are demonstrated to the students to enable a knowledge transfer of the theoretical aspects learned into practical application.

Contents of the lecture cover the entire machine learning and data mining process with topics on monitored and unsupervised learning processes and empirical evaluation. The learning methods covered range from classical approaches like decision trees, support vector machines and neural networks to selected approaches from current research. Learning problems considered include feature vector-based learning and text mining.

Learning objectives:

Students

- know fundamentals of Machine Learning, Data Mining and Knowledge Discovery.
- are able to design, train and evaluate adaptive systems.
- conduct Knowledge Discovery projects in regards to algorithms, representations and applications.

Literature

- M. Berhold, D. Hand (eds). Intelligent Data Analysis - An Introduction. 2003
- P. Tan, M. Steinbach, V. Kumar: Introduction to Data Mining, 2005, Addison Wesley
8.138 Course: L2-Invariants [T-MATH-105924]

**Responsible:** Dr. Holger Kammeyer
Prof. Dr. Roman Sauer

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-102952 - L2-Invariants

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**Prerequisites**

none
8.139 Course: Large-scale Optimization [T-WIWI-106549]

- **Responsible:** Prof. Dr. Steffen Rebennack
- **Organisation:** KIT Department of Economics and Management
- **Part of:**
  - M-WIWI-101473 - Mathematical Programming
  - M-WIWI-102832 - Operations Research in Supply Chain Management
  - M-WIWI-103289 - Stochastic Optimization

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**Legend:** 🖥 Online, 🧩 Blended (On-Site/Online), 📐 On-Site, ❌ Cancelled

**Competence Certificate**

The assessment consists of a written exam (60 minutes). The exam takes place in every semester.

**Prerequisites**

None.
8 COURSES

Course: Liberalised Power Markets [T-WIWI-107043]

8.140 Course: Liberalised Power Markets [T-WIWI-107043]

<table>
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<tr>
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<th>Prof. Dr. Wolf Fichtner</th>
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<td>2581998</td>
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<td>2 SWS</td>
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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

Competence Certificate
The assessment consists of a written exam (60 minutes) (following §4(2) of the examination regulation). The exam takes place in every semester. Re-examinations are offered at every ordinary examination date. Depending on the respective pandemic situation, the exam may be offered as an open book exam (alternative exam assessment, following §4(2), 3 of the examination regulation).

Prerequisites
None

Recommendation
None

Below you will find excerpts from events related to this course:

V Liberalised Power Markets
2581998, WS 22/23, 2 SWS, Language: English, [Open in study portal]

Lecture (V)
On-Site
Content
1. Power markets in the past, now and in future
2. Designing liberalised power markets
   2.1. Unbundling Dimensions of liberalised power markets
   2.2. Central dispatch versus markets without central dispatch
   2.3. The short-term market model
   2.4. The long-term market model
   2.5. Market flaws and market failure
   2.6. Regulation in liberalised markets
3. The power (sub)markets
   3.1 Day-ahead market
   3.2 Intraday market
   3.3 (Long-term) Forwards and futures markets
   3.4 Emission rights market
   3.5 Market for ancillary services
   3.6 The "market" for renewable energies
   3.7 Future market segments
4. Grid operation and congestion management
   4.1. Grid operation
   4.2. Congestion management
5. Market power
   5.1. Defining market power
   5.2. Indicators of market power
   5.3. Reducing market power
6. Future market structures in the electricity value chain
1. Power markets in the past, now and in future
2. Designing liberalised power markets
   2.2. Unbundling Dimensions of liberalised power markets
   2.3. Central dispatch versus markets without central dispatch
   2.4. The short-term market model
   2.5. The long-term market model
   2.6. Market flaws and market failure
   2.7. Regulation in liberalised markets
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   3.1 Day-ahead market
   3.2 Intraday market
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   3.4 Emission rights market
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   3.6 The "market" for renewable energies
   3.7 Future market segments
4. Grid operation and congestion management
   4.1. Grid operation
   4.2. Congestion management
5. Market power
   5.1. Defining market power
   5.2. Indicators of market power
   5.3. Reducing market power
6. Future market structures in the electricity value chain
Literature
Weiterführende Literatur:
## 8.141 Course: Lie Groups and Lie Algebras [T-MATH-108799]

**Responsible:** Prof. Dr. Tobias Hartnick  
Prof. Dr. Enrico Leuzinger  

**Organisation:** KIT Department of Mathematics  

**Part of:** M-MATH-104261 - Lie Groups and Lie Algebras

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8 COURSES

8.142 Course: Lie-Algebras (Linear Algebra 3) [T-MATH-111723]

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-105839 - Lie-Algebras (Linear Algebra 3)

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**Prerequisites**
none
8.143 Course: Machine Learning 1 - Basic Methods [T-WIWI-106340]

**Responsible:** Prof. Dr.-Ing. Johann Marius Zöllner

**Organisation:** KIT Department of Economics and Management

**Part of:** M-WIWI-101472 - Informatics

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**Events**

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<td>Lecture / 🗣️</td>
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<td>Grade to a third</td>
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<td>Exercises to Machine Learning 1 - Fundamental Methods</td>
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<td>Each winter term</td>
<td>Zöllner, Daaboul, Polley</td>
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</table>

**Competence Certificate**

Depending on further pandemic developments, the exam will be offered either as an open-book exam, or as a written exam (60 min):

The exam takes place every semester and can be repeated at every regular examination date.

**Prerequisites**

None.

Below you will find excerpts from events related to this course:

**Machine Learning 1 - Fundamental Methods**

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<tr>
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<td>Grade to a third</td>
<td>Each winter term</td>
<td>Zöllner, Daaboul, Polley</td>
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**Legend:** 🖥️ Online, 🧩 Blended (On-Site/Online), 🗣️ On-Site, ✗ Cancelled

**Content**

The field of knowledge acquisition and machine learning is a rapidly expanding field of knowledge and the subject of numerous research and development projects. The acquisition of knowledge can take place in different ways. Thus a system can benefit from experiences already made, it can be trained, or it draws conclusions from extensive background knowledge.

The lecture covers symbolic learning methods such as inductive learning (learning from examples, learning by observation), deductive learning (explanation-based learning) and learning from analogies, as well as sub-symbolic techniques such as neural networks, support vector machines and genetic algorithms. The lecture introduces the basic principles and structures of learning systems and examines the algorithms developed so far. The structure and operation of learning systems is presented and explained with some examples, especially from the fields of robotics and image processing.

**Learning objectives:**

- Students acquire knowledge of the fundamental methods in the field of machine learning.
- Students can classify, formally describe and evaluate methods of machine learning.
- Students can use their knowledge to select suitable models and methods for selected problems in the field of machine learning.

**Literature**

Die Foliensätze sind als PDF verfügbar

Weiterführende Literatur

- Artificial Intelligence: A Modern Approach - Peter Norvig and Stuart J. Russell
- Machine Learning - Tom Mitchell
- Pattern Recognition and Machine Learning - Christopher M. Bishop
- Reinforcement Learning: An Introduction - Richard S. Sutton and Andrew G. Barto
- Deep Learning - Ian Goodfellow, Yoshua Bengio, Aaron Courville

Weitere (spezifische) Literatur zu einzelnen Themen wird in der Vorlesung angegeben.
8.144 Course: Machine Learning 2 – Advanced Methods [T-WIWI-106341]

**Responsibility:** Prof. Dr.-Ing. Johann Marius Zöllner

**Organisation:** KIT Department of Economics and Management

**Part of:**
- M-WIWI-101472 - Informatics
- M-WIWI-101637 - Analytics and Statistics

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<td>4,5</td>
<td>Grade to a third</td>
<td>Each summer term</td>
<td>3</td>
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**Events**

| ST 2022 | 2511502 | Machine Learning 2 - Advanced methods | 2 SWS | Lecture / Zöllner |
| ST 2022 | 2511503 | Exercises for Machine Learning 2 - Advanced Methods | 1 SWS | Practice / Zöllner |

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

**Competition Certificate**

Depending on further pandemic developments, the exam will be offered either as an open-book exam, or as a written exam (60 min). The exam takes place every semester and can be repeated at every regular examination date.

**Prerequisites**

None.

Below you will find excerpts from events related to this course:

**Machine Learning 2 - Advanced methods**

- **V** 2511502, SS 2022, 2 SWS, Language: German, [Open in study portal]
- **Lecture (V) On-Site**

**Content**

The subject area of machine intelligence and, in particular, machine learning, taking into account real challenges of complex application domains, is a rapidly expanding field of knowledge and the subject of numerous research and development projects. The lecture “Machine Learning 2” deals with advanced methods of machine learning such as semi-supervised and active learning, deep neural networks (deep learning), pulsed networks, hierarchical approaches, e.g. As well as dynamic, probabilistic relational methods. Another focus is the embedding and application of machine learning methods in real systems.

The lecture introduces the latest basic principles as well as extended basic structures and elucidates previously developed algorithms. The structure and the mode of operation of the methods and methods are presented and explained by means of some application scenarios, especially in the field of technical (sub) autonomous systems (robotics, neurorobotics, image processing, etc.).

**Learning objectives:**

- Students understand extended concepts of machine learning and their possible applications.
- Students can classify, formally describe and evaluate methods of machine learning.
- In detail, methods of machine learning can be embedded and applied in complex decision and inference systems.
- Students can use their knowledge to select suitable models and methods of machine learning for existing problems in the field of machine intelligence.

**Recommendations:**

Attending the lecture *Machine Learning 1* or a comparable lecture is very helpful in understanding this lecture.
Literatur
Die Foliensätze sind als PDF verfügbar

Weiterführende Literatur

- Artificial Intelligence: A Modern Approach - Peter Norvig and Stuart J. Russell
- Machine Learning - Tom Mitchell
- Pattern Recognition and Machine Learning - Christopher M. Bishop
- Reinforcement Learning: An Introduction - Richard S. Sutton and Andrew G. Barto
- Deep Learning - Ian Goodfellow, Yoshua Bengio, Aaron Courville

Weitere (spezifische) Literatur zu einzelnen Themen wird in der Vorlesung angegeben.
8.145 Course: Management of IT-Projects [T-WIWI-102667]

**Responsible:** Dr. Roland Schätzle

**Organisation:** KIT Department of Economics and Management

**Part of:** M-WIWI-101472 - Informatics

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<td>Each summer term</td>
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**Events**

| ST 2022 | 2511214 | Management of IT-Projects | 2 SWS | Lecture / 🗣 | Schätzle |
| ST 2022 | 2511215 | Übungen zu Management von Informatik-Projekten | 1 SWS | Practice / 🗣 | Schätzle |

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

**Competence Certificate**

The assessment takes place in the form of a written examination (exam) in the amount of 60 minutes. The examination is offered every semester and can be repeated at any regular examination date.

**Prerequisites**

Prerequisite for the participation in the examination is the successful participation in the exercise, which takes place in the summer semester, starting from summer semester 2020. The number of participants in the exercise is limited.

Below you will find excerpts from events related to this course:

**Management of IT-Projects**

2511214, SS 2022, 2 SWS, Language: German, Open in study portal

Lecture (V) On-Site
Content
The lecture deals with the general framework, impact factors and methods for planning, handling, and controlling of IT projects. Especially following topics are addressed:

- project environment
- project organisation
- project planning including the following items:
  - plan of the project structure
  - flow chart
  - project schedule
  - plan of resources
- effort estimation
- project infrastructure
- project controlling
- risk management
- feasibility studies
- decision processes, conduct of negotiations, time management.

Learning objectives:
Students

- explain the terminology of IT project management and typical used methods for planning, handling and controlling,
- apply methods appropriate to current project phases and project contexts,
- consider organisational and social impact factors.

Recommendations:
Knowledge from the lecture Software Engineering is helpful.

Workload:

- Lecture 30h
- Exercise 15h
- Preparation of lecture 24h
- Preparation of exercises 25h
- Exam preparation 40h
- Exam 1h

Literature

- B. Hindel, K. Hörmann, M. Müller, J. Schmied. Basiswissen Software-Projektmanagement. dpunkt.verlag 2004

Übungen zu Management von Informatik-Projekten
2511215, SS 2022, 1 SWS, Language: German, Open in study portal

Content
The general conditions, influencing factors and methods in the planning, execution and control of IT projects are dealt with. In particular, the following topics will be dealt with: Project environment, project organization, project structure plan, effort estimation, project infrastructure, project control, decision-making processes, negotiation, time management. The lecture is accompanied by exercises in the form of tutorials. The date of the exercise will be announced later.
8.146 Course: Market Research [T-WIWI-107720]

**Responsible:** Prof. Dr. Martin Klarmann  
**Organisation:** KIT Department of Economics and Management  
**Part of:** M-WIWI-105312 - Marketing and Sales Management

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**Events**

| ST 2022 | 2571150 | Market Research | 2 SWS | Lecture / 🗣 | Klarmann |
| ST 2022 | 2571151 | Market Research Tutorial | 1 SWS | Practice / 🗣 | Pade |

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

**Competence Certificate**

The assessment of success takes place through a written exam with additional aids in the sense of an open book exam. The written exam will either take place in the lecture hall or online, depending on further pandemic developments. Further details will be announced during the lecture.

**Prerequisites**

None

**Recommendation**

None

**Annotation**

Please note that this course has to be completed successfully by students interested in master thesis positions at the Marketing & Sales Research Group.

Below you will find excerpts from events related to this course:

**Market Research**

2571150, SS 2022, 2 SWS, Language: English, Open in study portal
Content
Within the lecture, essential statistical methods for measuring customer attitudes (e.g. satisfaction measurement), understanding customer behavior and making strategic decisions will be discussed. The practical use as well as the correct handling of different survey methods will be taught, such as experiments and surveys. To analyze the collected data, various analysis methods are presented, including hypothesis tests, factor analyses, cluster analyses, variance and regression analyses. Building on this, the interpretation of the results will be discussed.

Topics addressed in this course are for example:

- Theoretical foundations of market research
- Statistical foundations of market research
- Measuring customer attitudes
- Understanding customer reactions
- Strategical decision making

The aim of this lecture is to give an overview of essential statistical methods. In the lecture students learn the practical use as well as the correct handling of different statistical survey methods and analysis procedures. In addition, emphasis is put on the interpretation of the results after the application of an empirical survey. The derivation of strategic options is an important competence that is required in many companies in order to react optimally to customer needs.

The assessment is carried out (according to §4(2), 3 SPO) in the form of a written open book exam.

The total workload for this course is approximately 135.0 hours.

Presence time: 30 hours
Preparation and wrap-up of the course: 45.0 hours
Exam and exam preparation: 60.0 hours

Please note that this course has to be completed successfully by students interested in master thesis positions at the chair of marketing.

Literature
8.147 Course: Marketing Strategy Business Game [T-WIWI-102835]

**Responsible:** Prof. Dr. Martin Klarmann

**Organisation:** KIT Department of Economics and Management

**Part of:** M-WIWI-105312 - Marketing and Sales Management

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**Competence Certificate**
The assessment (alternative exam assessment) consists of a group presentation and a subsequent round of questions totalling 20 minutes.

**Prerequisites**
None

**Recommendation**
None

**Annotation**
Please note that only one of the courses from the election block can be chosen in the module.

Please note: The number of participants for this course is limited. The Marketing and Sales Research Group typically provides the possibility to attend a course with 1.5 ECTS points in the respective module to all students. Participation in a specific course cannot be guaranteed.

In order to participate in this course, you need to apply. Applications are usually accepted at the start of the lecture period in summer term. Detailed information on the application process is usually provided on the website of the Marketing and Sales Research Group (marketing.iism.kit.edu) shortly before the lecture period in summer term starts.
8.148 Course: Markov Decision Processes [T-MATH-105921]

Responsible: Prof. Dr. Nicole Bäuerle
Organisation: KIT Department of Mathematics
Part of: M-MATH-102907 - Markov Decision Processes

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Prerequisites
none
**8.149 Course: Master's Thesis [T-MATH-105878]**

**Responsible:** Dr. Sebastian Grensing  
**Organisation:** KIT Department of Mathematics  
**Part of:** M-MATH-102917 - Master's Thesis

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<td>Grade to a third</td>
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**Final Thesis**  
This course represents a final thesis. The following periods have been supplied:

- **Submission deadline:** 6 months  
- **Maximum extension period:** 3 months  
- **Correction period:** 8 weeks
8.150 Course: Mathematical Methods in Signal and Image Processing [T-MATH-105862]

**Responsible:** Prof. Dr. Andreas Rieder

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-102897 - Mathematical Methods in Signal and Image Processing

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<td>Oral examination</td>
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**Prerequisites**
none
8.151 Course: Mathematical Methods of Imaging [T-MATH-106488]

**Responsible:** Prof. Dr. Andreas Rieder

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-103260 - Mathematical Methods of Imaging

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**Prerequisites**
None
### 8.152 Course: Mathematical Modelling and Simulation in Practise [T-MATH-105889]

**Responsible:** PD Dr. Gudrun Thäter  
**Organisation:** KIT Department of Mathematics  
**Part of:** M-MATH-102929 - Mathematical Modelling and Simulation in Practise

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<td>2 SWS</td>
<td>Lecture</td>
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<td>Tutorial for 0109400</td>
<td>1 SWS</td>
<td>Practice</td>
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Below you will find excerpts from events related to this course:

**Mathematical Modelling and Simulation**  
0109400, WS 22/23, 2 SWS, Language: English, Open in study portal

Lecture (V)
# 8.153 Course: Mathematical Statistics [T-MATH-105872]

### Responsible:
- Dr. rer. nat. Bruno Ebner
- Prof. Dr. Vicky Fasen-Hartmann
- PD Dr. Bernhard Klar
- Prof. Dr. Mathias Trabs

### Organisation:
- KIT Department of Mathematics

### Part of:
- M-MATH-102909 - Mathematical Statistics

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### Prerequisites
- none
### 8.154 Course: Mathematical Topics in Kinetic Theory [T-MATH-108403]

<table>
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<tr>
<th>Responsible</th>
<th>Prof. Dr. Dirk Hundertmark</th>
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<td>Part of</td>
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**Prerequisites**

none
Course: Mathematics for High Dimensional Statistics [T-WIWI-111247]

Responsible: Prof. Dr. Oliver Grothe
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101473 - Mathematical Programming
M-WIWI-101637 - Analytics and Statistics
M-WIWI-103289 - Stochastic Optimization

Type: Oral examination
Credits: 4.5
Grading scale: Grade to a third
Recurrence: Irregular
Version: 1

Competence Certificate
The assessment consists of an oral exam (30 min.) taking place in the recess period.

Prerequisites
None

Recommendation
Basic knowledge of mathematics and statistics is assumed.
Knowledge in multivariate statistics is an advantage, but not necessary for the course.
8.156 Course: Maxwell's Equations [T-MATH-105856]

**Responsible:**  
PD Dr. Tilo Arens  
Prof. Dr. Roland Griesmaier  
PD Dr. Frank Hettlich

**Organisation:**  
KIT Department of Mathematics

**Part of:**  
M-MATH-102885 - Maxwell's Equations

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8.157 Course: Medical Imaging [T-MATH-105861]

**Responsible:** Prof. Dr. Andreas Rieder

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-102896 - Medical Imaging

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**Prerequisites**

none
8.158 Course: Metric Geometry [T-MATH-111933]

**Responsible:** Prof. Dr. Alexander Lytchak  
**Organisation:** KIT Department of Mathematics  
**Part of:** M-MATH-105931 - Metric Geometry

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</table>

**Competence Certificate**  
oral examination of circa 20 minutes

**Prerequisites**  
none
### 8.159 Course: Mixed Integer Programming I [T-WIWI-102719]

**Responsible:** Prof. Dr. Oliver Stein  
**Organisation:** KIT Department of Economics and Management  
**Part of:**  
- M-WIWI-101473 - Mathematical Programming  
- M-WIWI-102832 - Operations Research in Supply Chain Management  
- M-WIWI-103289 - Stochastic Optimization

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**Credits** 4.5  
**Recurrence** Irregular  
**Version** 1

#### Competence Certificate

The assessment of the lecture is a written examination (60 minutes) according to §4(2), 1 of the examination regulation. The successful completion of the exercises is required for admission to the written exam. The examination is held in the semester of the lecture and in the following semester. The examination can also be combined with the examination of *Mixed Integer Programming II* [25140]. In this case, the duration of the written examination takes 120 minutes.

#### Prerequisites

None

#### Recommendation

It is strongly recommended to visit at least one lecture from the Bachelor program of this chair before attending this course.

#### Annotation

The lecture is offered irregularly. The curriculum of the next three years is available online (kop.ior.kit.edu).

---

Below you will find excerpts from events related to this course:

#### ST 2022 8.159 Mixed Integer Programming II [2550140]

**Type:** Lecture  
**ECTS:** 2  
**Language:** German  
**On-Site**

---

**Below you will find excerpts from events related to this course:**

#### V 8.159 Mixed Integer Programming II [2550140]

**Type:** Lecture (V)  
**ECTS:** 2  
**Language:** German  
**On-Site**

---

**Economathematics M.Sc.**  
Module Handbook as of 06/09/2022
Content

Many optimization problems from economics, engineering and natural sciences are modeled with continuous as well as with discrete variables. Examples are the energy minimal design of a chemical process in which several reactors may be switched on or off, portfolio optimization with limitations on the number of securities, the choice of locations to serve customers at minimum cost, and the optimal design of vote allocations in election procedures. For the algorithmic identification of optimal points of such problems an interaction of ideas from discrete as well as continuous optimization is necessary.

The lecture focusses on mixed-integer nonlinear optimization problems and is structured as follows:

- Continuous relaxation and error bounds for roundings
- Branch-and-Bound for convex and nonconvex problems
- Generalized Benders decomposition
- Outer approximation methods
- Lagrange relaxation
- Dantzig-Wolfe decomposition
- Heuristics

The lecture is accompanied by exercises which, amongst others, offers the opportunity to implement and to test some of the methods on practically relevant examples.

Remark:
The treatment of mixed-integer linear optimization problems forms the contents of the lecture "Mixed-integer Programming I".

Learning objectives:
The student

- knows and understands the fundamentals of nonlinear mixed integer programming,
- is able to choose, design and apply modern techniques of nonlinear mixed integer programming in practice.

Literature

- J. Kallrath: Gemischt-ganzzahlige Optimierung, Vieweg, 2002
- D. Li, X. Sun: Nonlinear Integer Programming, Springer, 2006
8.160 Course: Mixed Integer Programming II [T-WIWI-102720]

**Responsible:** Prof. Dr. Oliver Stein

**Organisation:** KIT Department of Economics and Management

**Part of:**
- M-WIWI-101473 - Mathematical Programming
- M-WIWI-102832 - Operations Research in Supply Chain Management
- M-WIWI-103289 - Stochastic Optimization

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**Events**

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<td>2550141</td>
<td>Exercise to Mixed-integer Programming II</td>
<td>Practice / On-Site</td>
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<td>Stein, Schwarze</td>
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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

**Competence Certificate**
The assessment of the lecture is a written examination (60 minutes) according to §4(2), 1 of the examination regulation. The successful completion of the exercises is required for admission to the written exam. The examination is held in the semester of the lecture and in the following semester. The examination can also be combined with the examination of Mixed Integer Programming I [2550138]. In this case, the duration of the written examination takes 120 minutes.

**Prerequisites**
None

**Recommendation**
It is strongly recommended to visit at least one lecture from the Bachelor program of this chair before attending this course.

**Annotation**
The lecture is offered irregularly. The curriculum of the next three years is available online (kop.ior.kit.edu).

Below you will find excerpts from events related to this course:

**Mixed-integer Programming II**
2550140, SS 2022, 2 SWS, Language: German, Open in study portal

Lecture (V) On-Site
Content
Many optimization problems from economics, engineering and natural sciences are modeled with continuous as well as with discrete variables. Examples are the energy minimal design of a chemical process in which several reactors may be switched on or off, portfolio optimization with limitations on the number of securities, the choice of locations to serve customers at minimum cost, and the optimal design of vote allocations in election procedures. For the algorithmic identification of optimal points of such problems an interaction of ideas from discrete as well as continuous optimization is necessary.

The lecture focusses on mixed-integer nonlinear optimization problems and is structured as follows:

- Continuous relaxation and error bounds for roundings
- Branch-and-Bound for convex and nonconvex problems
- Generalized Benders decomposition
- Outer approximation methods
- Lagrange relaxation
- Dantzig-Wolfe decomposition
- Heuristics

The lecture is accompanied by exercises which, amongst others, offers the opportunity to implement and to test some of the methods on practically relevant examples.

Remark:
The treatment of mixed-integer linear optimization problems forms the contents of the lecture "Mixed-integer Programming I".

Learning objectives:
The student
- knows and understands the fundamentals of nonlinear mixed integer programming,
- is able to choose, design and apply modern techniques of nonlinear mixed integer programming in practice.

Literature
- J. Kallrath: Gemischt-ganzzahlige Optimierung, Vieweg, 2002
- D. Li, X. Sun: Nonlinear Integer Programming, Springer, 2006
### 8.161 Course: Modeling and OR-Software: Advanced Topics [T-WIWI-106200]

**Responsible:** Prof. Dr. Stefan Nickel

**Organisation:** KIT Department of Economics and Management

**Part of:** M-WIWI-102832 - Operations Research in Supply Chain Management

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<td>Each winter term</td>
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**Competence Certificate**
The assessment is a written examination. The examination is held in every semester. The prerequisite can only be obtained in semesters in which the course exercises are offered.

**Prerequisites**
Prerequisite for admission to the exam is the successful participation in the exercises. This includes the processing and presentation of exercises.

**Recommendation**
Basic knowledge as conveyed in the module Introduction to Operations Research is assumed.
Successful completion of the course Modeling and OR-Software: Introduction.

**Annotation**
Due to capacity restrictions, registration before course start is required. For further information see the webpage of the course.
The lecture is held in every term. The planned lectures and courses for the next three years are announced online.

**Below you will find excerpts from events related to this course:**

#### Modellieren und OR-Software: Fortgeschrittene Themen
2550490, WS 22/23, 3 SWS, Language: German, Open in study portal

**Content**
The advanced course is designated for Master students that already attended the introductory course or gained equivalent experience elsewhere, e.g. during a seminar or bachelor thesis. We will work on advanced topics and methods in OR, among others cutting planes, column generation and constraint programming. The Software used for the exercises is IBM ILOG CPLEX Optimization Studio. The associated modelling programming languages are OPL and ILOG Script.

**Organizational issues**
Link zur Bewerbung:
http://go.wiwi.kit.edu/OR_Bewerbung

Bewerberzeitraum:
01.09.2022 00:00 - 31.10.2022 23:55
Course: Modeling and OR-Software: Introduction [T-WIWI-106199]

**Responsible:** Prof. Dr. Stefan Nickel  
**Organisation:** KIT Department of Economics and Management  
**Part of:** M-WIWI-101413 - Applications of Operations Research

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**Events**

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<td>Modellieren und OR-Software: Einführung</td>
<td>3 SWS</td>
<td>Practical course / 🧩</td>
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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

**Competence Certificate**  
The assessment is a written examination. The examination is held in every semester. The prerequisite can only be obtained in semesters in which the course exercises are offered.

**Prerequisites**  
Prerequisite for admission to the exam is the successful participation in the exercises. This includes the processing and presentation of exercises.

**Recommendation**  

**Annotation**  
Due to capacity restrictions, registration before course start is required. For further information see the webpage of the course.

The lecture is offered in every term. The planned lectures and courses for the next three years are announced online.

**Below you will find excerpts from events related to this course:**

**Modellieren und OR-Software: Einführung**  
2550490, SS 2022, 3 SWS, Language: German, [Open in study portal](#)

**Content**  
After an introduction to general concepts of modelling tools (implementation, data handling, result interpretation,...), the software IBM ILOG CPLEX Optimization Studio and the corresponding modeling language OPL will be discussed which can be used to solve OR problems on a computer-aided basis. Subsequently, a broad range of exercises will be discussed. The main goals of the exercises from literature and practical applications are to learn the process of modeling optimization problems as linear or mixed-integer programs, to efficiently utilize the presented tools for solving these optimization problems and to implement heuristic solution procedures for mixed-integer programs.

**Organizational issues**  
Bewerbung einreichen bis 31.03.2022:  
[http://go.wiwi.kit.edu/OR_Bewerbung](http://go.wiwi.kit.edu/OR_Bewerbung)
8.163 Course: Monotonicity Methods in Analysis [T-MATH-105877]

**Responsible:** PD Dr. Gerd Herzog

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-102887 - Monotonicity Methods in Analysis

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8.164 Course: Multicriteria Optimization [T-WIWI-111587]

Responsible: Prof. Dr. Oliver Stein
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101473 - Mathematical Programming
M-WIWI-102832 - Operations Research in Supply Chain Management
M-WIWI-103289 - Stochastic Optimization

Type | Credits | Grading scale | Recurrence | Version
--- | --- | --- | --- | ---
Written examination | 4,5 | Grade to a third | see Annotations | 1

Competence Certificate
The assessment of the lecture is a written examination (60 minutes) according to §4(2), 1 of the examination regulation. The successful completion of the exercises is required for admission to the written exam. The examination is held in the semester of the lecture and in the following semester.

Prerequisites
None

Recommendation
It is strongly recommended to visit at least one lecture from the Bachelor program of this chair before attending this course.

Annotation
The course is offered every second winter semester (starting WiSe 22/23). The curriculum of the next three years is available online (www.ior.kit.edu).

Contents:
Multicriteria optimization deals with optimization problems with multiple objective functions. In practice, the minimization or maximization of several objectives often conflict with each other, such as weight and stability of mechanical components, return and risk of stock portfolios, or cost and duration of transports. Various scalarization approaches allow one to formulate single-objective problems that can be solved using nonlinear or global optimization techniques, and whose optimal points have a reasonable interpretation for the underlying multicriteria problem.
However, some seemingly obvious scalarization approaches suffer from various drawbacks, so that regardless of scalarization approaches, it is necessary to clarify what is meant by the solution of a multicriteria optimization problem in the first place. For such Pareto-optimal points, optimality conditions and solution procedures based on them can be formulated. From the usually non-unique Pareto set, decision makers finally choose an alternative based on their subjective preferences.
The lecture gives a mathematically sound introduction to multicriteria optimization and is structured as follows:
- Introductory examples and terminology
- Solution concepts
- Methods for the determination of the Pareto set
- Selection of Pareto-optimal points under subjective preferences
8.165 Course: Multivariate Statistical Methods [T-WIWI-103124]

**Responsible:** Prof. Dr. Oliver Grothe

**Organisation:** KIT Department of Economics and Management

**Part of:**
- M-WIWI-101473 - Mathematical Programming
- M-WIWI-101637 - Analytics and Statistics
- M-WIWI-101639 - Econometrics and Statistics II
- M-WIWI-103289 - Stochastic Optimization

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<td>Each summer term</td>
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**Events**

| ST 2022   | 2550554 | Multivariate Verfahren | 2 SWS | Lecture / Grothe |
| ST 2022   | 2550555 | Übung zu Multivariate Verfahren | 2 SWS | Practice / Kächele |

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

**Competence Certificate**

Depending on further pandemic developments, the examination will be offered either as a 60-minute written examination (written examination according to SPO § 4 Abs. 2, Pkt. 1) or as an open-book examination (alternative exam assessment according to SPO § 4 Abs. 2, Pkt. 3).

The exam is offered every semester. Re-examinations are offered only for repeaters.

**Prerequisites**

None

**Recommendation**

The course covers highly advanced statistical methods with a quantitative focus. Hence, participants are necessarily expected to have advanced statistical knowledge, e.g. acquired in the course "Advanced Statistics". Without this, participation in the course is not advised.

Previous attendance of the course Analysis of Multivariate Data is recommended. Alternatively, the script can be provided to interested students.

*Below you will find excerpts from events related to this course:*

**Multivariate Verfahren**

2550554, SS 2022, 2 SWS, [Open in study portal](#)

**Literature**

Skript zur Vorlesung
8.166 Course: Nature-Inspired Optimization Methods [T-WIWI-102679]

**Responsible:** apl. Prof. Dr. Pradyumn Kumar Shukla

**Organisation:** KIT Department of Economics and Management

**Part of:** M-WIWI-101472 - Informatics

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<td>2 SWS</td>
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<td>Übungen zu Nature-Inspired Optimization Methods</td>
<td>1 SWS</td>
<td>Practice / Shukla</td>
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**Competence Certificate**

The assessment consists of a written exam (60 min) (according to Section 4(2), 1 of the examination regulation) and an additional written examination called “bonus exam”, 60 min (according Section 4(2), 3 of the examination regulation) or a selection of exercises. The bonus exam may be split into several shorter written tests.

The grade of this course is the achieved grade in the written examination. If this grade is at least 4.0 and at most 1.3, a passed bonus exam will improve it by one grade level (i.e. by 0.3 or 0.4).

**Prerequisites**

None

*Below you will find excerpts from events related to this course:*

**Nature-Inspired Optimization Methods**

2511106, SS 2022, 2 SWS, Language: English, [Open in study portal](#)

**Content**

Many optimization problems are too complex to be solved to optimality. A promising alternative is to use stochastic heuristics, based on some fundamental principles observed in nature. Examples include evolutionary algorithms, ant algorithms, or simulated annealing. These methods are widely applicable and have proven very powerful in practice. During the course, such optimization methods based on natural principles are presented, analyzed and compared. Since the algorithms are usually quite computational intensive, possibilities for parallelization are also investigated.

**Learning objectives:**

Students learn:

- Different nature-inspired methods: local search, simulated annealing, tabu search, evolutionary algorithms, ant colony optimization, particle swarm optimization
- Different aspects and limitation of the methods
- Applications of such methods
- Multi-objective optimization methods
- Constraint handling methods
- Different aspects in parallelization and computing platforms

**Literature**

* E. Bonabeau, M. Dorigo, G. Theraulaz: 'Swarm Intelligence'. Oxford University Press, 1999
* A. E. Eiben, J. E. Smith: 'Introduction to Evolutionary Computation'. Bradford Book, 2004
* Springer, 2003

Econmathematics M.Sc.
Module Handbook as of 06/09/2022

417
8.167 Course: Non- and Semiparametrics [T-WIWI-103126]

Responsible: Prof. Dr. Melanie Schienle
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101638 - Econometrics and Statistics I
M-WIWI-101639 - Econometrics and Statistics II

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<td>Non- and Semiparametrics</td>
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Competence Certificate
The assessment consists of a written exam (90 minutes) (following §4(2), 1 of the examination regulation).

Prerequisites
None

Recommendation
Knowledge of the contents covered by the course "Applied Econometrics" [2520020]

Annotation
The course takes place every second winter semester: 2018/19 then 2020/21

Below you will find excerpts from events related to this course:

Non- and Semiparametrics
2521300, WS 22/23, 2 SWS, Language: German, Open in study portal

Content
Learning objectives:
The student
- has profound knowledge of non- and semiparametric estimation methods
- is capable of implementing these methods using statistical software and using them to assess empirical problems

Content:
Kernel density estimation, local constant and local linear regression, bandwidth choice, series and sieve estimators, additive models, semiparametric models

Requirements:
It is recommended to attend the course Applied Econometrics prior to this course.

Workload:
Total workload for 4.5 CP: approx. 135 hours
Attendance: 30 hours
Preparation and follow-up: 65 hours
Exam preparation: 40 hours

Literature
8.168 Course: Nonlinear Analysis [T-MATH-107065]

**Responsible:** Prof. Dr. Tobias Lamm

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-103539 - Nonlinear Analysis

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**Prerequisites**

none
### 8.169 Course: Nonlinear Maxwell Equations [T-MATH-106484]

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**Prerequisites**
Keine
### 8.170 Course: Nonlinear Maxwell Equations [T-MATH-110283]

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**Prerequisites**

none
8.171 Course: Nonlinear Optimization I [T-WIWI-102724]

**Responsible:** Prof. Dr. Oliver Stein  
**Organisation:** KIT Department of Economics and Management  
**Part of:**  
- M-WIWI-101414 - Methodical Foundations of OR  
- M-WIWI-101473 - Mathematical Programming

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**Events**

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<th>2550111</th>
<th>Nonlinear Optimization I</th>
<th>2 SWS</th>
<th>Lecture / 🗣</th>
<th>Stein</th>
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<td>Practice / 🗣</td>
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Legend: 🖥 Online, ⚡ Blended (On-Site/Online), 🗣 On-Site, ✗ CANCELLED

**Competence Certificate**
The assessment consists of a written exam (60 minutes) according to Section 4(2), 1 of the examination regulation. The successful completion of the exercises is required for admission to the written exam. The exam takes place in the semester of the lecture and in the following semester.
The examination can also be combined with the examination of Nonlinear Optimization II [2550113]. In this case, the duration of the written examination takes 120 minutes.

**Prerequisites**
The module component exam T-WIWI-103637 "Nonlinear Optimization I and II" may not be selected.

**Annotation**
Part I and II of the lecture are held consecutively in the same semester.

*Below you will find excerpts from events related to this course:*

**Nonlinear Optimization I**  
2550111, WS 22/23, 2 SWS, Language: German, [Open in study portal]

**Content**
The lecture treats the minimization of smooth nonlinear functions without constraints. For such problems, which occur very often in economics, engineering, and natural sciences, optimality conditions are derived and, based on them, solution algorithms are developed. The lecture is structured as follows:

- Introduction, examples, and terminology
- Existence results for optimal points
- First and second order optimality conditions
- Algorithms (line search, steepest descent method, variable metric methods, Newton method, Quasi Newton methods, CG method, trust region method)

The lecture is accompanied by exercises which, amongst others, offers the opportunity to implement and to test some of the methods on practically relevant examples.

**Remark:**
The treatment of optimization problems with constraints forms the contents of the lecture “Nonlinear Optimization II”. The lectures "Nonlinear Optimization I" and "Nonlinear Optimization II" are held consecutively in the same semester.

**Learning objectives:**
The student

- knows and understands fundamentals of unconstrained nonlinear optimization,
- is able to choose, design and apply modern techniques of unconstrained nonlinear optimization in practice.
Literature

Weiterführende Literatur:
- W. Alt, Nichtlineare Optimierung, Vieweg, 2002
- M.S. Bazaraa, H.D. Sherali, C.M. Shetty, Nonlinear Programming, Wiley, 1993
8.172 Course: Nonlinear Optimization I and II [T-WIWI-103637]

**Responsible:** Prof. Dr. Oliver Stein

**Organisation:** KIT Department of Economics and Management

**Part of:**
- M-WIWI-101414 - Methodical Foundations of OR
- M-WIWI-101473 - Mathematical Programming

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<td>Exercises Nonlinear Optimization I + II</td>
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<td>Stein, Schwarze</td>
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*Legend:* 📬 Online, 🧩 Blended (On-Site/Online), 📺 On-Site, ✗ Canceled

**Competence Certificate**

The assessment consists of a written exam (120 minutes) according to Section 4(2), 1 of the examination regulation. The successful completion of the exercises is required for admission to the written exam. The exam takes place in the semester of the lecture and in the following semester.

**Prerequisites**

None.

**Annotation**

Part I and II of the lecture are held consecutively in the same semester.

Below you will find excerpts from events related to this course:

**Nonlinear Optimization I**

2550111, WS 22/23, 2 SWS, Language: German, [Open in study portal]

**Lecture (V)**

On-Site

**Content**

The lecture treats the minimization of smooth nonlinear functions without constraints. For such problems, which occur very often in economics, engineering, and natural sciences, optimality conditions are derived and, based on them, solution algorithms are developed. The lecture is structured as follows:

- Introduction, examples, and terminology
- Existence results for optimal points
- First and second order optimality conditions
- Algorithms (line search, steepest descent method, variable metric methods, Newton method, Quasi Newton methods, CG method, trust region method)

The lecture is accompanied by exercises which, amongst others, offers the opportunity to implement and to test some of the methods on practically relevant examples.

**Remark:**

The treatment of optimization problems with constraints forms the contents of the lecture "Nonlinear Optimization II". The lectures "Nonlinear Optimization I" and "Nonlinear Optimization II" are held consecutively in the same semester.

**Learning objectives:**

The student

- knows and understands fundamentals of unconstrained nonlinear optimization,
- is able to choose, design and apply modern techniques of unconstrained nonlinear optimization in practice.
Nonlinear Optimization II
2550113, WS 22/23, 2 SWS, Language: German, Open in study portal

Content
The lecture treats the minimization of smooth nonlinear functions under nonlinear constraints. For such problems, which occur very often in economics, engineering, and natural sciences, optimality conditions are derived and, based on them, solution algorithms are developed. The lecture is structured as follows:

- Topology and first order approximations of the feasible set
- Theorems of the alternative, first and second order optimality conditions
- Algorithms (penalty method, multiplier method, barrier method, interior point method, SQP method, quadratic optimization)

The lecture is accompanied by exercises which, amongst others, offers the opportunity to implement and to test some of the methods on practically relevant examples.

Remark:
The treatment of optimization problems without constraints forms the contents of the lecture "Nonlinear Optimization I". The lectures "Nonlinear Optimization I" and "Nonlinear Optimization II" are held consecutively in the same semester.

Learning objectives:
The student
- knows and understands fundamentals of constrained nonlinear optimization,
- is able to choose, design and apply modern techniques of constrained nonlinear optimization in practice.

Literature

Weiterführende Literatur:
- W. Alt, Nichtlineare Optimierung, Vieweg, 2002
- M.S. Bazaraa, H.D. Sherali, C.M. Shetty, Nonlinear Programming, Wiley, 1993
### 8.173 Course: Nonlinear Optimization II [T-WIWI-102725]

**Responsible:** Prof. Dr. Oliver Stein  
**Organisation:** KIT Department of Economics and Management  
**Part of:**  
- M-WIWI-101414 - Methodical Foundations of OR  
- M-WIWI-101473 - Mathematical Programming

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<td>Nonlinear Optimization II</td>
<td>2 SWS</td>
<td>Lecture / ⌁</td>
<td>Stein</td>
</tr>
</tbody>
</table>

**Competence Certificate**  
The assessment consists of a written exam (60 minutes) according to Section 4(2), 1 of the examination regulation. The successful completion of the exercises is required for admission to the written exam.  
The exam takes place in the semester of the lecture and in the following semester.  
The exam can also be combined with the examination of Nonlinear Optimization I [2550111]. In this case, the duration of the written exam takes 120 minutes.

**Prerequisites**  
None.

**Annotation**  
Part I and II of the lecture are held consecutively in the same semester.

Below you will find excerpts from events related to this course:

<table>
<thead>
<tr>
<th>Nonlinear Optimization II</th>
<th>Lecture (V)</th>
<th>On-Site</th>
</tr>
</thead>
<tbody>
<tr>
<td>2550113, WS 22/23, 2 SWS, Language: German</td>
<td>Open in study portal</td>
<td></td>
</tr>
</tbody>
</table>

**Content**  
The lecture treats the minimization of smooth nonlinear functions under nonlinear constraints. For such problems, which occur very often in economics, engineering, and natural sciences, optimality conditions are derived and, based on them, solution algorithms are developed. The lecture is structured as follows:

- Topology and first order approximations of the feasible set
- Theorems of the alternative, first and second order optimality conditions
- Algorithms (penalty method, multiplier method, barrier method, interior point method, SQP method, quadratic optimization)

The lecture is accompanied by exercises which, amongst others, offers the opportunity to implement and to test some of the methods on practically relevant examples.

**Remark:**  
The treatment of optimization problems without constraints forms the contents of the lecture "Nonlinear Optimization I". The lectures "Nonlinear Optimization I" and "Nonlinear Optimization II" are held consecutively in the same semester.

**Learning objectives:**  
The student

- knows and understands fundamentals of constrained nonlinear optimization,  
- is able to choose, design and apply modern techniques of constrained nonlinear optimization in practice.
Literature

Weiterführende Literatur:

- W. Alt, Nichtlineare Optimierung, Vieweg, 2002
- M.S. Bazaraa, H.D. Sherali, C.M. Shetty, Nonlinear Programming, Wiley, 1993
### 8.174 Course: Nonlinear Wave Equations [T-MATH-110806]

**Responsible:** Dr. Birgit Schörkhuber  
**Organisation:** KIT Department of Mathematics  
**Part of:** M-MATH-105326 - Nonlinear Wave Equations

<table>
<thead>
<tr>
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<th>Credits</th>
<th>Grading scale</th>
<th>Recurrence</th>
<th>Version</th>
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<tbody>
<tr>
<td>Oral exam.</td>
<td>4</td>
<td>Grade to a third</td>
<td>Irregular</td>
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</tr>
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</table>

**Prerequisites**
none
8.175 Course: Nonparametric Statistics [T-MATH-105873]

**Responsible:** Dr. rer. nat. Bruno Ebner  
Prof. Dr. Vicky Fasen-Hartmann  
PD Dr. Bernhard Klar  
Prof. Dr. Mathias Trabs

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-102910 - Nonparametric Statistics

<table>
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<tr>
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<td>Grade to a third</td>
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**Events**

<table>
<thead>
<tr>
<th>Semester</th>
<th>Event ID</th>
<th>Event Name</th>
<th>SWS</th>
<th>Type</th>
<th>Instructor</th>
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</thead>
<tbody>
<tr>
<td>WT 22/23</td>
<td>0162300</td>
<td>Nichtparametrische Statistik</td>
<td>2</td>
<td>Lecture</td>
<td>Klar</td>
</tr>
<tr>
<td>WT 22/23</td>
<td>0162310</td>
<td>Übungen zu 0162300 (Nichtparametrische Statistik)</td>
<td>1</td>
<td>Practice</td>
<td>Klar</td>
</tr>
</tbody>
</table>
8.176 Course: Numerical Analysis of Helmholtz Problems [T-MATH-111514]

<table>
<thead>
<tr>
<th>Responsible:</th>
<th>TT-Prof. Dr. Barbara Verfürth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organisation:</td>
<td>KIT Department of Mathematics</td>
</tr>
<tr>
<td>Part of:</td>
<td>M-MATH-105764 - Numerical Analysis of Helmholtz Problems</td>
</tr>
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<table>
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<tr>
<th>Type</th>
<th>Credits</th>
<th>Grading scale</th>
<th>Recurrence</th>
<th>Expansion</th>
<th>Version</th>
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<td>Grade to a third</td>
<td>Irregular</td>
<td>1 terms</td>
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</table>
Course: Numerical Complex Analysis [T-MATH-112280]

**Responsible:** Prof. Dr. Marlis Hochbruck

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-106063 - Numerical Complex Analysis

<table>
<thead>
<tr>
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<th>Credits</th>
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<th>Recurrence</th>
<th>Expansion</th>
<th>Version</th>
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<td>Grade to a third</td>
<td>Irregular</td>
<td>1 terms</td>
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</table>

**Competence Certificate**
oral exam of ca. 20 minutes

**Prerequisites**
none

**Recommendation**
Some basic knowledge of Complex Analysis is strongly recommended.
8.178 Course: Numerical Continuation Methods [T-MATH-105912]

**Responsible:** Prof. Dr. Jens Rottmann-Matthes

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-102944 - Numerical Continuation Methods

<table>
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<th>Version</th>
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<td>Grade to a third</td>
<td>1</td>
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</table>

**Prerequisites**
none

**Responsible:** Jun.-Prof. Dr. Hartwig Anzt

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-103709 - Numerical Linear Algebra for Scientific High Performance Computing

<table>
<thead>
<tr>
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<th>Grading scale</th>
<th>Recurrence</th>
<th>Version</th>
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<tr>
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**Events**

| ST 2022 | 0110650 | Numerical Linear Algebra for Scientific High Performance Computing | 2 SWS | Lecture | Anzt |

**Prerequisites**

none
## 8.180 Course: Numerical Linear Algebra in Image Processing [T-MATH-108402]

<table>
<thead>
<tr>
<th>Responsible:</th>
<th>PD Dr. Volker Grimm</th>
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<tbody>
<tr>
<td>Organisation:</td>
<td>KIT Department of Mathematics</td>
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<tr>
<td>Part of:</td>
<td>M-MATH-104058 - Numerical Linear Algebra in Image Processing</td>
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<table>
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<tbody>
<tr>
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<td>Recurrence</td>
<td>Irregular</td>
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</table>

**Prerequisites**

none
### 8.181 Course: Numerical Methods for Differential Equations [T-MATH-105836]

**Responsible:**
- Prof. Dr. Willy Dörfler
- Prof. Dr. Marlis Hochbruck
- Prof. Dr. Tobias Jahnke
- Prof. Dr. Andreas Rieder
- Prof. Dr. Christian Wieners

**Organisation:**
KIT Department of Mathematics

**Part of:**
M-MATH-102888 - Numerical Methods for Differential Equations

<table>
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**Events**

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<th>Event Title</th>
<th>Weekly Sessions (SWS)</th>
<th>Type</th>
<th>Responsible</th>
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<td>0110700</td>
<td>Numerische Methoden für Differentialgleichungen</td>
<td>4</td>
<td>Lecture / Online</td>
<td>Rieder</td>
</tr>
<tr>
<td>WT 22/23</td>
<td>0110800</td>
<td>Übungen zu 0110700</td>
<td>2</td>
<td>Practice / Online</td>
<td>Rieder</td>
</tr>
</tbody>
</table>

**Legend:**
- 🖥 Online
- 🧩 Blended (On-Site/Online)
- 🗣 On-Site
- ✗ Cancelled
8.182 Course: Numerical Methods for Hyperbolic Equations [T-MATH-105900]

**Responsible:** Prof. Dr. Willy Dörfler

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-102915 - Numerical Methods for Hyperbolic Equations

**Type**
Oral examination

**Credits**
6

**Grading scale**
Grade to a third

**Version**
1

**Prerequisites**
none
8.183 Course: Numerical Methods for Integral Equations [T-MATH-105901]

**Responsible:**
- PD Dr. Tilo Arens
- PD Dr. Frank Hettlich

**Organisation:**
- KIT Department of Mathematics

**Part of:**
- M-MATH-102930 - Numerical Methods for Integral Equations

<table>
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<tr>
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<td>Grade to a third</td>
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</table>
### 8.184 Course: Numerical Methods for Maxwell's Equations [T-MATH-105920]

- **Responsible:** Prof. Dr. Marlis Hochbruck  
  Prof. Dr. Tobias Jahnke
- **Organisation:** KIT Department of Mathematics
- **Part of:** M-MATH-102931 - Numerical Methods for Maxwell's Equations

<table>
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<th>Grading scale</th>
<th>Type</th>
<th>Version</th>
</tr>
</thead>
<tbody>
<tr>
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<td>3 SWS</td>
<td>Lecture</td>
<td>Numerical methods for Maxwell's equations</td>
<td>1</td>
</tr>
<tr>
<td>ST 2022 0155810</td>
<td>1 SWS</td>
<td>Practice</td>
<td>Tutorial for 0155800</td>
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</table>

Economathematics M.Sc.  
Module Handbook as of 06/09/2022
### 8.185 Course: Numerical Methods for Time-Dependent Partial Differential Equations  
**[T-MATH-105899]**

**Responsible:**  
Prof. Dr. Marlis Hochbruck  
Prof. Dr. Tobias Jahnke

**Organisation:**  
KIT Department of Mathematics

**Part of:**  
M-MATH-102928 - Numerical Methods for Time-Dependent Partial Differential Equations

<table>
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<tr>
<td>Oral examination</td>
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<td>Grade to a third</td>
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</tr>
</tbody>
</table>
8.186 Course: Numerical Methods in Computational Electrodynamics [T-MATH-105860]

**Responsible:** Prof. Dr. Willy Dörfler
Prof. Dr. Marlis Hochbruck
Prof. Dr. Tobias Jahnke
Prof. Dr. Andreas Rieder
Prof. Dr. Christian Wieners

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-102894 - Numerical Methods in Computational Electrodynamics

<table>
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<th>Grading scale</th>
<th>Version</th>
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</thead>
<tbody>
<tr>
<td>Oral examination</td>
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<td>Grade to a third</td>
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</table>

**Prerequisites**
none
<table>
<thead>
<tr>
<th>Type</th>
<th>Credits</th>
<th>Grading scale</th>
<th>Version</th>
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</thead>
<tbody>
<tr>
<td>Oral examination</td>
<td>4</td>
<td>Grade to a third</td>
<td>1</td>
</tr>
</tbody>
</table>

**Course: Numerical Methods in Fluid Mechanics [T-MATH-105902]**

**Responsible:** Prof. Dr. Willy Dörfler  
PD Dr. Gudrun Thäter

**Organisation:** KIT Department of Mathematics  
**Part of:** M-MATH-102932 - Numerical Methods in Fluid Mechanics

<table>
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<th>Events</th>
<th>Identifier</th>
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<th>Type</th>
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<th>Lecturer</th>
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<tr>
<td>ST 2022</td>
<td>0164200</td>
<td>2 SWS</td>
<td>Lecture</td>
<td>Thäter</td>
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<td>0164210</td>
<td>1 SWS</td>
<td>Practice</td>
<td>Thäter</td>
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#### Description
- **Type:** Oral examination  
- **Credits:** 4  
- **Grading scale:** Grade to a third  
- **Version:** 1

**Events**
- **ST 2022 0164200:** Numerische Methoden in der Strömungsmechanik  
  - **Lecture**  
  - **Thäter**
- **ST 2022 0164210:** Übungen zu 0164210 (Numerische Methoden in der Strömungsmechanik)  
  - **Practice**  
  - **Thäter**
8.188 Course: Numerical Methods in Mathematical Finance [T-MATH-105865]

<table>
<thead>
<tr>
<th>Responsible:</th>
<th>Prof. Dr. Tobias Jahnke</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organisation:</td>
<td>KIT Department of Mathematics</td>
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<tr>
<td>Part of:</td>
<td>M-MATH-102901 - Numerical Methods in Mathematical Finance</td>
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<table>
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<th>Grading scale</th>
<th>Version</th>
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<td>Grade to a third</td>
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Prerequisites
none
8.189 Course: Numerical Methods in Mathematical Finance II [T-MATH-105880]

**Responsible:** Prof. Dr. Tobias Jahnke

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-102914 - Numerical Methods in Mathematical Finance II

<table>
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<tr>
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<th>Version</th>
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<tbody>
<tr>
<td>Oral examination</td>
<td>8</td>
<td>Grade to a third</td>
<td>1</td>
</tr>
</tbody>
</table>

**Competence Certificate**
Mündliche Prüfung im Umfang von ca. 30 Minuten

**Prerequisites**
none
### 8.190 Course: Numerical Optimisation Methods [T-MATH-105858]

**Responsible:** Prof. Dr. Willy Dörfler  
Prof. Dr. Marlis Hochbruck  
Prof. Dr. Tobias Jahnke  
Prof. Dr. Andreas Rieder  
Prof. Dr. Christian Wieners

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-102892 - Numerical Optimisation Methods

<table>
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<th>Grading scale</th>
<th>Version</th>
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<tbody>
<tr>
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<td>Grade to a third</td>
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<tr>
<td>Responsible</td>
<td>PD Dr. Volker Grimm</td>
<td></td>
<td></td>
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<tr>
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<tr>
<td>Part of</td>
<td>M-MATH-105327 - Numerical Simulation in Molecular Dynamics</td>
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</table>

**Prerequisites**

none
8.192 Course: Online Concepts for Karlsruhe City Retailers [T-WIWI-111848]

**Responsible:** Prof. Dr. Martin Klarmann

**Organisation:** KIT Department of Economics and Management

**Part of:** M-WIWI-105312 - Marketing and Sales Management

<table>
<thead>
<tr>
<th>Events</th>
<th>Type</th>
<th>Credits</th>
<th>Grading scale</th>
<th>Recurrence</th>
<th>Version</th>
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</thead>
<tbody>
<tr>
<td>ST 2022</td>
<td>Online concepts for Karlsruhe city retailers</td>
<td>1.5</td>
<td>Grade to a third</td>
<td>Once</td>
<td>1</td>
</tr>
</tbody>
</table>

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

**Competence Certificate**
Alternative exam assessment according (interim presentation and final presentation in teams).

**Annotation**
Please note that only one of the 1.5 ECTS courses can be counted within the module. This course has a restriction on attendance. The Marketing and Sales Research Group typically allows all students to attend a 1.5 credit course in the corresponding module. Under no circumstances can a guarantee be made that a particular course will be attended. An application is required to attend this course. The application phase usually takes place at the beginning of the lecture period in the summer semester. More information on the application process is usually available on the Marketing and Sales Research Group website (marketing.iism.kit.edu) shortly before the start of the lecture period in the summer semester.

**Below you will find excerpts from events related to this course:**

**Online concepts for Karlsruhe city retailers**
2571184, SS 2022, 1 SWS, Language: German, Open in study portal

**On-Site**

**Content**

**Content**
As part of a practical project in cooperation with the city marketing department of KME Karlsruhe Marketing und Event GmbH, students will have the opportunity to directly interact with retailers in Karlsruhe. Challenges of the digitalization of brick-and-mortar retailing will be analyzed and solutions will be developed and implemented.

In a theoretical part at the beginning of the event, students will gain an insight into the theoretical foundations of specific online marketing instruments. In cooperation with Karlsruhe City Marketing, students are taught application-oriented skills in online marketing tools, such as content management systems, social media platforms, search engine optimization or Google Ads campaigns.

In the practical part of the course, student teams cooperate with a real retailer in Karlsruhe’s city center and learn how to analyze and optimize online presences and digital solutions based on key performance indicators. Possible use cases range from social media communication and website optimization to the introduction of innovative pricing and payment methods. In this way, students are given the tools for developing, maintaining and optimizing individual websites and digital solutions in stationary retailing.

Learning objectives result accordingly as follows:
- Learning of theoretical basics of central, application-oriented tools of online marketing
- Application and practical deep-dive of the acquired knowledge in a real case
- Concise and structured presentation of results

Total time required for 1.5 credit points: approx. 45.0 hours

Attendance time: 8 hours

Preparation and wrap-up of the course: 29.5 hours

Exam and exam preparation: 7.5 hours
Course: Operations Research in Health Care Management [T-WIWI-102884]

**Responsible:** Prof. Dr. Stefan Nickel

**Organisation:** KIT Department of Economics and Management

**Part of:** M-WIWI-102805 - Service Operations

<table>
<thead>
<tr>
<th>Type</th>
<th>Credits</th>
<th>Grading scale</th>
<th>Recurrence</th>
<th>Version</th>
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<tbody>
<tr>
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<td>Irregular</td>
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**Events**

<table>
<thead>
<tr>
<th>Events</th>
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<th>Type</th>
<th>Grading scale</th>
<th>Recurrence</th>
<th>Responsible</th>
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<tbody>
<tr>
<td>WT 22/23</td>
<td>2550495</td>
<td>Operations Research in Health Care Management</td>
<td>2 SWS</td>
<td>Lecture / 📖</td>
<td>Nickel</td>
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<tr>
<td>WT 22/23</td>
<td>2550496</td>
<td>Übungen zu OR im Health Care Management</td>
<td>1 SWS</td>
<td>Practice</td>
<td>Bakker</td>
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</table>

**Competence Certificate**  
The assessment is a 60 minutes written examination (according to §4(2), 1 of the examination regulation). The examination is held in the term of the lecture and the following lecture.

**Prerequisites**  
None

**Recommendation**  
Basic knowledge as conveyed in the module "Introduction to Operations Research" is assumed.

**Annotation**  
The course is offered irregularly. Planned lectures for the next three years can be found in the internet at http://dol.ior.kit.edu/english/Courses.php.

*Below you will find excerpts from events related to this course:*

**Operations Research in Health Care Management**  
2550495, WS 22/23, 2 SWS, Language: English, [Open in study portal](#)

**Literature**  
**Elective literature:**

- Fleiß: Grundzüge der Krankenhausbetriebslehre, Oldenbourg, 2007
- Fleiß: Grundzüge der Krankenhaussteuerung, Oldenbourg, 2008
**8.194 Course: Operations Research in Supply Chain Management [T-WIWI-102715]**

**Responsible:** Prof. Dr. Stefan Nickel  
**Organisation:** KIT Department of Economics and Management  
**Part of:**  
- M-WIWI-101473 - Mathematical Programming  
- M-WIWI-102805 - Service Operations  
- M-WIWI-102832 - Operations Research in Supply Chain Management  
- M-WIWI-103289 - Stochastic Optimization

<table>
<thead>
<tr>
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<th>Credits</th>
<th>Grading scale</th>
<th>Recurrence</th>
<th>Version</th>
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<tbody>
<tr>
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<td>Irregular</td>
<td>2</td>
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</table>

**Competence Certificate**  
The assessment is a 60 minutes written examination (according to §4(2), 1 of the examination regulation).  
The examination is held in the term of the lecture and the following lecture.

**Prerequisites**  
None

**Recommendation**  
Basic knowledge as conveyed in the module Introduction to Operations Research and in the lectures Facility Location and Strategic SCM, Tactical and operational SCMs assumed.

**Annotation**  
The course is offered irregularly. Planned lectures for the next three years can be found in the internet at [http://dol.ior.kit.edu/english/Courses.php](http://dol.ior.kit.edu/english/Courses.php).
### 8.195 Course: Optimisation and Optimal Control for Differential Equations [T-MATH-105864]

**Organisation:** KIT Department of Mathematics  
**Part of:** M-MATH-102899 - Optimisation and Optimal Control for Differential Equations

<table>
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<tr>
<td>Oral exam</td>
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<td>1</td>
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**Prerequisites**

none
### 8.196 Course: Optimization in Banach Spaces [T-MATH-105893]

**Responsible:** Prof. Dr. Roland Griesmaier  
PD Dr. Frank Hettlich

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-102924 - Optimization in Banach Spaces

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<tr>
<td>Oral exam</td>
<td>5</td>
<td>Grade to a third</td>
<td>2</td>
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</tbody>
</table>

**Competence Certificate**
oral examination of approximately 30 minutes

**Prerequisites**
none

**Recommendation**
Some basic knowledge of finite dimensional optimization theory and functional analysis is desirable.
<table>
<thead>
<tr>
<th>Responsible:</th>
<th>Dr. Nathan Sudermann-Merx</th>
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</thead>
<tbody>
<tr>
<td>Organisation:</td>
<td>KIT Department of Economics and Management</td>
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<tr>
<td>Part of:</td>
<td>M-WIWI-101473 - Mathematical Programming</td>
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<td>M-WIWI-102832 - Operations Research in Supply Chain Management</td>
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<td>M-WIWI-103289 - Stochastic Optimization</td>
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<tr>
<td>Recurrence</td>
<td>see Annotations</td>
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<tr>
<td>Version</td>
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</tr>
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</table>

**Competence Certificate**

The examination will take place for the last time in the winter semester 2020/2021.

The assessment consists of a written exam (60 min.) according to § 4 paragraph 2 Nr. 1 of the examination regulation.

The prerequisite for participation in the exam is the achievement of a minimum number of points in delivery sheets. Details will be announced at the beginning of the course.

**Prerequisites**

None.

**Annotation**

The course will take place for the last time in the winter semester 20/21.
**8.198 Course: Optimization under Uncertainty [T-WIWI-106545]**

**Responsible:** Prof. Dr. Steffen Rebennack

**Organisation:** KIT Department of Economics and Management

**Part of:**
- M-WIWI-101413 - Applications of Operations Research
- M-WIWI-103289 - Stochastic Optimization

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<td>Each winter term</td>
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**Events**

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<tr>
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<td>2550464</td>
<td>Optimization Under Uncertainty</td>
<td>2</td>
<td>Lecture /🖥</td>
<td>Rebbennack</td>
<td></td>
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<tr>
<td>WT 22/23</td>
<td>2550465</td>
<td>Übungen zu Optimierungsansätze unter Unsicherheit</td>
<td>1</td>
<td>Practice /🗣</td>
<td>Rebbennack, Füllner</td>
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<tr>
<td>WT 22/23</td>
<td>2550466</td>
<td></td>
<td>2</td>
<td>Others (sons)</td>
<td>Rebbennack, Füllner</td>
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</table>

Legend: 🖥 Online, 🟢 Blended (On-Site/Online), 📣 On-Site, ✗ Cancelled

**Competence Certificate**

The assessment consists of a written exam (60 minutes) according to Section 4(2), 1 of the examination regulation. The exam takes place in every the semester.

**Prerequisites**

None.
## 8.199 Course: Panel Data [T-WIWI-103127]

**Responsible:** apl. Prof. Dr. Wolf-Dieter Heller  
**Organisation:** KIT Department of Economics and Management  
**Part of:**  
- M-WIWI-101638 - Econometrics and Statistics I  
- M-WIWI-101639 - Econometrics and Statistics II

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<td>Each summer term</td>
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### Events

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<th>Language</th>
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<th>Recurrence</th>
<th>Version</th>
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<tr>
<td>ST 2022 2520320</td>
<td>2 SWS</td>
<td>Panel Data</td>
<td>German</td>
<td>Lecture</td>
<td>Heller</td>
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<tr>
<td>ST 2022 2520321</td>
<td>2 SWS</td>
<td>Übungen zu Paneldaten</td>
<td>German</td>
<td>Practice</td>
<td>Heller</td>
<td></td>
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</tbody>
</table>

### Prerequisites

None

---

Below you will find excerpts from events related to this course:

#### Panel Data

2520320, SS 2022, 2 SWS, Language: German, [Open in study portal](#)

**Content**

**Content:**

- Fixed-Effects-Models, Random-Effects-Models, Time-Demeaning

**Workload:**

- Total workload for 4.5 CP: approx. 135 hours
- Attendance: 30 hours
- Preparation and follow-up: 65 hours
- Exam preparation: 40 hours
- Exam preparation: 40 hours

**Literature**

| **Responsible:**   | PD Dr. Mathias Krause  
|                   | Prof. Dr. Christian Wieners |
| **Organisation:** | KIT Department of Mathematics |
| **Part of:**      | M-MATH-101338 - Parallel Computing |

<table>
<thead>
<tr>
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<th><strong>Grading scale</strong></th>
<th><strong>Version</strong></th>
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<tbody>
<tr>
<td>Oral examination</td>
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<td>Grade to a third</td>
<td>1</td>
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</tbody>
</table>
8.201 Course: Parametric Optimization [T-WIWI-102855]

- **Responsible:** Prof. Dr. Oliver Stein
- **Organisation:** KIT Department of Economics and Management
- **Part of:** M-WIWI-101473 - Mathematical Programming

### Type
Written examination

### Credits
4,5

### Grading scale
Grade to a third

### Recurrence
Irregular

### Version
1

**Competence Certificate**
The assessment of the lecture is a written examination (60 minutes) according to §4(2), 1 of the examination regulation. The successful completion of the exercises is required for admission to the written exam.
The examination is held in the semester of the lecture and in the following semester.

**Prerequisites**
None

**Recommendation**
It is strongly recommended to visit at least one lecture from the Bachelor program of this chair before attending this course.

**Annotation**
The lecture is offered irregularly. The curriculum of the next three years is available online (www.ior.kit.edu).
### 8.202 Course: Percolation [T-MATH-105869]

**Responsible:** Prof. Dr. Daniel Hug  
Prof. Dr. Günter Last  
PD Dr. Steffen Winter

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-102905 - Percolation

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<tr>
<td>Oral examination</td>
<td>5</td>
<td>Grade to a third</td>
<td>2</td>
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</tbody>
</table>

**Prerequisites**

none
### 8.203 Course: Poisson Processes [T-MATH-105922]

**Responsible:** Prof. Dr. Vicky Fasen-Hartmann  
Prof. Dr. Daniel Hug  
Prof. Dr. Günter Last  
PD Dr. Steffen Winter

**Organisation:** KIT Department of Mathematics  
**Part of:** M-MATH-102922 - Poisson Processes

<table>
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<tbody>
<tr>
<td>Oral examination</td>
<td>5</td>
<td>Grade to a third</td>
<td>1</td>
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</table>

**Events**

| ST 2022 | 0152700 | Der Poisson-Prozess | 2 SWS | Lecture | Last |

**Prerequisites**

none
Course: Portfolio and Asset Liability Management [T-WIWI-103128]

**8.204**

**Responsible:** Dr. Mher Safarian  
**Organisation:** KIT Department of Economics and Management  
**Part of:** M-WIWI-101639 - Econometrics and Statistics II

**Type**  
Written examination  
**Credits** 4.5  
**Grading scale** Grade to a third  
**Recurrence** Each summer term  
**Version** 1

| Events |  
|---|---|---|---|---|---|
| ST 2022 | 2520357 | Portfolio and Asset Liability Management | 2 SWS | Lecture | Safarian |
| ST 2022 | 2520358 | Übungen zu Portfolio and Asset Liability Management | 2 SWS | Practice | Safarian |

**Competence Certificate**  
The assessment of this course consists of a written examination (following §4(2), 1 SPOs, 180 min.).

**Prerequisites**  
None

**Below you will find excerpts from events related to this course:**

**Portfolio and Asset Liability Management**  
2520357, SS 2022, 2 SWS, Language: English, [Open in study portal](#)

**Content**  
**Learning objectives:**  
Knowledge of various portfolio management techniques in the financial industry.

**Content:**  
Portfolio theory: principles of investment, Markowitz-portfolio analysis, Modigliani-Miller theorems and absence of arbitrage, efficient markets, capital asset pricing model (CAPM), multi factorial CAPM, arbitrage pricing theory (APT), arbitrage and hedging, multi factorial models, equity-portfolio management, passive strategies, active investment

Asset liability: statistical portfolio analysis in stock allocation, measures of success, dynamic multi seasonal models, models in building scenarios, stochastic programming in bond and liability management, optimal investment strategies, integrated asset liability management

**Workload:**  
Total workload for 4.5 CP: approx. 135 hours  
Attendance: 30 hours  
Preparation and follow-up: 65 hours  
Exam preparation: 40 hours  
Exam preparation: 40 hours

**Organizational issues**  
Blockveranstaltung, Termine werden über Ilias bekanntgegeben

**Literature**  
To be announced in the lecture
## 8.205 Course: Potential Theory [T-MATH-105850]

### Responsible:
- PD Dr. Tilo Arens
- PD Dr. Frank Hettlich
- Prof. Dr. Andreas Kirsch
- Prof. Dr. Wolfgang Reichel

### Organisation:
- KIT Department of Mathematics

### Part of:
- M-MATH-102879 - Potential Theory

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<tr>
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<td>8</td>
<td>Grade to a third</td>
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</table>
8.206 Course: Practical Seminar: Health Care Management (with Case Studies) [T-WIWI-102716]

**Responsible:** Prof. Dr. Stefan Nickel

**Organisation:** KIT Department of Economics and Management

**Part of:** M-WIWI-102805 - Service Operations

<table>
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<tbody>
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<td>4,5</td>
<td>Grade to a third</td>
<td>Each term</td>
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**Events**

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<tr>
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<td>2550498</td>
<td>Practical seminar: Health Care Management</td>
<td>3 SWS</td>
<td>Practical course / 📚</td>
<td>Nickel, Mitarbeiter</td>
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<tr>
<td>WT 22/23</td>
<td>2500008</td>
<td>Practical seminar: Health Care Management</td>
<td>3 SWS</td>
<td>Practical course / 👤</td>
<td>Nickel, Mitarbeiter</td>
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</table>

**Legend:** 🖥 Online, 🧩 Blended (On-Site/Online), 👤 On-Site, ✗ Cancelled

**Competence Certificate**

Due to a research semester of Professor Nickel in WS 19/20, the courses *Location Planning and Strategic SCM* and *Practice Seminar: Health Care Management* do NOT take place in WS 19/20. Please also refer to the information at [https://dol.ior.kit.edu/Lehrveranstaltungen.php](https://dol.ior.kit.edu/Lehrveranstaltungen.php) for further details.

The assessment consists in a case study, the writing of a corresponding paper, and an oral exam (according to §4(2), 2 of the examination regulation).

**Prerequisites**

None.

**Recommendation**

Basic knowledge as conveyed in the module *Introduction to Operations Research* is assumed.

**Annotation**

The credits have been reduced to 4.5 starting summer term 2016.

The lecture is offered every term.

The planned lectures and courses for the next three years are announced online.
8 COURSES

Course: Practical Seminar: Information Systems and Service Design [T-WIWI-108437]

### 8.207 Course: Practical Seminar: Information Systems and Service Design [T-WIWI-108437]

**Responsible:** Prof. Dr. Alexander Mädche  
**Organisation:** KIT Department of Economics and Management  
**Part of:** M-WIWI-104068 - Information Systems in Organizations

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<td>Grade to a third</td>
<td>Each term</td>
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**Events**

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<td>2540554</td>
<td>Practical Seminar: Information Systems &amp; Service Design (Master)</td>
<td>3 SWS</td>
<td>Lecture / 🧩</td>
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</table>

**Competition Certificate**

The assessment of this course is according to §4(2), 3 SPO in form of a written documentation, a presentation of the outcome of the conducted practical components and an active participation in class. Please take into account that, beside the written documentation, also a practical component (e.g. implementation of a prototype) is part of the course. Please examine the course description for the particular tasks. The final mark is based on the graded and weighted attainments (such as the written documentation, presentation, practical work and an active participation in class). In the winter terms, the course is only offered as a seminar.

**Prerequisites**

None.

**Recommendation**

Attending the course „Digital Service Design“ is recommended, but not mandatory.

**Annotation**

The course is held in English.

Below you will find excerpts from events related to this course:

**Content**

In this practical seminar, students get an individual assignment and develop a running software prototype. Beside the software prototype, the students also deliver a written documentation.

**Prerequisites**

Profound skills in software development are required

**Literature**

Further literature will be made available in the seminar.
8.208 Course: Predictive Mechanism and Market Design [T-WIWI-102862]

Responsible: Prof. Dr. Johannes Philipp Reiß
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101505 - Experimental Economics

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<tr>
<td>ST 2022 2500014 Predictive Mechanism and Market Design 2 SWS Lecture</td>
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<td>ST 2022 2520403 1 SWS Practice</td>
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Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

**Competence Certificate**
The assessment consists of a written exam (60 minutes) (following §4(2), 1 of the examination regulation).

**Prerequisites**
None

**Annotation**
The course is given every second fall term, e.g., WS2017/18, WS2019/20, ...
The retake exam is given in the summer term subsequent to the fall term where the course (lecture and final exam) is given.
8.209 Course: Predictive Modeling [T-WIWI-110868]

Responsible: TT-Prof. Dr. Fabian Krüger
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101638 - Econometrics and Statistics I
M-WIWI-101639 - Econometrics and Statistics II

Events

<table>
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<tr>
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<th>Credits</th>
<th>Grade to a third</th>
<th>Recurrence</th>
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<td>2 SWS</td>
<td>Lecture / 🕵️‍♂️</td>
<td>Each summer term</td>
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<td>ST 2022</td>
<td>2 SWS</td>
<td>Practice / 🕵️‍♂️</td>
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Legend: 🌐 Online, 🕵️‍♂️ Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

Competence Certificate
Examination of another type (open book exam, online).

Prerequisites
None

Below you will find excerpts from events related to this course:

Predictive Modeling
2521311, SS 2022, 2 SWS, Language: English, Open in study portal
Lecture (V)
Blended (On-Site/Online)

Content

Contents
This course presents methods for making and evaluating statistical predictions based on data. We consider various types of predictions (mean, probability, quantile, and full distribution), all of which are practically relevant. In each case, we discuss selected modeling approaches and their implementation using R software. We consider various economic case studies. Furthermore, we present methods for absolute evaluation (assessing whether a given model is compatible with the data) and relative evaluation (comparing the predictive performance of alternative models).

Learning objectives
Students have a good conceptual understanding of statistical prediction methods. They are able to implement these methods using statistical software, and can assess which method is suitable in a given situation.

Prerequisites
Students should know econometrics on the level of the course 'Applied Econometrics' [2520020]

Literature

- Weitere Literatur wird in der Vorlesung bekanntgegeben.

Predictive Modeling (Tutorial)
2521312, SS 2022, 2 SWS, Language: English, Open in study portal
Practice (Ü)
Blended (On-Site/Online)
8.210 Course: Price Negotiation and Sales Presentations [T-WIWI-102891]

Responsible: Prof. Dr. Martin Klarmann
Mark Schröder

Organisation: KIT Department of Economics and Management

Part of: M-WIWI-105312 - Marketing and Sales Management

<table>
<thead>
<tr>
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<th>Type</th>
<th>Credits</th>
<th>Grading scale</th>
<th>Recurrence</th>
<th>Version</th>
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<td>1,5</td>
<td>Grade to a third</td>
<td>Each winter term</td>
<td>3</td>
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<tr>
<td>2572198</td>
<td>Price Negotiation and Sales Presentations</td>
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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

Competence Certificate
This alternative exam assessment consists of a presentation with a subsequent discussion totalling 25 minutes. Moreover learning contents are checked by realistic 30-minute price negotiations.

Prerequisites
None

Recommendation
None

Annotation
The course is scheduled to be completed after the first half of the semester. Participation requires an application. The application period starts at the beginning of the semester. More information can be obtained on the website of the research group Marketing & Sales (marketing.iism.kit.edu). Access to this course is restricted. Typically, all students will be granted the attendance of one course with 1.5 ECTS. Nevertheless, participation for a specific course cannot be guaranteed. For further information, please contact the Marketing and Sales Research Group (marketing.iism.kit.edu). Please note that only one of the courses from the election block can be attended in the module.

Below you will find excerpts from events related to this course:

Price Negotiation and Sales Presentations
2572198, WS 22/23, 1 SWS, Language: German, Open in study portal

Content
At first, theoretical knowledge about the behavior in selling contexts is discussed. Then, in a practical part, students will apply this knowledge in their own price negotiations.

Students
- gain a clear impression of the theoretical knowledge about price negotiations and sales presentations
- improve their own negotiation abilities

Non exam assessment (following §4(2), 3 of the examination regulation).

The total workload for this course is approximately 45.0 hours. For further information see German version.

- In order to participate in this course, you need to apply. Applications usually start with the lecture period in the winter term. Detailed information on the application process is provided on the website of the Marketing and Sales Research Group (marketing.iism.kit.edu) shortly before the lecture period in winter term starts.
- Please note that only one of the 1.5 ECTS courses can be chosen in the module.
- Please note: The number of participants for this course is limited. The Marketing and Sales Research Group typically provides the possibility to attend a course with 1.5 ECTS in the respective module to all students. Participation in a specific course cannot be guaranteed.

Organizational issues
Blockseminar: genau Uhrzeiten und Raum werden noch bekannt gegeben
8.211 Course: Pricing Excellence [T-WIWI-111246]

**Responsible:** Dr. Fabian Bill  
Prof. Dr. Martin Klarmann

**Organisation:** KIT Department of Economics and Management

**Part of:** M-WIWI-105312 - Marketing and Sales Management

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<th>Grading scale</th>
<th>Recurrence</th>
<th>Version</th>
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<tbody>
<tr>
<td>ST 2022</td>
<td>2571175</td>
<td>Pricing Excellence</td>
<td>1 SWS</td>
<td>Others (sons / 🤖) Bill</td>
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</table>

Legend: 🌐 Online, ☑️ Blended (On-Site/Online), 🤖 On-Site, ✗ Cancelled

**Competence Certificate**  
Alternative exam assessment (team presentation of a case study with a duration of about 25 minutes and a subsequent discussion).

**Prerequisites**  
None.

**Annotation**  
Please note that only one of the courses in the module's supplementary offering can be counted. This event has a restriction on participation. The Marketing and Sales Research Group typically allows all students to attend a 1.5 credit course in the corresponding module. A guarantee for the attendance of a certain event cannot be given. An application is required for participation in this event. The application phase usually takes place at the beginning of the lecture period in the summer semester. More information on the application process is usually available on the Marketing and Sales Research Group website (marketing.iism.kit.edu) shortly before the start of the lecture period in the summer semester.

**Below you will find excerpts from events related to this course:**

**Pricing Excellence**  
2571175, SS 2022, 1 SWS, Language: English, Open in study portal

**Content**  
In a theoretical part at the beginning of the course, students are taught the theoretical foundations of pricing. This includes an introduction to (1) price setting of product prices as well as (2) price setting of customer net prices (development of discount systems). Furthermore, theoretical foundations of price implementation and price monitoring are discussed.  
Theoretical contents are applied and presented by teams within a case study format.

The learning objectives are as follows:

- Getting to know the theoretical foundations of price setting  
- Getting to know the theoretical foundations of price execution and price monitoring  
- Application of the acquired knowledge in a case study format  
- Concise and structured presentation of the results  

Alternative exam assessment according to § 4 paragraph 2 Nr. 3 of the examination regulation (presentation of a case study with subsequent discussion).  
Total time required for 1.5 credit points: approx. 45.0 hours  
Attendance time: 15 hours  
Preparation and wrap-up of the course: 22.5 hours  
Exam and exam preparation: 7.5 hours

**Organizational issues**  
Blockveranstaltung, Raum 115, Geb. 20.21, Termine werden noch bekannt gegeben
### Course: Probabilistic Time Series Forecasting Challenge [T-WIWI-111387]

**Responsible:** TT-Prof. Dr. Fabian Krüger  
**Organisation:** KIT Department of Economics and Management  
**Part of:**  
- M-WIWI-101638 - Econometrics and Statistics I  
- M-WIWI-101639 - Econometrics and Statistics II

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**Events**

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<td>2 SWS</td>
<td>Practice / 🤓</td>
<td>Krüger, Bracher, Koster, Lerch</td>
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<td>WT 22/23</td>
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**Competence Certificate**

Alternative exam assessment. Necessary conditions to pass the course:

1. Weekly submission of statistical forecasts during the semester (excluding the Christmas break).  
2. Submission of a final report (10-15 pages) at the end of the semester, describing the forecasting methods and their statistical evaluation.

Grading is based on the final report.

**Prerequisites**

Good methodological knowledge in statistics and data science.  
Good knowledge in applied data analysis, incl. programming skills in R, Python or similar.  
Knowledge of time series analysis is helpful, but not required.

**Annotation**

The course is limited in participation. Participants will be selected via the WIWI portal.

*Below you will find excerpts from events related to this course:*

**Probabilistic Time Series Forecasting Challenge**  
2500081, WS 22/23, SWS, Language: English, [Open in study portal](#)  
**Project (PRO)**  
Blended (On-Site/Online)

**Content**

Statistical forecasts are relevant across all fields of society. In this data science project, students make, evaluate and communicate their own statistical forecasts in a real-time setting. We consider probabilistic forecasts that involve a measure of uncertainty in addition to a point forecast. Students are asked to make forecasts of several real-world time series (including weather variables and the DAX stock market index). Historical data on all series are available from public sources that are updated as time proceeds. While the time series differ from each other in important ways, statistical methods can meaningfully be used for prediction in all cases. We focus on quantile forecasts which are useful to measure forecast uncertainty in a relatively simple way.
Organizational issues
Short description
In this data science project, students make and evaluate statistical forecasts in a realistic setup (involving real-time predictions and real-world time series data). A kick-off meeting will take place in mid October. During the semester, there will be a weekly meeting in which students and instructors discuss the current state of the forecasting challenge.

Prerequisites
Students should have a good working knowledge of statistics and data science, including proficiency in a programming language like R, Python, or Matlab. Knowledge of time series analysis is helpful but not strictly required. Motivation and curiosity are particularly important in this course format that requires regular, active participation over the whole semester.

Please note that the number of participants is limited due to the interactive course format. Application takes place via the Wiwi portal, where further information is available.

Examination rules
The project seminar counts for 4.5 credit points (Leistungspunkte). Examination is via an alternative exam assessment (§4(2), 3 SPO). Necessary conditions to pass the course: 1) Weekly submission of statistical forecasts during the semester (excluding the Christmas break). 2) Submission of a final report (10-15 pages) at the end of the semester, describing the forecasting methods and their statistical evaluation. Grading is based on the final report.
Course: Probability Theory and Combinatorial Optimization [T-MATH-105923]

**Responsibility:** Prof. Dr. Daniel Hug  
Prof. Dr. Günter Last  

**Organisation:** KIT Department of Mathematics  

**Part of:** M-MATH-102947 - Probability Theory and Combinatorial Optimization

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**Prerequisites**  
None
Course: Process Mining [T-WIWI-109799]

Responsible: Prof. Dr. Andreas Oberweis
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101472 - Informatics

Type: Written examination
Credits: 4.5
Grading scale: Grade to a third
Recurrence: Each summer term
Version: 2

Events

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<th>Lecture / 🗣</th>
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<td>Exercise Process Mining</td>
<td>1 SWS</td>
<td>Practice / 🗣</td>
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Legend: Online, Blended (On-Site/Online), 🗣 On-Site, x Cancelled

Competence Certificate
The assessment of this course is a written examination (60 min) according to §4(2), 1 of the examination regulation in the first week after lecture period.

Prerequisites
None

Annotation
Former name (up to winter semester 2018/1019) "Workflow Management".

Below you will find excerpts from events related to this course:

Process Mining
2511204, SS 2022, 2 SWS, Language: German, Open in study portal
Lecture (V) On-Site

Content
The area of process mining covers approaches which aim at deducting new knowledge on the basis of logfiles generated by information systems. Such information systems are e.g., workflow-management-systems which are used for an efficient control of processes in enterprises and organisations. The lecture introduces the foundations of processes and respective modeling and analysis techniques. In the following, the foundations of process mining and the three classical types of approaches - discovery, conformance and enhancement - will be taught. In addition to the theoretical basics, tools, application scenarios in practice and open research questions are covered as well.

Learning objectives:
Students
- understand the concepts and approaches of process mining and know how they are applied,
- create and evaluate business process models,
- analyze static and dynamic properties of workflows,
- apply approaches and tools of process mining.

Recommendations:
Knowledge of course Applied Informatics - Modelling is expected.

Workload:
- Lecture 30h
- Exercise 15h
- Preparation of lecture 24h
- Preparation of exercises 25h
- Exam preparation 40h
- Exam 1h


Literature


Weitere Literatur wird in der Vorlesung bekannt gegeben.
8.215 Course: Product and Innovation Management [T-WIWI-109864]

**Responsible:** Prof. Dr. Martin Klarmann

**Organisation:** KIT Department of Economics and Management

**Part of:** M-WIWI-105312 - Marketing and Sales Management

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**Events**

| ST 2022       | 2571154 | Product and Innovation Management | 2 SWS | Lecture / Klarmann |

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

**Competence Certificate**

The assessment of success takes place through a written exam with additional aids in the sense of an open book exam. The written exam will either take place in the lecture hall or online, depending on further pandemic developments. Further details will be announced during the lecture.

**Prerequisites**

None

**Annotation**

For further information please contact Marketing & Sales Research Group (marketing.iism.kit.edu).

**Below you will find excerpts from events related to this course:**

Product and Innovation Management

2571154, SS 2022, 2 SWS, Language: English, Open in study portal

**Lecture (V) On-Site**

**Content**

This course addresses topics around the management of new as well as existing products. After the foundations of product management, especially the product choice behavior of customers, students get to know in detail different steps of the innovation process. Another section regards the management of the existing product portfolio.

Students

- know the most important terms of the product and innovation concept
- understand the models of product choice behavior (e.g., the Markov model, the Luce model)
- are familiar with the basics of network theory (e.g., the Triadic Closure concept)
- know the central strategic concepts of innovation management (especially the market driving approach, pioneer and successor, Miles/Snow typology, blockbuster strategy)
- master the most important methods and sources of idea generation (e.g., open innovation, lead user method, crowdsourcing, creativity techniques, voice of the customer, innovation games, conjoint analysis, quality function deployment, online toolkits)
- are capable of defining and evaluating new product concepts and know the associated instruments like focus groups, product testing, speculative sales, test market simulation Assessor, electronic micro test market
- have advanced knowledge about market introduction (e.g., adoption and diffusion models Bass, Fourt/Woodlock, Mansfield)
- understand important connections of the innovation process (cluster formation, innovation culture, teams, stage-gate process)

The assessment is carried out (according to §4(2), 3 SPO) in the form of a written open book exam.

Total effort for 3 credit points: approx. 90 hours

Presence time: 30 hours

Preparation and wrap-up of LV: 45.0 hours

Exam and exam preparation: 15.0 hours

For further information please contact Marketing & Sales Research Group (marketing.iism.kit.edu).
Organizational issues
Die Veranstaltung findet in Geb. 20.21, Raum 217 statt. Während anstehender Bauarbeiten wird die Veranstaltung in Geb. 10.11, Raum 223 verlegt. Dies wird kurzfristig bekanntgegeben.

Literature
8.216 Course: Project Centered Software-Lab [T-MATH-105907]

**Responsible:** PD Dr. Gudrun Thäter

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-102938 - Project Centered Software-Lab

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**Prerequisites**
none
8.217 Course: Project Lab Cognitive Automobiles and Robots [T-WIWI-109985]

**Responsible:** Prof. Dr.-Ing. Johann Marius Zöllner

**Organisation:** KIT Department of Economics and Management

**Part of:** M-WIWI-101472 - Informatics

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<td>Practical course / 🥽</td>
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Legend: 📚 Online, 🥽 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

**Competence Certificate**
The alternative exam assessment consists of:

- a practical work
- a presentation and
- a written seminar thesis

Details of the grade formation will be announced at the beginning of the course.

**Prerequisites**
None

**Below you will find excerpts from events related to this course:**

**V Cognitive Automobiles and Robots**
2513500, SS 2022, 2 SWS, Language: German/English, Open in study portal

**Content**
The seminar is intended as a theoretical supplement to lectures such as "Machine Learning". The theoretical basics will be deepened in the seminar. The aim of the seminar is that the participants work individually to analyze a subsystem from the field of robotics and cognitive systems using one or more procedures from the field of AI/ML.

The individual projects require the analysis of the task at hand, selection of suitable procedures, specification and theoretical evaluation of the approach taken. Finally, the chosen solution has to be documented and presented in a short presentation.

**Learning objectives:**
- Students can apply knowledge from the Machine Learning lecture in a selected field of current research in robotics or cognitive automobiles for theoretical analysis.
- Students can evaluate, document and present their concepts and results.

**Recommendations:**
Attendance of the lecture machine learning

**Workload:**
The workload of 3 credit points consists of the time spent on literature research and planning/specifying the proposed solution. In addition, a short report and a presentation of the work carried out will be prepared.

**Organizational issues**
Anmeldung und weitere Informationen sind im WiWi-Portal zu finden.

Registration and further information can be found in the WiWi-portal.
Content
The lab is intended as a practical supplement to lectures such as "Machine Learning". The theoretical basics are applied in the lab course. The aim of the lab course is that the participants work together to design, develop and evaluate a subsystem from the field of robotics and cognitive systems using one or more procedures from the field of AI/ML.

In addition to the scientific objectives involved in the investigation and application of the methods, aspects of project-specific teamwork in research (from specification to presentation of the results) are also developed in this practical course.

The individual projects require the analysis of the task at hand, selection of suitable procedures, specification and implementation and evaluation of the approach taken. Finally, the chosen solution has to be documented and presented in a short presentation.

Learning objectives:
- Students can practically apply knowledge from the Machine Learning lecture in a selected field of current research in robotics or cognitive automobiles.
- Students master the analysis and solution of corresponding problems in a team.
- Students can evaluate, document and present their concepts and results.

Recommendations:
Attendance of the lecture machine learning, C/C++ knowledge, Python knowledge

Workload:
The workload of 4.5 credit points consists of the time spent in the lab for practical implementation of the selected solution, as well as the time spent on literature research and planning/specifying the proposed solution. In addition, a short report and a presentation of the work carried out will be prepared.

Organizational issues
Anmeldung und weitere Informationen sind im WiWi-Portal zu finden.
Registration and further information can be found in the WiWi-portal.
8.218 Course: Project Lab Machine Learning [T-WIWI-109983]

**Responsible:** Prof. Dr.-Ing. Johann Marius Zöllner

**Organisation:** KIT Department of Economics and Management

**Part of:** M-WIWI-101472 - Informatics

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<td>Each summer term</td>
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**Events**

| ST 2022 | 2512500 | Project Lab Machine Learning | 3 SWS | Practical course / Zöllner |

**Competence Certificate**

The alternative exam assessment consists of:

- a practical work
- a presentation and
- a written seminar thesis

Details of the grade formation will be announced at the beginning of the course.

**Prerequisites**

None

Below you will find excerpts from events related to this course:

**Project Lab Machine Learning**

2512500, SS 2022, 3 SWS, Language: German/English, Open in study portal

**Content**

The lab is intended as a practical supplement to lectures such as "Machine Learning". The theoretical basics are applied in the lab course. The aim of the lab course is that the participants work together to design, develop and evaluate a subsystem from the field of robotics and cognitive systems using one or more procedures from the field of AI/ML.

In addition to the scientific objectives involved in the investigation and application of the methods, aspects of project-specific teamwork in research (from specification to presentation of the results) are also developed in this practical course.

The individual projects require the analysis of the task at hand, selection of suitable procedures, specification and implementation and evaluation of the approach taken. Finally, the chosen solution has to be documented and presented in a short presentation.

**Learning objectives:**

- Students can practically apply knowledge from the Machine Learning lecture in a selected field of current research in robotics or cognitive automobiles.
- Students master the analysis and solution of corresponding problems in a team.
- Students can evaluate, document and present their concepts and results.

**Recommendations:**

Attendance of the lecture machine learning, C/C++ knowledge, Python knowledge

**Workload:**

The workload of 4.5 credit points consists of the time spent in the lab for practical implementation of the selected solution, as well as the time spent on literature research and planning/specifying the proposed solution. In addition, a short report and a presentation of the work carried out will be prepared.

**Organizational issues**

Anmeldung und weitere Informationen sind im Wiwi-Portal zu finden. Registration and further information can be found in the WiWi-portal.
8.219 Course: Public Management [T-WIWI-102740]

**Responsible:** Prof. Dr. Berthold Wigger

**Organisation:** KIT Department of Economics and Management

**Part of:** M-WIWI-101504 - Collective Decision Making

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**Events**

| WT 22/23 | 2561127 | Public Management | 3 SWS | Lecture / Practice (VÜ) | Online |

**Legend:** 🖥 Online, Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

**Competence Certificate**

Depending on the further pandemic development the assessment will consist either of an open book exam (following Art. 4, para. 2, clause 3 of the examination regulation), or of an 1.5h written exam (following Art. 4, para. 2, clause 1 of the examination regulation).

**Prerequisites**

None

**Recommendation**

Basic knowledge of Public Finance is required.

Below you will find excerpts from events related to this course:

**Literature**

Weiterführende Literatur:

### Course: Quantitative Methods in Energy Economics [T-WIWI-107446]

**Responsible:** Dr. Patrick Plötz

**Organisation:** KIT Department of Economics and Management

**Part of:** M-WIWI-101451 - Energy Economics and Energy Markets

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**Events**

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<td>WT 22/23</td>
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<td>Übung zu Quantitative Methods in Energy Economics</td>
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<td>Practice / 🗣</td>
<td>Plötz, Dengiz, Yilmaz</td>
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**Competence Certificate**

The assessment consists of an oral (30 minutes) exam (following §4(2) of the examination regulation). The exam takes place in every semester. Re-examinations are offered at every ordinary examination date. Depending on the respective pandemic situation, the exam may be offered as an open book exam (alternative exam assessment, following §4(2), 3 of the examination regulation).

**Prerequisites**

None

**Recommendation**

None

Below you will find excerpts from events related to this course:

**Quantitative Methods in Energy Economics**

Lecture (V)

2581007, WS 22/23, 2 SWS, Language: English, [Open in study portal](#)

**Content**

Energy economics makes use of many quantitative methods in exploration and analysis of data as well as in simulations and modelling. This lecture course aims at introducing students of energy economics into the application of quantitative methods and techniques as taught in elementary courses to real problems in energy economics. The focus is mainly on regression, simulation, time series analysis and related statistical methods as applied in energy economics.

**Learning Goals:**

The student

- knows and understands selected quantitative methods of energy economics
- is able to use selected quantitative methods of energy economics
- understands they range of usage, limits and is autonomously able to address new problems by them.

**Literature**

Wird in der Vorlesung bekannt gegeben.
### 8.221 Course: Random Graphs [T-MATH-105929]

**Responsible:** Prof. Dr. Daniel Hug  
**Organisation:** KIT Department of Mathematics  
**Part of:** M-MATH-102951 - Random Graphs

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**Prerequisites**

none
8.222 Course: Random Graphs and Networks [T-MATH-112241]

**Responsible:** Prof. Dr. Daniel Hug

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-106052 - Random Graphs and Networks

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**Competence Certificate**
oral exam of ca. 30 min

**Prerequisites**
none

**Recommendation**
The contents of the module ‘Probability Theory’ are strongly recommended.
8.223 Course: Regulation Theory and Practice [T-WIWI-102712]

<table>
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<tr>
<th>Responsible:</th>
<th>Prof. Dr. Kay Mitusch</th>
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**Competence Certificate**
The lecture is not offered for an indefinite period of time.
Result of success is made by a 20-30 minutes oral examination. Examination is offered every semester and can be retried at any regular examination date.

**Prerequisites**
None

**Recommendation**
Basic knowledge and skills of microeconomics from undergraduate studies (bachelor’s degree) are expected.
Particularly helpful but not necessary: Industrial Economics and Principal-Agent- or Contract theories. Prior attendance of the lecture *Competition in Networks* [26240] is helpful in any case but not considered a formal precondition.

**Annotation**
The lecture is not offered for an indefinite period of time.
### 8.224 Course: Ruin Theory [T-MATH-108400]

- **Responsible:** Prof. Dr. Vicky Fasen-Hartmann
- **Organisation:** KIT Department of Mathematics
- **Part of:** M-MATH-104055 - Ruin Theory

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**Prerequisites**

- None
## 8.225 Course: Scattering Theory [T-MATH-105855]

**Responsible:**
- PD Dr. Tilo Arens
- Prof. Dr. Roland Griesmaier
- PD Dr. Frank Hettlich

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-102884 - Scattering Theory

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8.226 Course: Selected Issues in Critical Information Infrastructures [T-WIWI-109251]

**Responsible:** Prof. Dr. Ali Sunyaev  
**Organisation:** KIT Department of Economics and Management  
**Part of:** M-WIWI-101472 - Informatics

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**Events**

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<td>ST 2022</td>
<td>2512403</td>
<td>Advanced Lab Blockchain Hackathon (Master)</td>
<td>Practical course</td>
<td>Sunyaev, Beyene, Kannengießer</td>
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<td>ST 2022</td>
<td>2513401</td>
<td>Seminar Selected Issues in Critical Information Infrastructures (Master)</td>
<td>Seminar</td>
<td>Sunyaev, Lins</td>
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<td>WT 22/23</td>
<td>2513401</td>
<td>Seminar Selected Issues in Critical Information Infrastructures (Master)</td>
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</table>

**Legend:** 🔄 Online, 📱 Blended (On-Site/Online), ⚖ On-Site, ✗ CANCELLED

**Competence Certificate**
Alternative exam assessment (§ 4(2), 3 SPO). Details will be announced in the respective course.

**Prerequisites**
None.

**Annotation**
T-WIWI-109251 “Selected Issues in Critical Information Infrastructures” serves to credit an extracurricular course in the module “Critical Digital Infrastructures”.
8.227 Course: Selected Methods in Fluids and Kinetic Equations [T-MATH-111853]

**Organisation:** KIT Department of Mathematics
**Part of:** M-MATH-105897 - Selected Methods in Fluids and Kinetic Equations

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**Competence Certificate**
oral examination of approx. 30 minutes

**Prerequisites**
none

**Recommendation**
The courses "Classical Methods for Partial Differential Equations" and "Functional Analysis" are recommended.
8.228 Course: Selected Topics in Harmonic Analysis [T-MATH-109065]

**Responsible:** Prof. Dr. Dirk Hundertmark

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-104435 - Selected Topics in Harmonic Analysis

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</table>

**Prerequisites**
none

Economathematics M.Sc.
Module Handbook as of 06/09/2022
8.229 Course: Semantic Web Technologies [T-WIWI-110848]

**Responsible:** Dr. Tobias Christof Käfer

**Organisation:** KIT Department of Economics and Management

**Part of:** M-WIWI-101472 - Informatics

<table>
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**Events**

| ST 2022 | 2511310 | Semantic Web Technologies  | 2 SWS   | Lecture / 🗣 | Färber, Käfer, Braun |
| ST 2022 | 2511311 | Exercises to Semantic Web Technologies | 1 SWS   | Practice / 🖥 | Färber, Käfer |

*Legend:* 🖥 Online,  🔄 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

**Competence Certificate**
The assessment consists of an 1h written exam following §4, Abs. 2, 1 of the examination regulation or of an oral exam (20 min) following §4, Abs. 2, 2 of the examination regulation.

The exam takes place every semester and can be repeated at every regular examination date.

**Prerequisites**
None

**Recommendation**
Lectures on Informatics of the Bachelor on Information Systems (Semester 1-4) or equivalent are required.

*Below you will find excerpts from events related to this course:*
Content
The aim of the Semantic Web is to make the meaning (semantics) of data on the web usable in intelligent systems, e.g. in e-commerce and internet portals.

Central concepts are the representation of knowledge in form of RDF and ontologies, the access via Linked Data, as well as querying the data by using SPARQL. This lecture provides the foundations of knowledge representation and processing for the corresponding technologies and presents example applications.

The following topics are covered:

- Resource Description Framework (RDF) and RDF Schema (RDFS)
- Web Architecture and Linked Data
- Web Ontology Language (OWL)
- Query language SPARQL
- Rule languages
- Applications

Learning objectives:

The student

- understands the motivation and foundational ideas behind Semantic Web and Linked Data technologies, and is able to analyse and realise systems
- demonstrates basic competency in the areas of data and system integration on the web
- masters advanced knowledge representation scenarios involving ontologies

Recommendations:

Lectures on Informatics of the Bachelor on Information Systems (Semester 1-4) or equivalent are required. Knowledge of modeling with UML is required.

Workload:

- The total workload for this course is approximately 135 hours
- Time of presentness: 45 hours
- Time of preparation and postprocessing: 60 hours
- Exam and exam preparation: 30 hours

Literature


Weitere Literatur


Exercises to Semantic Web Technologies
2511311, SS 2022, 1 SWS, Language: English, Open in study portal
Content
The exercises are related to the lecture Semantic Web Technologies. Multiple exercises are held that capture the topics, held in the lecture Semantic Web Technologies, and discuss them in detail. Thereby, practical examples are given to the students in order to transfer theoretical aspects into practical implementation.

The following topics are covered:

- Resource Description Framework (RDF) and RDF Schema (RDFS)
- Web Architecture and Linked Data
- Web Ontology Language (OWL)
- Query language SPARQL
- Rule languages
- Applications

Learning objectives:
The student

- understands the motivation and foundational ideas behind Semantic Web and Linked Data technologies, and is able to analyse and realise systems
- demonstrates basic competency in the areas of data and system integration on the web
- masters advanced knowledge representation scenarios involving ontologies

Recommendations:
Lectures on Informatics of the Bachelor on Information Systems (Semester 1-4) or equivalent are required. Knowledge of modeling with UML is required.

Organizational issues
Die Übungen finden im Rahmen der Termine der Blockvorlesung statt.

Literature


Weitere Literatur

# Course: Seminar in Business Administration A (Master) [T-WIWI-103474]

**Responsible:** Professorenschaft des Fachbereichs Betriebswirtschaftslehre  
**Organisation:** KIT Department of Economics and Management  
**Part of:** M-WIWI-102971 - Seminar

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<td>ST 2022 2530580 Seminar in Finance (Master): Machine Learning Stock Returns with Option Data</td>
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Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

**Competence Certificate**

Alternative exam assessment (§ 4(2), 3 SPO 2015). The following aspects are included:

- Regular participation in the seminar dates
- Preparation of a seminar paper on a partial aspect of the seminar topic according to scientific methods
- Lecture on the topic of the seminar paper.

The point scheme for the assessment is determined by the lecturer of the respective course. It will be announced at the beginning of the course.

**Prerequisites**

None.

**Recommendation**

See seminar description in the course catalogue of the KIT (https://campus.kit.edu/)
Annotation
The listed seminar titles are placeholders. Currently offered seminars of each semester will be published on the websites of the institutes and in the course catalogue of the KIT. In general, the current seminar topics of each semester are already announced at the end of the previous semester. Furthermore for some seminars there is an application required.
The available places are listed on the internet: https://portal.wiwi.kit.edu.

Below you will find excerpts from events related to this course:

Interactive Analytics Seminar
2400121, SS 2022, 2 SWS, Language: English, Open in study portal

Content
Providing new and innovative ways for interacting with data is becoming increasingly important. In this seminar, an interdisciplinary team of students engineers a running software prototype of an advanced interactive system leveraging state-of-the-art hardware and software focusing on an analytical use case. The seminar is carried out in cooperation between Tecco/Chair of Pervasive Computing Systems (Prof. Beigl) and the Institute of Information Systems and Marketing (Research Group ISSD, Prof. Mädche). This seminar follows an interdisciplinary approach. Students the fields of computer science, information systems and industrial engineering work together in teams.

Learning Objectives
- Explore and specify a data-driven interaction challenge
- Suggest and evaluate different design solutions for addressing the identified problem
- Build interactive analytics prototypes using advanced interaction concepts and pervasive computing technologies

Prerequisites
Strong analytic abilities and profound skills in SQL as well as Python and/or R are required.

Literature
Further literature will be made available in the seminar.

Organizational issues
Vereinbarung

Advances in Financial Machine Learning
2530372, SS 2022, 2 SWS, Language: English, Open in study portal

Content
Machine learning (ML) is changing virtually every aspect of our lives. Today ML algorithms accomplish tasks that until recently only expert humans could perform. As it relates to finance, this is the most exciting time to adopt a disruptive technology that will transform how everyone invests for generations.

In this seminar we will apply modern machine learning techniques hands on to important computational risk and asset management problems. In particular we will use the state of the art Python programming language to implement investment related applications and/ or Finance 4.0 risk management solutions.

In a bi-weekly schedule you and your supervisor will first learn and discuss important machine learning concepts and then apply it within a practical FinTech project to real-world data. As a prerequisite students should already have some basic Python and data science skills.

Organizational issues
Location: Räume des Lehrstuhls, Blücherstraße 17, E-008

Literature
Literatur wird in der ersten Vorlesung bekannt gegeben.

Data Science for the Industrial Internet of Things
2540493, SS 2022, SWS, Language: English, Open in study portal

Content
Building interactive analytics prototypes using advanced interaction concepts and pervasive computing technologies

Objectives
• Suggest and evaluate different design solutions for addressing the identified problem
• Explore and specify a data-driven interaction challenge
• Build interactive analytics prototypes using advanced interaction concepts and pervasive computing technologies

Prerequisites
Strong analytic abilities and profound skills in SQL as well as Python and/or R are required.

Literature
Further literature will be made available in the seminar.

Organizational issues
Vereinbarung
Content
Learning Objectives
1. Gain practical experience in translating a business problem into a data modeling problem
2. Apply solid theoretical foundations from lectures to real-world data
3. Acquire hands-on experience with industrial data science tools
4. Learn how to communicate data science findings to business stakeholders

Course Credits
The practical seminar can be credited as Seminar Betriebswirtschaftslehre A [WIWI-103474] (3 ECTS). Other courses can be credited upon request.

Seminar Description
The Internet of Things is significantly transforming industries such as automotive, healthcare, and energy. With the rise of ubiquitous computing power, internet access, and economical sensors – physical products turn into cyber-physical smart products that create vast amounts of data.

Current airplanes for example have around 6,000 sensors, creating around 1 TB of data per flight. This data is about the size of all tweets in 3 months worldwide. And this number is growing tremendously. But only 3% of potentially useful data is tagged today, end even less is analyzed. Although Internet of Things use cases such as predictive maintenance are projected to help companies save $630 billion by 2025 (McKinsey, 2015), companies struggle to turn sensor data into actionable insights. To solve this challenge, substantive expertise needs to be combined with skills from software engineering and statistics and machine learning to generate valuable insights from machine data.

The practical seminar is held in cooperation with industry partners of the KSRI, which provide some real-world datasets. Students will then work in teams of three in a close and agile collaboration with the industry subject matter experts from around the world, making use of to the CRISP DM methodology (Chapman et al. 2000)

There will be four different topics and datasets, each assigned to a team of three students. The assignment will be done in the kickoff in calendar week 18. The exact date of the kickoff event will be determined when the participating students have been selected. Attendance at the kickoff event in calendar week 18 is mandatory and a prerequisite for participation.

Expertise in Python and Data Science / Machine Learning is strongly recommended.

Contact
Dominik Martin – dominik.martin@kit.edu
Dr. Niklas Kühl – niklas.kuehl@kit.edu

The practical seminar will be held in English. Application documents can be handed in in English or German.

Master Seminar in Data Science and Machine Learning
2540510, SS 2022, 2 SWS, Language: German/English, Open in study portal

User-Adaptive Systems Seminar
2540553, SS 2022, 2 SWS, Language: English, Open in study portal
Content
User-adaptive systems collect and analyze biosignals from users to recognize user states as a basis for adaptation. Thermic, mechanical, electric, acoustic, and optical signals are collected using sensors which are integrated in wearables, e.g. glasses, earphones, belts, or bracelets. The collected data is processed with analytics and machine learning techniques in order to determine short-term, evolving over time, and long-term user states in the form of user characteristics, affective-cognitive states, or behavior. Finally, the recognized user states are leveraged for realizing user-centric adaptations.

In this seminar, interdisciplinary teams of students design, develop, and evaluate a user-adaptive system prototype leveraging state-of-the-art hard- and software. This seminar follows an interdisciplinary approach. Students from the fields of computer science, information systems and industrial engineering & management collaborate in the prototype design, development, and evaluation.

The seminar is carried out in cooperation between Teco/Chair of Pervasive Computing Systems (Prof. Beigl) and the Institute of Information Systems and Marketing (Research Group ISSD, Prof. Mädche). It is offered as part of the DFG-funded graduate school “KD2School: Designing Adaptive Systems for Economic Decisions” (https://kd2school.info/)

Learning objectives of the seminar
- Explain what a user-adaptive system is and how it can be conceptualized
- Suggest and evaluate different design solutions for addressing the identified problem
- Build a user-adaptive system prototype using state-of-the-art hard- and software
- Perform a user-centric evaluation of the user-adaptive system prototype

Prerequisites
Strong analytical abilities and profound software development skills are required.

Organizational issues
Termine werden bekannt gegeben

Literature
Required literature will be made available in the seminar.

Information Systems and Service Design Seminar
2540557, SS 2022, 3 SWS, Language: English, Open in study portal
Content
With this seminar, we aim to provide students with the possibility to independently work on state-of-the-art research topics in addition to the knowledge gained in the lectures of the research group ISSD (Prof. Mädche). The research group "Information Systems & Service Design" (ISSD) headed by Prof. Mädche focuses in research, education, and innovation on designing interactive intelligent systems. It is positioned at the intersection of Information Systems and Human-Computer Interaction (HCI).

In the seminar, participants will get deeper insights in a contemporary research topic in the field of information systems, specifically interactive intelligent systems.

The actual seminar topics will be derived from current research activities of the research group. Our research assistants offer a rich set of topics from our research clusters (digital experience and participation, intelligent enterprise systems, or digital services design & innovation). Students can select among these topics individually depending on their personal interests. The seminar is carried out in the form of a literature-based thesis project. In the seminar, students will acquire the important methodological skills of running a systematic literature review.

Learning Objectives
- focus on a contemporary topic at the intersection of Information Systems and Human-Computer Interaction (HCI), specifically interactive intelligent systems
- carry out a structured literature search for a given topic
- aggregate the collected information in a suitable way to present and extract knowledge
- write a seminar thesis following academic writing standards
- deliver a presentation in a scientific context in front of an auditorium

Prerequisites
No specific prerequisites are required for the seminar.

Literature
Further literature will be made available in the seminar.

Organizational issues
Termine werden bekannt gegeben

V Entrepreneurship Research
2545002, SS 2022, 2 SWS, Language: English, Open in study portal

Seminar Human Resource Management (Master)
2573012, SS 2022, 2 SWS, Language: German, Open in study portal
Content
The topics are redefined each semester on basis of current research topics. The topics will be announced on the website of the Wiwi-Portal.

Aim
The student
- looks critically into current research topics in the fields of Human Resource Management and Personnel Economics.
- trains his / her presentation skills.
- learns to get his / her ideas and insights across in a focused and concise way, both in oral and written form, and to sum up the crucial facts.
- cultivates the discussion of research approaches.

Workload
The total workload for this course is: approximately 90 hours.
Lecture: 30h
Preparation of lecture: 45h
Exam preparation: 15h

Literature
Selected journal articles and books.

Organizational issues
Geb. 05.20, Raum 2A-12.1, Termine werden bekannt gegeben

Seminar Human Resources and Organizations (Master)
2573013, SS 2022, 2 SWS, Language: German, Open in study portal

Content
The topics are redefined each semester on basis of current research topics. The topics will be announced on the website of the Wiwi-Portal.

Aim
The student
- looks critically into current research topics in the fields of human resources and organizations.
- trains his / her presentation skills.
- learns to get his / her ideas and insights across in a focused and concise way, both in oral and written form, and to sum up the crucial facts.
- cultivates the discussion of research approaches.

Workload
The total workload for this course is: approximately 90 hours.
Lecture: 30h
Preparation of lecture: 45h
Exam preparation: 15h

Literature
Selected journal articles and books.

Organizational issues
Geb. 05.20, Raum 2A-12.1, Termine werden bekannt gegeben

Seminar Management Accounting
2579909, SS 2022, 2 SWS, Language: English, Open in study portal
Content
The course will be a mix of lectures, discussions, and student presentations. Students will write a paper in small groups, and present this in the final week. You are to a large extent free to select your own topic. The seminar course is concentrated in four meetings that are spread throughout the semester.

Learning objectives:
- Students are largely independently able to identify a distinct topic in Management Accounting,
- Students are capable to research the topic, analyze the information, to conceptualize and deduct fundamental principles and relationships from relatively unstructured information,
- Students can afterwards logically and systematically present the results in writing and as an oral presentation, following a scientific approach (structuring, terminology, sources).

Workload:
- The total workload for this course is approximately 90 hours. For further information see German version.

Examination:
- The performance review is carried out in the form of a "Prüfungsleistung anderer Art" (following § 4 (2) No. 3 of the examination regulation), which in this case is an essay the seminar participants prepare in group work.
- The final grade of the course is the grade awarded to the paper.

Note:
- Maximum of 16 students.

Organizational issues
Geb.05.20, 2A-12.1; Termine werden bekannt gegeben

Literature
Will be announced in the course.
**Digital Citizen Science**
2500019, WS 22/23, 2 SWS, Language: German/English, Open in study portal

**Methoden im Innovationsmanagement**
2545107, WS 22/23, 2 SWS, Language: German/English, Open in study portal

**Data Science in Service Management**
2540473, WS 22/23, 2 SWS, Language: German, Open in study portal

**Seminar Human Resource Management (Master)**
2573012, WS 22/23, 2 SWS, Language: German, Open in study portal

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**Content**

**Digital Citizen Science** is an innovative approach to conduct field research - interactively and in the real world. Especially in times of social distancing measures essential questions about how private lives are changing are investigated. Who is experiencing more stress during HomeOffice hours? Who is flourishing while learning at home because flow is experienced more often? Which formats of digital cooperation are fostering social contacts and bonding? These and other questions that target the main topic: Well-being @Home are focused in these seminar projects.

The seminar theses are supervised by academics from multiple institutes that are working together on the topic of Digital Citizen Science arbeiten. Involved are the research groups of Prof. Mädche, Prof. Nieken, Prof. Scheibehenne, Prof. Szech, Prof. Volkamer, Prof. Weinhardt and Prof. Woll.

**Methoden im Innovationsmanagement**

The seminar "Methods in Innovation Management" aims at the discussion and development of different methods for the structured generation of ideas in selected contexts. In a block seminar, methods and contexts are discussed, from which seminar topics are defined with the participants. These topics are to be worked on independently using methods and procedures. The results will be presented at a presentation date and then a written seminar paper will be prepared. This means that creativity methods and their combination will be presented and applied. The methods are worked on in a structured form and process-like sequence in order to clarify the advantages and disadvantages of different methods.

**Seminar Human Resource Management (Master)**

The topics are redefined each semester on basis of current research topics. The topics will be announced on the website of the Wiwi-Portal.

**Aim**

The student

- looks critically into current research topics in the fields of Human Resource Management and Personnel Economics.
- trains his / her presentation skills.
- learns to get his / her ideas and insights across in a focused and concise way, both in oral and written form, and to sum up the crucial facts.
- cultivates the discussion of research approaches.

**Workload**

The total workload for this course is: approximately 90 hours.

Lecture: 30h
Preparation of lecture: 45h
Exam preparation: 15h

**Literature**

Selected journal articles and books.
Organizational issues
Blockveranstaltung siehe Homepage

Seminar Human Resources and Organizations (Master)
2573013, WS 22/23, 2 SWS, Language: German, Open in study portal

Content
The topics are redefined each semester on basis of current research topics. The topics will be announced on the website of the Wiwi-Portal.

Aim
The student

- looks critically into current research topics in the fields of human resources and organizations.
- trains his / her presentation skills.
- learns to get his / her ideas and insights across in a focused and concise way, both in oral and written form, and to sum up the crucial facts.
- cultivates the discussion of research approaches.

Workload
The total workload for this course is: approximately 90 hours.
Lecture: 30h
Preparation of lecture: 45h
Exam preparation: 15h

Literature
Selected journal articles and books.

Organizational issues
Blockveranstaltung siehe Homepage

Seminar Management Accounting - Special Topics
2579919, WS 22/23, 2 SWS, Language: English, Open in study portal

Content
The course will be a mix of lectures, discussions, and student presentations. Students will write a paper in small groups, and present this in the final week. Topics are selectively prediscibed. The seminar course is concentrated in several meetings that are spread throughout the semester.

Learning objectives:

- Students are largely independently able to identify a distinct topic in Management Accounting.
- Students are capable to research the topic, analyze the information, to conceptualize and deduct fundamental principles and relationships from relatively unstructured information,
- Students can afterwards logically and systematically present the results in writing and as an oral presentation, following a scientific approach (structuring, terminology, sources.

Examination:

- The performance review is carried out in the form of a "Prüfungsleistung anderer Art" (following § 4 (2) No. 3 of the examination regulation), which in this case is an essay the seminar participants prepare in group work.
- The final grade of the course is the grade awarded to the paper.

Required prior Courses:

- The LV "Betriebswirtschaftslehre: Finanzwirtschaft und Rechnungswesen" (2600026) must have been completed before starting this seminar.

Workload:

- The total workload for this course is approximately 90 hours. For further information see German version.

Note:

- Maximum of 16 students.
Organizational issues
Ort und Zeit werden noch bekannt gegeben bzw. über ILIAS

Literature
Will be announced in the course.
### 8.231 Course: Seminar in Business Administration B (Master) [T-WIWI-103476]

**Responsible:** Professorenschaft des Fachbereichs Betriebswirtschaftslehre  
**Organisation:** KIT Department of Economics and Management  
**Part of:** M-WIWI-102972 - Seminar

<table>
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<td>Each term</td>
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**Events**

| ST 2022 | 2500015 | Innovation & Space | 2 SWS | Seminar | Beyer |
| ST 2022 | 2500125 | Current Topics in Digital Transformation Seminar | 3 SWS | Seminar / 🦂 | Mädche |
| ST 2022 | 2530372 | Advances in Financial Machine Learning | 2 SWS | Seminar | Ulrich |
| ST 2022 | 2530580 | Seminar in Finance (Master): Machine Learning Stock Returns with Option Data | Seminar / 📊 | Uhrig-Homburg, Müller, Thimme |
| ST 2022 | 2540472 | Digital Citizen Science | 2 SWS | Seminar | Weinhardt, Knierim, Mädche |
| ST 2022 | 2540473 | Business Data Analytics | 2 SWS | Seminar | Badewitz, Weinhardt |
| ST 2022 | 2540475 | Electronic Markets & User Behavior | 2 SWS | Seminar | Knierim |
| ST 2022 | 2540477 | Digital Experience & Participation | 2 SWS | Seminar | Peukert, Fegert |
| ST 2022 | 2540478 | Smart Grid Economics & Energy Markets | 2 SWS | Seminar | Staudt, Henni, Semmelmann, Qu, Bluhm, Golla |
| ST 2022 | 2540493 | Data Science for the Industrial Internet of Things | | Seminar / 📊 | Martin, Kühl |
| ST 2022 | 2540510 | Master Seminar in Data Science and Machine Learning | 2 SWS | Seminar | Geyer-Schulz |
| ST 2022 | 2540553 | User-Adaptive Systems Seminar | 2 SWS | Seminar / 🤖 | Mädche, Beigl |
| ST 2022 | 2540557 | Information Systems and Service Design Seminar | 3 SWS | Seminar / 🤖 | Mädche |
| ST 2022 | 2545002 | Entrepreneurship Research | 2 SWS | Seminar / 📊 | Terzidis, Dang, Kuschel |
| ST 2022 | 2571180 | Seminar in Marketing and Sales (Master) | 2 SWS | Seminar / 📊 | Klarmann, Mitarbeiter |
| ST 2022 | 2573012 | Seminar Human Resource Management (Master) | 2 SWS | Seminar / 📊 | Nieken, Mitarbeiter |
| ST 2022 | 2573013 | Seminar Human Resources and Organizations (Master) | 2 SWS | Seminar / 📊 | Nieken, Mitarbeiter |
| ST 2022 | 2579909 | Seminar Management Accounting | 2 SWS | Seminar / 📊 | Wouters, Jaedeke |
| ST 2022 | 2579910 | Entrepreneurial Strategy and Financing of Start-Ups | 2 SWS | Seminar / 📊 | Burkardt |
| ST 2022 | 2579919 | Seminar in Management Accounting - Special Topics | 2 SWS | Seminar / 📊 | Ebinger |
| ST 2022 | 2581030 | Seminar Energiewirtschaft IV | 2 SWS | Seminar / 📊 | Dehler-Holland, Fichtner |
| ST 2022 | 2581977 | Seminar Produktionswirtschaft und Logistik II | 2 SWS | Seminar / 📊 | Volk, Schultmann |
| ST 2022 | 2581980 | Seminar Energiewirtschaft II | 2 SWS | Seminar / 📊 | Kraft, Fichtner |
| ST 2022 | 2581990 | 2 SWS | Seminar / 📊 | Schultmann |
| WT 22/23 | 2500019 | Digital Citizen Science | 2 SWS | Seminar / 📊 | Mädche, Nieken |
| WT 22/23 | 2500045 | Digital Democracy - Challenges and Opportunities of the Digital Society | 2 SWS | Seminar / 📊 | Fegert |
| WT 22/23 | 2500125 | Current Topics in Digital Transformation Seminar | 3 SWS | Seminar / 🧩 | Mädche |
| WT 22/23 | 2530293 | Data Science in Service Management | 2 SWS | Seminar / 🧩 | Ruckes, Hoang, Benz, Strych, Luedecke, Silbereis, Wiegratz |
| WT 22/23 | 2540473 | Digital Platforms, Markets & Work | 2 SWS | Seminar / 🧩 | Knierim, del Puppo, Bartholomeyczik |
| WT 22/23 | 2540475 | Digital Experience and Participation | 2 SWS | Seminar / 🧩 | Peukert, Fegert, Greif-Winzrieth, Stein, Bezzaoui |
| WT 22/23 | 2540478 | Smart Grids and Energy Markets | 2 SWS | Seminar / 🧩 | Golla, Henni, Bluhm, Semmelmann |
| WT 22/23 | 2540557 | Information Systems and Design (ISSD) Seminar | 2 SWS | Seminar / 🧩 | Mädche |
| WT 22/23 | 2545107 | Methoden im Innovationsmanagement | 2 SWS | Seminar / 🧩 | Koch |
| WT 22/23 | 2571181 | Seminar Digital Marketing (Master) | 2 SWS | Seminar / 🧩 | Kupfer |
| WT 22/23 | 2573012 | Seminar Human Resource Management (Master) | 2 SWS | Seminar / 🧩 | Nieken, Mitarbeiter |
| WT 22/23 | 2573013 | Seminar Human Resources and Organizations (Master) | 2 SWS | Seminar / 🧩 | Nieken, Mitarbeiter |
| WT 22/23 | 2579910 | Entrepreneurial Strategy and Financing of Start-Ups | 2 SWS | Seminar / 🧩 | Burkardt |
| WT 22/23 | 2579919 | Seminar Management Accounting - Special Topics | 2 SWS | Seminar / 🧩 | Wouters, Dickemann |
| WT 22/23 | 2581030 | Seminar in Energy Economics | 2 SWS | Seminar / 🧩 | Dehler-Holland, Fichtner |
| WT 22/23 | 2581976 | Seminar in Production and Operations Management I | 2 SWS | Seminar / 🧩 | Glöser-Chaboud, Schultmann |
| WT 22/23 | 2581977 | Seminar in Production and Operations Management II | 2 SWS | Seminar / 🧩 | Volk, Schultmann |
| WT 22/23 | 2581980 | Seminar in Energy Economics | 2 SWS | Seminar / 🧩 | Fichtner, Kraft, Zimmermann |
| WT 22/23 | 2581981 | Seminar in Energy Economics | 2 SWS | Seminar / 🧩 | Ardone, Finck, Fichtner, Slednev |
| WT 22/23 | 2581990 | Seminar in Energy Economics | 2 SWS | Seminar / 🧩 | Schultmann |

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

**Competence Certificate**

Alternative exam assessment (§ 4(2), 3 SPO 2015). The following aspects are included:

- Regular participation in the seminar dates
- Preparation of a seminar paper on a partial aspect of the seminar topic according to scientific methods
- Lecture on the topic of the seminar paper.

The point scheme for the assessment is determined by the lecturer of the respective course. It will be announced at the beginning of the course.

**Prerequisites**

None.

**Recommendation**

See seminar description in the course catalogue of the KIT (https://campus.kit.edu/)

**Annotation**

The listed seminar titles are placeholders. Currently offered seminars of each semester will be published on the websites of the institutes and in the course catalogue of the KIT. In general, the current seminar topics of each semester are already announced at the end of the previous semester. Furthermore for some seminars there is an application required.

The available places are listed on the internet: https://portal.wiwi.kit.edu.
Below you will find excerpts from events related to this course:

### Advances in Financial Machine Learning
2530372, SS 2022, 2 SWS, Language: English, [Open in study portal]

#### Content
Machine learning (ML) is changing virtually every aspect of our lives. Today ML algorithms accomplish tasks that until recently only expert humans could perform. As it relates to finance, this is the most exciting time to adopt a disruptive technology that will transform how everyone invests for generations.

In this seminar we will apply modern machine learning techniques hands on to important computational risk and asset management problems. In particular we will use the state of the art Python programming language to implement investment related applications and/or Finance 4.0 risk management solutions.

In a bi-weekly schedule you and your supervisor will first learn and discuss important machine learning concepts and then apply it within a practical FinTech project to real-world data. As a prerequisite students should already have some basic Python and data science skills.

**Organizational issues**
Location: Räume des Lehrstuhls, Blücherstraße 17, E-008

**Literature**
Literatur wird in der ersten Vorlesung bekannt gegeben.

### Data Science for the Industrial Internet of Things
2540493, SS 2022, SWS, Language: English, [Open in study portal]

#### Content
Learning Objectives

1. Gain practical experience in translating a business problem into a data modeling problem
2. Apply solid theoretical foundations from lectures to real-world data
3. Acquire hands-on experience with industrial data science tools
4. Learn how to communicate data science findings to business stakeholders

**Course Credits**
The practical seminar can be credited as Seminar Betriebswirtschaftslehre A [WIWI-103474] (3 ECTS). Other courses can be credited upon request.

**Seminar Description**
The Internet of Things is significantly transforming industries such as automotive, healthcare, and energy. With the rise of ubiquitous computing power, internet access, and economical sensors – physical products turn into cyber-physical smart products that create vast amounts of data.

Current airplanes for example have around 6,000 sensors, creating around 1 TB of data per flight. This data is about the size of all tweets in 3 months worldwide. And this number is growing tremendously. But only 3% of potentially useful data is tagged today, end even less is analyzed. Although Internet of Things use cases such as predictive maintenance are projected to help companies save $630 billion by 2025 (McKinsey, 2015), companies struggle to turn sensor data into actionable insights. To solve this challenge, substantive expertise needs to be combined with skills from software engineering and statistics and machine learning to generate valuable insights from machine data.

The practical seminar is held in cooperation with industry partners of the KSRI, which provide some real-word datasets. Students will then work in teams of three in a close and agile collaboration with the industry subject matter experts from around the world, making use of to the CRISP DM methodology (Chapman et al. 2000)

There will be four different topics and datasets, each assigned to a team of three students. The assignment will be done in the kickoff in calendar week 18. The exact date of the kickoff event will be determined when the participating students have been selected. Attendance at the kickoff event in calendar week 18 is mandatory and a prerequisite for participation.

**Expertise in Python and Data Science / Machine Learning is strongly recommended.**

**Contact**
Dominik Martin – dominik.martin@kit.edu
Dr. Niklas Kühl – niklas.kuehl@kit.edu

The practical seminar will be held in English. Application documents can be handed in in English or German.
Content
User-adaptive systems collect and analyze biosignals from users to recognize user states as a basis for adaptation. Thermic, mechanical, electric, acoustic, and optical signals are collected using sensors which are integrated in wearables, e.g., glasses, earphones, belts, or bracelets. The collected data is processed with analytics and machine learning techniques in order to determine short-term, evolving over time, and long-term user states in the form of user characteristics, affective-cognitive states, or behavior. Finally, the recognized user states are leveraged for realizing user-centric adaptations.

In this seminar, interdisciplinary teams of students design, develop, and evaluate a user-adaptive system prototype leveraging state-of-the-art hard- and software. This seminar follows an interdisciplinary approach. Students from the fields of computer science, information systems and industrial engineering & management collaborate in the prototype design, development, and evaluation.

The seminar is carried out in cooperation between Teco/Chair of Pervasive Computing Systems (Prof. Beigl) and the Institute of Information Systems and Marketing (Research Group ISSD, Prof. Mädche). It is offered as part of the DFG-funded graduate school "KD2School: Designing Adaptive Systems for Economic Decisions" (https://kd2school.info/)

Learning objectives of the seminar
- Explain what a user-adaptive system is and how it can be conceptualized
- Suggest and evaluate different design solutions for addressing the identified problem
- Build a user-adaptive system prototype using state-of-the-art hard- and software
- Perform a user-centric evaluation of the user-adaptive system prototype

Prerequisites
Strong analytical abilities and profound software development skills are required.

Organizational issues
Termine werden bekannt gegeben

Literature
Required literature will be made available in the seminar.
Content
With this seminar, we aim to provide students with the possibility to independently work on state-of-the-art research topics in addition to the knowledge gained in the lectures of the research group ISSD (Prof. Mädche). The research group "Information Systems & Service Design" (ISSD) headed by Prof. Mädche focuses on research, education, and innovation on designing interactive intelligent systems. It is positioned at the intersection of Information Systems and Human-Computer Interaction (HCI).

In the seminar, participants will get deeper insights in a contemporary research topic in the field of information systems, specifically interactive intelligent systems.

The actual seminar topics will be derived from current research activities of the research group. Our research assistants offer a rich set of topics from our research clusters (digital experience and participation, intelligent enterprise systems, or digital services design & innovation). Students can select among these topics individually depending on their personal interests. The seminar is carried out in the form of a literature-based thesis project. In the seminar, students will acquire the important methodological skills of running a systematic literature review.

Learning Objectives
- focus on a contemporary topic at the intersection of Information Systems and Human-Computer Interaction (HCI), specifically interactive intelligent systems
- carry out a structured literature search for a given topic
- aggregate the collected information in a suitable way to present and extract knowledge
- write a seminar thesis following academic writing standards
- deliver a presentation in a scientific context in front of an auditorium

Prerequisites
No specific prerequisites are required for the seminar.

Literature
Further literature will be made available in the seminar.

Organizational issues
Termine werden bekannt gegeben

Content
Content
The students independently develop a topic from entrepreneurship research in an international setting as a tandem with a partner. At first, there will be an introduction to the methodologies used such as systematic literature review, design science, qualitative and quantitative data analysis and more. As part of a written elaboration, the seminar topic must be presented scientifically on 15-20 pages. The results of the seminar paper will be presented in a block event at the end of the semester (20 min + 10 min open discussion).

Learning Objectives
As part of the written elaboration, the basics of independent scientific work (literature research, argumentation + discussion, citing literature sources, application of qualitative, quantitative and simulative methods) are trained. The skills acquired in the seminar are used to prepare for a potential master thesis. The course is therefore particularly aimed at students who want to write their thesis at the Chair for Entrepreneurship and Technology Management.

Registration:
Registration is via the Wiwi portal.

Organizational issues
Termine werden noch bekannt gegeben.

Please note that this seminar will be held in presence at the current planning stage. Further information will be announced via ILIAS.

Literature
Wird im Seminar bekannt gegeben.

Seminar Human Resource Management (Master)
2573012, SS 2022, 2 SWS, Language: German, Open in study portal
Content
The topics are redefined each semester on basis of current research topics. The topics will be announced on the website of the Wiwi-Portal.

Aim
The student
- looks critically into current research topics in the fields of Human Resource Management and Personnel Economics.
- trains his / her presentation skills.
- learns to get his / her ideas and insights across in a focused and concise way, both in oral and written form, and to sum up the crucial facts.
- cultivates the discussion of research approaches.

Workload
The total workload for this course is: approximately 90 hours.
Lecture: 30h
Preparation of lecture: 45h
Exam preparation: 15h

Literature
Selected journal articles and books.

Organizational issues
Geb. 05.20, Raum 2A-12.1, Termine werden bekannt gegeben
Content
The course will be a mix of lectures, discussions, and student presentations. Students will write a paper in small groups, and present this in the final week. You are to a large extent free to select your own topic. The seminar course is concentrated in four meetings that are spread throughout the semester.

Learning objectives:
- Students are largely independently able to identify a distinct topic in Management Accounting,
- Students are capable to research the topic, analyze the information, to conceptualize and deduct fundamental principles and relationships from relatively unstructured information,
- Students can afterwards logically and systematically present the results in writing and as an oral presentation, following a scientific approach (structuring, terminology, sources).

Workload:
- The total workload for this course is approximately 90 hours. For further information see German version.

Examination:
- The performance review is carried out in the form of a "Prüfungsleistung anderer Art" (following § 4 (2) No. 3 of the examination regulation), which in this case is an essay the seminar participants prepare in group work.
- The final grade of the course is the grade awarded to the paper.

Note:
- Maximum of 16 students.

Organizational issues
Geb.05.20, 2A-12.1; Termine werden bekannt gegeben

Literature
Will be announced in the course.
Digital Citizen Science
2500019, WS 22/23, 2 SWS, Language: German/English, Open in study portal

Content
Digital Citizen Science is an innovative approach to conduct field research - interactively and in the real world. Especially in times of social distancing measures essential questions about how private lives are changing are investigated. Who is experiencing more stress during HomeOffice hours? Who is flourishing while learning at home because flow is experienced more often? Which formats of digital cooperation are fostering social contacts and bonding? These and other questions that target the main topic: Well-being @Home are focused in these seminar projects.

The seminar theses are supervised by academics from multiple institutes that are working together on the topic of Digital Citizen Science arbeiten. Involved are the research groups of Prof. Mädche, Prof. Nieken, Prof. Scheibehenne, Prof. Szech, Prof. Volkamer, Prof. Weinhardt and Prof. Woll.

Data Science in Service Management
2540473, WS 22/23, 2 SWS, Language: German/English, Open in study portal

Content
wird auf deutsch und englisch gehalten

Organizational issues
Blockveranstaltung, siehe WWW

Methoden im Innovationsmanagement
2545107, WS 22/23, 2 SWS, Language: German, Open in study portal

Content
The seminar "Methods in Innovation Management" aims at the discussion and development of different methods for the structured generation of ideas in selected contexts. In a block seminar, methods and contexts are discussed, from which seminar topics are defined with the participants. These topics are to be worked on independently using methods and procedures. The results will be presented at a presentation date and then a written seminar paper will be prepared. This means that creativity methods and their combination will be presented and applied. The methods are worked on in a structured form and process-like sequence in order to clarify the advantages and disadvantages of different methods.

Literature
Werden in der ersten Veranstaltung bekannt gegeben.

Seminar Human Resource Management (Master)
2573012, WS 22/23, 2 SWS, Language: German, Open in study portal

Content
The topics are redefined each semester on basis of current research topics. The topics will be announced on the website of the Wiwi-Portal.

Aim
The student

- looks critically into current research topics in the fields of Human Resource Management and Personnel Economics.
- trains his / her presentation skills.
- learns to get his / her ideas and insights across in a focused and concise way, both in oral and written form, and to sum up the crucial facts.
- cultivates the discussion of research approaches.

Workload
The total workload for this course is: approximately 90 hours.
Lecture: 30h
Preparation of lecture: 45h
Exam preparation: 15h

Literature
Selected journal articles and books.
Seminar Human Resources and Organizations (Master)
2573013, WS 22/23, 2 SWS, Language: German, Open in study portal

Content
The topics are redefined each semester on basis of current research topics. The topics will be announced on the website of the Wiwi-Portal.

Aim
The student

- looks critically into current research topics in the fields of human resources and organizations.
- trains his / her presentation skills.
- learns to get his / her ideas and insights across in a focused and concise way, both in oral and written form, and to sum up the crucial facts.
- cultivates the discussion of research approaches.

Workload
The total workload for this course is: approximately 90 hours.
Lecture: 30h
Preparation of lecture: 45h
Exam preparation: 15h

Content
The course will be a mix of lectures, discussions, and student presentations. Students will write a paper in small groups, and present this in the final week. Topics are selectively prediscibed. The seminar course is concentrated in several meetings that are spread throughout the semester.

Learning objectives:

- Students are largely independently able to identify a distinct topic in Management Accounting.
- Students are capable to research the topic, analyze the information, to conceptualize and deduct fundamental principles and relationships from relatively unstructured information,
- Students can afterwards logically and systematically present the results in writing and as an oral presentation, following a scientific approach (structuring, terminology, sources.

Examination:

- The performance review is carried out in the form of a "Prüfungsleistung anderer Art" (following § 4 (2) No. 3 of the examination regulation), which in this case is an essay the seminar participants prepare in group work.
- The final grade of the course is the grade awarded to the paper.

Required prior Courses:

- The LV "Betriebswirtschaftslehre: Finanzwirtschaft und Rechnungswesen" (2600026) must have been completed before starting this seminar.

Workload:

- The total workload for this course is approximately 90 hours. For further information see German version.

Note:

- Maximum of 16 students.
Organizational issues
Ort und Zeit werden noch bekannt gegeben bzw. über ILIAS

Literature
Will be announced in the course.
### 8.232 Course: Seminar in Economics A (Master) [T-WIWI-103478]

**Responsible:** Professorenschaft des Fachbereichs Volkswirtschaftslehre  
**Organisation:** KIT Department of Economics and Management  
**Part of:** M-WIWI-102971 - Seminar

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<td>Each term</td>
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<td>ST 2022</td>
<td>2520367</td>
<td>Strategische Entscheidungen</td>
<td>Seminar</td>
<td>Each term</td>
<td>2 SWS</td>
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<td>2521310</td>
<td>Advanced Topics in Econometrics</td>
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<tr>
<td>ST 2022</td>
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<td>Seminar in economic policy</td>
<td>Seminar</td>
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<td>ST 2022</td>
<td>2560552</td>
<td>Shaping AI and Digitization for Society - Seminar Morals and Social Behavior (Master)</td>
<td>Seminar</td>
<td>Each term</td>
<td>2 SWS</td>
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<tr>
<td>ST 2022</td>
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<td>Bounded Rationality - Theory and Experiments, Seminar on Topics in Political Economy (Bachelor)</td>
<td>Seminar</td>
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<td>WT 22/23</td>
<td>2560142</td>
<td>Moral Wiggle Room and Info Avoidance - Topics in Political Economy (Master)</td>
<td>Seminar</td>
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<td>2 SWS</td>
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<td>WT 22/23</td>
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<td>Morals &amp; Social Behavior (Master)</td>
<td>Seminar</td>
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<td>Seminar in economic policy</td>
<td>Seminar</td>
<td>Each term</td>
<td>2 SWS</td>
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<td>WT 22/23</td>
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<td>Seminar</td>
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<td>Seminar in Macroeconomics II</td>
<td>Seminar</td>
<td>Each term</td>
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Legend: 🖥 Online, Blended (On-Site/Online), 🗣 On-Site, 🗑 Cancelled

**Competence Certificate**  
Alternative exam assessment (§ 4(2), 3 SPO 2015). The following aspects are included:
- Regular participation in the seminar dates
- Preparation of a seminar paper on a partial aspect of the seminar topic according to scientific methods
- Lecture on the topic of the seminar paper.

The point scheme for the assessment is determined by the lecturer of the respective course. It will be announced at the beginning of the course.

**Prerequisites**  
None.

**Recommendation**  
See seminar description in the course catalogue of the KIT (https://campus.kit.edu/)

**Annotation**  
The listed seminar titles are placeholders. Currently offered seminars of each semester will be published on the websites of the institutes and in the course catalogue of the KIT. In general, the current seminar topics of each semester are already announced at the end of the previous semester. Furthermore for some seminars there is an application required.

The available places are listed on the internet: https://portal.wiwi.kit.edu.
Below you will find excerpts from events related to this course:

**Predictive Data Analytics - An Introduction to Machine Learning**

2500013, SS 2022, SWS, Language: English, [Open in study portal](#)

**Seminar (S)**

**Blended (On-Site/Online)**

**Content**
Modern methods from artificial intelligence and machine learning, in particular deep learning methods based on multi-layered artificial neural networks, provide unprecedented tools for data analysis and prediction. Over the past years, they have transformed many scientific fields and have become ubiquitous in real-world applications from speech recognition to self-driving cars.

This seminar will provide a broad introduction to machine learning from statistical foundations to applications in the sciences, economics and engineering. The focus will be on modern machine learning methods for predictive data analytics such as random forests, gradient boosting machines and neural networks, their trans-disciplinary application to supervised learning tasks, and approaches to gain insight into the 'black box' of machine learning models. Lectures on the theoretical background will be accompanied by hands-on programming exercises in Python that will cover practical aspects of implementing machine learning methods for analyzing scientific and real-world datasets.

**Organizational issues**
The seminar consists of three parts:

1. A 3-day block course of lectures and hands-on programming exercises will take place on April 11-13, 2022, either online or in person at Campus South, depending on the Covid-19 situation and regulations. Participation is mandatory. Some familiarity with basic concepts of probability theory and statistics is expected, as well as basic programming skills in Python. For the programming exercises, participants are expected to bring their own laptop with Python and relevant libraries installed.
2. Afterwards, all students will conduct a project for which they will choose a dataset from a list of scientific and real-world datasets and apply what they have learned in the course. Exemplary tasks include predictions of AirBnB prices, wine ratings, salaries, air quality, electricity prices or wildfires. The (potentially preliminary) results will be presented in a meeting during the semester (0.5 days, date to be determined, either online or in person), in a presentation of max. 15 minutes. Participation is mandatory.
3. A final report on the project of 10-20 pages and the code has to be submitted by September 30, 2022. The final grade will be based on the active participation in the seminar (10%), the presentation (30%) and the final report (60%).

**Advanced Topics in Econometrics**

2521310, SS 2022, 2 SWS, Language: German/English, [Open in study portal](#)

**Seminar (S)**

**Organizational issues**
Blockveranstaltung. Termine werden bekannt gegeben

**Shaping AI and Digitization for Society - Seminar Morals and Social Behavior (Master)**

2560552, SS 2022, 2 SWS, Language: English, [Open in study portal](#)

**Seminar (S)**

**Blended (On-Site/Online)**

**Content**
Participation will be limited to 12 students.

For Master students of the fields Industrial Engineering and Management, Information Engineering and Management, Economics Engineering or Economathematics.

Objective: The student develops an own idea for an economic experiment in this research direction. Students work in groups. Changing topics each semester. For current topics, see [http://polit.econ.kit.edu](http://polit.econ.kit.edu) or [https://portal.wiwi.kit.edu/Seminare](https://portal.wiwi.kit.edu/Seminare)

The acceptance of students for the seminar is based on preferences and suitability for the topics. This includes theoretical and practical experience with Behavioral Economics as well as English skills.

Seminar Papers of 8–10 pages are to be handed in.

Students’ grades will be based on the quality of presentations in the seminar (40%) and the seminar paper (40%). Additionally students will have to hand in two abstracts with different lengths (20%). Students can improve their grades by actively participating in the discussions of the presentations.

Recommendation: Knowledge in the field of experimental economic research or behavioral economics as well as in the field of microeconomics and game theory may be helpful.
Organizational issues
Blockveranstaltung:
Introductory Meeting April 20 (online)
Seminar Presentations June 3 (Präsenz or online)

Bounded Rationality - Theory and Experiments, Seminar on Topics in Political Economy (Bachelor)
2560555, SS 2022, 2 SWS, Language: English, Open in study portal

Content
For Bachelor students of the fields Industrial Engineering and Management, Information Engineering and Management, Economics Engineering or Economathematics.
Objective: The student develops an own idea for an economic experiment in this research direction. Students work in groups.
Changing topics each semester. For current topics, see http://polit.econ.kit.edu or https://portal.wiwi.kit.edu/Seminare
The acceptance of students for the seminar is based on preferences and suitability for the topics. This includes theoretical and practical experience with Behavioral Economics as well as English skills.
Seminar Papers of 8–10 pages are to be handed in.
Recommendation: Knowledge in the field of experimental economic research or behavioral economics as well as in the field of microeconomics and game theory may be helpful.

Organizational issues
Blockveranstaltung:
Introductory Meeting April 19 (online)
Seminar Presentations May 30 (Präsenz or online)

Topics in Econometrics
2521310, WS 22/23, 2 SWS, Language: German, Open in study portal

Organizational issues
Blockveranstaltung, Termine werden auf Homepage und über Ilias bekannt gegeben

Moral Wiggle Room and Info Avoidance - Topics in Political Economy (Master)
2560142, WS 22/23, 2 SWS, Language: English, Open in study portal

Content
For Master students of the fields Industrial Engineering and Management, Information Engineering and Management, Economics Engineering or Economathematics.
Objective: The student develops an own idea for an economic experiment in this research direction. Students work in groups.
Changing topics each semester. For current topics, see http://polit.econ.kit.edu or https://portal.wiwi.kit.edu/Seminare
Seminar Papers of 8–10 pages are to be handed in.
Recommendation: Knowledge in the field of experimental economic research or behavioral economics as well as in the field of microeconomics and game theory may be helpful.

Organizational issues
Application is possible via https://portal.wiwi.kit.edu/Seminare

Morals & Social Behavior (Master)
2560143, WS 22/23, 2 SWS, Language: English, Open in study portal
Content
For Master students of the fields Industrial Engineering and Management, Information Engineering and Management, Economics Engineering or Economathematics.

The student develops an own idea for an economic experiment in this research direction. Students work in groups. Changing topics each semester. For current topics, see http://polit.econ.kit.edu or https://portal.wiwi.kit.edu/Seminare

Seminar Papers of 8–10 pages are to be handed in.

Recommendation: Knowledge in the field of experimental economic research or behavioral economics as well as in the field of microeconomics and game theory may be helpful.

Organizational issues
Application is possible via https://portal.wiwi.kit.edu/Seminare
8.233 Course: Seminar in Economics B (Master) [T-WIWI-103477]

**Responsible:** Professorenschaft des Fachbereichs Volkswirtschaftslehre

**Organisation:** KIT Department of Economics and Management

**Part of:** M-WIWI-102972 - Seminar

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<td>Each term</td>
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**Events**

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<td>Seminar / 📲</td>
<td>Each term</td>
<td>Lerch, Koster</td>
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<td>ST 2022 2520367</td>
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<td>Each term</td>
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<td>ST 2022 2521310</td>
<td>2</td>
<td>Advanced Topics in Econometrics</td>
<td>Seminar</td>
<td>Each term</td>
<td>Schienle, Krüger, Görgen, Koster, Buse, Rüter</td>
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<td>ST 2022 2560259</td>
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<td>Each term</td>
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<td>Seminar / 📲</td>
<td>Each term</td>
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<td>ST 2022 2560552</td>
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<td>Seminar / 📲</td>
<td>Each term</td>
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<td>ST 2022 2560555</td>
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<td>Each term</td>
<td>Szech, Rosar, Rau</td>
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<td>WT 22/23 2560400</td>
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<td>Seminar in Macroeconomics II</td>
<td>Seminar / 📲</td>
<td>Each term</td>
<td>Brumm, Krause, Pegorari, Hußmann</td>
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</table>

**Legend:** 🖥 Online, 🧬 Blended (On-Site/Online), 🗣 On-Site, ❌ Cancelled

**Competence Certificate**

Alternative exam assessment (§ 4(2), 3 SPO 2015). The following aspects are included:

- Regular participation in the seminar dates
- Preparation of a seminar paper on a partial aspect of the seminar topic according to scientific methods
- Lecture on the topic of the seminar paper.

The point scheme for the assessment is determined by the lecturer of the respective course. It will be announced at the beginning of the course.

**Prerequisites**

None.

**Recommendation**

See seminar description in the course catalogue of the KIT (https://campus.kit.edu/)

**Annotation**

The listed seminar titles are placeholders. Currently offered seminars of each semester will be published on the websites of the institutes and in the course catalogue of the KIT. In general, the current seminar topics of each semester are already announced at the end of the previous semester. Furthermore for some seminars there is an application required.

The available places are listed on the internet: https://portal.wiwi.kit.edu.
Below you will find excerpts from events related to this course:

**Predictive Data Analytics - An Introduction to Machine Learning**
2500013, SS 2022, SWS, Language: English, Open in study portal

**Seminar (S) Blended (On-Site/Online)**

**Content**
Modern methods from artificial intelligence and machine learning, in particular deep learning methods based on multi-layered artificial neural networks, provide unprecedented tools for data analysis and prediction. Over the past years, they have transformed many scientific fields and have become ubiquitous in real-world applications from speech recognition to self-driving cars.

This seminar will provide a broad introduction to machine learning from statistical foundations to applications in the sciences, economics and engineering. The focus will be on modern machine learning methods for predictive data analytics such as random forests, gradient boosting machines and neural networks, their trans-disciplinary application to supervised learning tasks, and approaches to gain insight into the 'black box' of machine learning models. Lectures on the theoretical background will be accompanied by hands-on programming exercises in Python that will cover practical aspects of implementing machine learning methods for analyzing scientific and real-world datasets.

**Organizational issues**
The seminar consists of three parts:

1. A 3-day block course of lectures and hands-on programming exercises will take place on April 11-13, 2022, either online or in person at Campus South, depending on the Covid-19 situation and regulations. Participation is mandatory. Some familiarity with basic concepts of probability theory and statistics is expected, as well as basic programming skills in Python. For the programming exercises, participants are expected to bring their own laptop with Python and relevant libraries installed.
2. Afterwards, all students will conduct a project for which they will choose a dataset from a list of scientific and real-world datasets and apply what they have learned in the course. Exemplary tasks include predictions of AirBnB prices, wine ratings, salaries, air quality, electricity prices or wild fires. The (potentially preliminary) results will be presented in a meeting during the semester (0.5 days, date to be determined, either online or in person), in a presentation of max. 15 minutes. Participation is mandatory.
3. A final report on the project of 10-20 pages and the code has to be submitted by September 30, 2022. The final grade will be based on the active participation in the seminar (10%), the presentation (30%) and the final report (60%).

**Advanced Topics in Econometrics**
2521310, SS 2022, 2 SWS, Language: German/English, Open in study portal

**Seminar (S)**

**Shaping AI and Digitization for Society - Seminar Morals and Social Behavior (Master)**
2560552, SS 2022, 2 SWS, Language: English, Open in study portal

**Seminar (S) Blended (On-Site/Online)**

**Content**
Participation will be limited to 12 students.

For Master students of the fields Industrial Engineering and Management, Information Engineering and Management, Economics Engineering or Economathematics.

Objective: The student develops an own idea for an economic experiment in this research direction. Students work in groups. Changing topics each semester. For current topics, see [http://politecon.kit.edu](http://politecon.kit.edu) or [https://portal.wiwi.kit.edu/Seminare](https://portal.wiwi.kit.edu/Seminare)

The acceptance of students for the seminar is based on preferences and suitability for the topics. This includes theoretical and practical experience with Behavioral Economics as well as English skills.

Seminar Papers of 8–10 pages are to be handed in.

Students' grades will be based on the quality of presentations in the seminar (40%) and the seminar paper (40%). Additionally students will have to hand in two abstracts with different lengths (20%). Students can improve their grades by actively participating in the discussions of the presentations.

Recommendation: Knowledge in the field of experimental economic research or behavioral economics as well as in the field of microeconomics and game theory may be helpful.
Organizational issues
Blockveranstaltung:
Introductory Meeting April 20 (online)
Seminar Presentations June 3 (Präsenz or online)

**Bounded Rationality - Theory and Experiments, Seminar on Topics in Political Economy (Bachelor)**
2560555, SS 2022, 2 SWS, Language: English, [Open in study portal](#)

**Content**
For Bachelor students of the fields Industrial Engineering and Management, Information Engineering and Management, Economics Engineering or Economathematics.

Objective: The student develops an own idea for an economic experiment in this research direction. Students work in groups. Changing topics each semester. For current topics, see [http://polit.econ.kit.edu](http://polit.econ.kit.edu) or [https://portal.wiwi.kit.edu/Seminare](https://portal.wiwi.kit.edu/Seminare)

The acceptance of students for the seminar is based on preferences and suitability for the topics. This includes theoretical and practical experience with Behavioral Economics as well as English skills.

Seminar Papers of 8–10 pages are to be handed in.

Recommendation: Knowledge in the field of experimental economic research or behavioral economics as well as in the field of microeconomics and game theory may be helpful.

Organizational issues
Application is possible via [https://portal.wiwi.kit.edu/Seminare](https://portal.wiwi.kit.edu/Seminare)

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**Topics in Econometrics**
2521310, WS 22/23, 2 SWS, Language: German, [Open in study portal](#)

**Organizational issues**
Blockveranstaltung, Termine werden auf Homepage und über Ilias bekannt gegeben

**Moral Wiggle Room and Info Avoidance - Topics in Political Economy (Master)**
2560142, WS 22/23, 2 SWS, Language: English, [Open in study portal](#)

**Content**
For Master students of the fields Industrial Engineering and Management, Information Engineering and Management, Economics Engineering or Economathematics.

Objective: The student develops an own idea for an economic experiment in this research direction. Students work in groups. Changing topics each semester. For current topics, see [http://polit.econ.kit.edu](http://polit.econ.kit.edu) or [https://portal.wiwi.kit.edu/Seminare](https://portal.wiwi.kit.edu/Seminare)

Seminar Papers of 8–10 pages are to be handed in.

Recommendation: Knowledge in the field of experimental economic research or behavioral economics as well as in the field of microeconomics and game theory may be helpful.

Organizational issues
Application is possible via [https://portal.wiwi.kit.edu/Seminare](https://portal.wiwi.kit.edu/Seminare)
Course: Seminar in Informatics A (Master) [T-WIWI-103479]

Responsible: Professorenschaft des Instituts AIFB
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-102973 - Seminar

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- 8.234 Course: Seminar in Informatics A (Master) [T-WIWI-103479]

Events:
- **ST 2022 2513211** Seminar Business Information Systems (Master) 2 SWS Seminar / oberweis, forell, frister, fritsch, rybinski, schreiber, schüler, ullrich, schiefer
- **ST 2022 2513219** Seminar Advanced Topics in Petri Net Modeling (Master) 2 SWS Seminar / oberweis, fritsch
- **ST 2022 2513309** Seminar Knowledge Discovery and Data Mining (Master) 3 SWS Seminar / färber, noullet, saier, popovic
- **ST 2022 2513311** Seminar Data Science & Real-time Big Data Analytics (Master) 2 SWS Seminar / färber, käfer, kulbach, thoma
- **ST 2022 2513403** Seminar Emerging Trends in Internet Technologies (Master) 2 SWS Seminar / lins, sunyaev, thiebes
- **ST 2022 2513405** Seminar Emerging Trends in Digital Health (Master) 2 SWS Seminar / lins, sunyaev, thiebes
- **ST 2022 2513500** Cognitive Automobiles and Robots 2 SWS Seminar / zöllner
- **ST 2022 2513553** Seminar E-Voting (Master) 2 SWS Seminar / beckert, müller-quade, volkamer, dörre, düzung, kirsten
- **WT 22/23 2400125** Security and Privacy Awareness 2 SWS Seminar / seidel-saul, volkamer, aldag
- **WT 22/23 2513219** Seminar Process Mining for process oriented Data Science (Master) 2 SWS Seminar / oberweis, alpers
- **WT 22/23 2513220** Seminar Verification of Software (Master) 2 SWS Seminar / oberweis, fritsch
- **WT 22/23 2513313** Seminar Linked Data and the Semantic Web (Master) 3 SWS Seminar / färber, käfer, braun
- **WT 22/23 2513314** Seminar Real-World Challenges in Data Science and Analytics (Bachelor) 3 SWS / färber, höllig, thoma
- **WT 22/23 2513315** Seminar Real-World Challenges in Data Science and Analytics (Master) 3 SWS / färber, höllig, thoma
- **WT 22/23 2513500** Seminar Cognitive Automobiles and Robots (Master) 2 SWS Seminar / zöllner, daaboul

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

Competence Certificate
Alternative exam assessment (§ 4(2), 3 SPO 2015). The following aspects are included:

- Regular participation in the seminar dates
- Preparation of a seminar paper on a partial aspect of the seminar topic according to scientific methods
- Lecture on the topic of the seminar paper.

The point scheme for the assessment is determined by the lecturer of the respective course. It will be announced at the beginning of the course.

Prerequisites
None.
Recommendation
See seminar description in the course catalogue of the KIT (https://campus.kit.edu/)

Annotation
Placeholder for seminars offered by the Institute AIFB.
Currently offered seminars of each semester will be published on the websites of the institutes and in the course catalogue of the KIT. In general, the current seminar topics of each semester are already announced at the end of the previous semester. Furthermore for some seminars there is an application required.
The available places are listed on the internet: https://portal.wiwi.kit.edu.

Below you will find excerpts from events related to this course:

V Seminar Advanced Topics in Petri Net Modeling (Master) 2513219, SS 2022, 2 SWS, Language: English, Open in study portal
Seminar (S) Blended (On-Site/Online)

Content
A system should be correct and efficient. We specify discrete event systems by Petri nets to apply formal analysis techniques based on graph theory and linear algebra to prove correctness. Extended models, such as colored Petri nets, are applied to implement performance evaluation via simulation. We start from case studies using the modeling system Tina and its facilities of model checking for verification of communication protocols. Then we apply Petri nets for the control of robotic manufacturing and consider the sharing of resources in automated manufacturing. Colored Petri nets allow more precise specification of systems, which also leads to reduced abilities for applying formal techniques. So the basic method of investigation is simulation. Our case study concerns modern technology of networking and models are supplied with measuring components which compute statistical characteristics directly in the process of simulation. Finally, a review of modern theory of infinite Petri nets and Sleptsov net computing are provided with a view on cybersecurity of intelligent grids and clouds and hyper-performance concurrent computations.

Organizational issues
Die Veranstaltung findet auf Englisch statt. Die Bewerbung erfolgt über das WiWi-Portal: https://portal.wiwi.kit.edu/ys/6074

Literature
Tools:
CPN Tools [https://cpntools.org/](https://cpntools.org/)

References:
Recent developments in papers on [http://daze.ho.ua](http://daze.ho.ua/)

V Seminar Knowledge Discovery and Data Mining (Master) 2513309, SS 2022, 3 SWS, Language: English, Open in study portal
Seminar (S) Online

Content
In this seminar different machine learning and data mining methods are implemented.
The seminar includes different methods of machine learning and data mining. Participants of the seminar should have basic knowledge of machine learning and programming skills.
Domains of interest include, but are not limited to:

- Medicine
- Social Media
- Finance Market
- Scientific Publications

Further Information: https://aifb.kit.edu/web/Lehre/Praktikum_Knowledge_Discovery_and_Data_Science
The exact dates and information for registration will be announced at the event page.

Organizational issues
Die Anmeldung erfolgt über das WiWi Portal https://portal.wiwi.kit.edu/.
Für weitere Fragen bezüglich des Seminar und der behandelten Themen wenden Sie sich bitte an die entsprechenden Verantwortlichen.

Economathematics M.Sc.
Module Handbook as of 06/09/2022
Literature
Detaillierte Referenzen werden zusammen mit den jeweiligen Themen angegeben. Allgemeine Hintergrundinformationen ergeben sich z.B. aus den folgenden Lehrbüchern:

- Mitchell, T.: Machine Learning

Seminar Data Science & Real-time Big Data Analytics (Master)
2513311, SS 2022, 2 SWS, Language: English, Open in study portal

Content
In this seminar, students will design applications in teams that use meaningful and creative Event Processing methods. Thereby, students have access to an existing record.

Event processing and real-time data are everywhere: financial market data, sensors, business intelligence, social media analytics, logistics. Many applications collect large volumes of data in real time and are increasingly faced with the challenge of being able to process them quickly and react promptly. The challenges of this real-time processing are currently also receiving a great deal of attention under the term "Big Data". The complex processing of real-time data requires both knowledge of methods for data analysis (data science) and their processing (real-time analytics). Seminar papers are offered on both of these areas as well as on interface topics, the input of own ideas is explicitly desired.

Further information to the practical seminar is given under the following Link: http://seminar-cep.fzi.de

Questions are answered via the e-mail address sem-ep@fzi.de.

Organizational issues
Further information as well as the registration form can be found under the following link: http://seminar-cep.fzi.de

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Cognitive Automobiles and Robots
2513500, SS 2022, 2 SWS, Language: German/English, Open in study portal

Content
The seminar is intended as a theoretical supplement to lectures such as "Machine Learning". The theoretical basics will be deepened in the seminar. The aim of the seminar is that the participants work individually to analyze a subsystem from the field of robotics and cognitive systems using one or more procedures from the field of AI/ML.

The individual projects require the analysis of the task at hand, selection of suitable procedures, specification and theoretical evaluation of the approach taken. Finally, the chosen solution has to be documented and presented in a short presentation.

Learning objectives:
- Students can apply knowledge from the Machine Learning lecture in a selected field of current research in robotics or cognitive automobiles for theoretical analysis.
- Students can evaluate, document and present their concepts and results.

Recommendations:
Attendance of the lecture machine learning

Workload:
The workload of 3 credit points consists of the time spent on literature research and planning/specifying the proposed solution. In addition, a short report and a presentation of the work carried out will be prepared.

Organizational issues
Anmeldung und weitere Informationen sind im Wiwi-Portal zu finden.

Registration and further information can be found in the WiWi-portal.

Seminar E-Voting (Master)
2513553, SS 2022, 2 SWS, Language: German/English, Open in study portal

Content
This course can also be credited for the KASTEL certificate. Further information about obtaining the certificate can be found on the SECUSO website https://secuso.aifb.kit.edu/Studium_und_Lehre.php.

Economathematics M.Sc.
Module Handbook as of 06/09/2022

520
Organizational issues
Die Anmeldung für das Seminar ist bis zum Sonntag 03.04.2022, 23:59 Uhr, über die Seite https://portal.wiwi.kit.edu/ys/5915 möglich.

Security and Privacy Awareness
2400125, WS 22/23, 2 SWS, Open in study portal

Seminar (S)
Blended (On-Site/Online)

Content
Within the framework of this interdisciplinary seminar, the topics security awareness and privacy awareness are to be considered from different perspectives. It deals with legal, information technology, psychological, social as well as philosophical aspects.

Note: The link to enrol is for every student, regardless of the study background!

Dates:
- Kick-Off: 22.10.21, 14:00 o’clock
- Final version: 23.01.2022
- Presentation: 04.02.2022, 13:00 o’clock

Topics will be assigned after the enrolment deadline, before the Kick-Off.

Consider that legal focused topics require you to speak and understand german legal texts.

Topics:
- Phishing for Difference: How Does Phishing Impact Visually-Impaired Users?
- Wann wird Marketing im Security-Kontext ethisch bedenklich?
- Untersuchung der Wahrnehmung von (technischen) Backdoors zur Strafverfolgung.
- Data-Governance-Act – Fluch oder Segen für den Datenschutz?
- Würde lieber kein Thema anbieten, notfalls “Was ist der Wert von Privatheit?”
- Massenüberwachung von Kommunikationsknotenpunkten und Chilling Effects -- Eine rechtliche und ethische Auseinandersetzung
- Verletzt algorithmische Analyse von personenbezogenen Daten durch KI Privatheit -- und wenn ja, wie schlimm ist das?

ATTENTION: The seminar is only for MASTER students!

Seminar Verification of Software (Master)
2513220, WS 22/23, 2 SWS, Language: English, Open in study portal

Seminar (S)
Blended (On-Site/Online)

Content
The course presents a balance of theory and practice of software verification, including verification of parallel and distributed programs. These methods are the basis for the development of reliable (secure) software. Most information about the reliability of modern programs is based on testing methods that guarantee a certain probability of the program performing a given function. Formal proof of software correctness is the next step in improving the reliability of software for special applications in real-time systems, as well as in vital areas.

The goal of course is to form knowledge of basic terms and concepts of mathematical techniques and software verification; to study theoretical and practical foundations, principles and basic methods of software verification; as well as acquisition of practical skills to prove the correctness of applied algorithms, acquisition of skills which are necessary for further scientific and professional activities.

Topic 1. Tools for verification of serial and parallel programs written on algorithmic languages.
Topic 2. Verification of parallel software by Petri nets (PN).
Topic 3. Algebra and calculus of processes as verification technique of distributed programs.

Organizational issues

Literature
Laboratory work uses Tina modeling system, mCRL2 (http://projects.laas.fr/tina, https://www.mcrl2.org), modern open source software and models located in the GitHub.

Seminar Linked Data and the Semantic Web (Master)
2513313, WS 22/23, 3 SWS, Language: German/English, Open in study portal

Seminar (S)
On-Site
Content
Linked Data is a way of publishing data on the web in a machine-understandable fashion. The aim of this practical seminar is to build applications and devise algorithms that consume, provide, or analyse Linked Data.

The Linked Data principles are a set of practices for data publishing on the web. Linked Data builds on the web architecture and uses HTTP for data access, and RDF for describing data, thus aiming towards web-scale data integration. There is a vast amount of data available published according to those principles: recently, 4.5 billion facts have been counted with information about various domains, including music, movies, geography, natural sciences. Linked Data is also used to make web-pages machine-understandable, corresponding annotations are considered by the big search engine providers. On a smaller scale, devices on the Internet of Things can also be accessed using Linked Data which makes the unified processing of device data and data from the web easy.

In this practical seminar, students will build prototypical applications and devise algorithms that consume, provide, or analyse Linked Data. Those applications and algorithms can also extend existing applications ranging from databases to mobile apps.

For the seminar, programming skills or knowledge about web development tools/technologies are highly recommended. Basic knowledge of RDF and SPARQL are also recommended, but may be acquired during the seminar. Students will work in groups. Seminar meetings will take place as ‘Block-Seminar’.

Topics of interest include, but are not limited to:

- Travel Security
- Geo data
- Linked News
- Social Media

The exact dates and information for registration will be announced at the event page.

Seminar Real-World Challenges in Data Science and Analytics (Bachelor)
2513314, WS 22/23, 3 SWS, Language: German/English, Open in study portal

Content
In the seminar, various Real-World Challenges in Data Science and Analytics will be worked on.

During this seminar, groups of students work on a case challenge with data provided. Here, the typical process of a data science project is depicted: integration of data, analysis of these, modeling of the decisions and visualization of the results.

During the seminar, solution concepts are worked out, implemented as a software solution and presented in an intermediate and final presentation. The seminar "Real-World Challenges in Data Science and Analytics" is aimed at students in master’s programs.

The exact dates and information for registration will be announced at the course page.

Seminar Real-World Challenges in Data Science and Analytics (Master)
2513315, WS 22/23, 3 SWS, Language: German/English, Open in study portal

Content
In the seminar, various Real-World Challenges in Data Science and Analytics will be worked on.

During this seminar, groups of students work on a case challenge with data provided. Here, the typical process of a data science project is depicted: integration of data, analysis of these, modeling of the decisions and visualization of the results.

During the seminar, solution concepts are worked out, implemented as a software solution and presented in an intermediate and final presentation. The seminar "Real-World Challenges in Data Science and Analytics" is aimed at students in master’s programs.

The exact dates and information for registration will be announced at the course page.

Seminar Cognitive Automobiles and Robots (Master)
2513500, WS 22/23, 2 SWS, Language: German/English, Open in study portal

Seminar (S)
Blended (On-Site/Online)
Content
The seminar is intended as a theoretical supplement to lectures such as "Machine Learning". The theoretical basics will be deepened in the seminar. The aim of the seminar is that the participants work individually to analyze a subsystem from the field of robotics and cognitive systems using one or more procedures from the field of AI/ML.

The individual projects require the analysis of the task at hand, selection of suitable procedures, specification and theoretical evaluation of the approach taken. Finally, the chosen solution has to be documented and presented in a short presentation.

Learning objectives:
- Students can apply knowledge from the Machine Learning lecture in a selected field of current research in robotics or cognitive automobiles for theoretical analysis.
- Students can evaluate, document and present their concepts and results.

Recommendations:
Attendance of the lecture machine learning

Workload:
The workload of 3 credit points consists of the time spent on literature research and planning/specifying the proposed solution. In addition, a short report and a presentation of the work carried out will be prepared.

Organizational issues
Anmeldung und weitere Informationen sind im WiWi-Portal zu finden.

Registration and further information can be found in the WiWi-portal.
8 COURSES

Course: Seminar in Informatics B (Master) [T-WIWI-103480]

8.235 Course: Seminar in Informatics B (Master) [T-WIWI-103480]

Responsible: Professorenschaft des Instituts AIFB
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-102974 - Seminar

<table>
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<th>Type</th>
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<th>Grading scale</th>
<th>Recurrence</th>
<th>Version</th>
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Events

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<th>Grading scale</th>
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<td>ST 2022 2513211</td>
<td>Seminar Business Information Systems (Master)</td>
<td>2 SWS</td>
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<td>ST 2022 2513219</td>
<td>Seminar Advanced Topics in Petri Net Modeling (Master)</td>
<td>2 SWS</td>
<td>Seminar / 🩳</td>
<td>Oberweis, Fritsch</td>
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<td>ST 2022 2513309</td>
<td>Seminar Knowledge Discovery and Data Mining (Master)</td>
<td>3 SWS</td>
<td>Seminar / 🩳</td>
<td>Färber, Noullet, Saier, Popovic</td>
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<td>ST 2022 2513311</td>
<td>Seminar Data Science &amp; Real-time Big Data Analytics (Master)</td>
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<td>Färber, Käfer, Kulbach, Thoma</td>
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<td>ST 2022 2513403</td>
<td>Seminar Emerging Trends in Internet Technologies (Master)</td>
<td>2 SWS</td>
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<td>Lins, Sunyaev, Thiebes</td>
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<td>ST 2022 2513405</td>
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<td>2 SWS</td>
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<td>ST 2022 2513500</td>
<td>Cognitive Automobiles and Robots</td>
<td>2 SWS</td>
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<td>ST 2022 2513553</td>
<td>Seminar E-Voting (Master)</td>
<td>2 SWS</td>
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<td>WT 22/23 2400125</td>
<td>Security and Privacy Awareness</td>
<td>2 SWS</td>
<td>Seminar / 🩳</td>
<td>Seidel-Saul, Volkamer, Aldag</td>
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<td>WT 22/23 2513219</td>
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Legend: 🩳 Online, 🧩 Blended (On-Site/Online), 🕵️ On-Site, ✗ Cancelled

Competence Certificate
Alternative exam assessment (§ 4(2), 3 SPO 2015). The following aspects are included:

- Regular participation in the seminar dates
- Preparation of a seminar paper on a partial aspect of the seminar topic according to scientific methods
- Lecture on the topic of the seminar paper.

The point scheme for the assessment is determined by the lecturer of the respective course. It will be announced at the beginning of the course.

Prerequisites
None.
Recommendation
See seminar description in the course catalogue of the KIT (https://campus.kit.edu/)

Annotation
Placeholder for seminars offered by the Institute AIFB.

The listed seminar titles are placeholders. Currently offered seminars of each semester will be published on the websites of the institutes and in the course catalogue of the KIT. In general, the current seminar topics of each semester are already announced at the end of the previous semester. Furthermore for some seminars there is an application required.

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Content
A system should be correct and efficient. We specify discrete event systems by Petri nets to apply formal analysis techniques based on graph theory and linear algebra to prove correctness. Extended models, such as colored Petri nets, are applied to implement performance evaluation via simulation. We start from case studies using the modeling system Tina and its facilities of model checking for verification of communication protocols. Then we apply Petri nets for the control of robotic manufacturing and consider the sharing of resources in automated manufacturing. Colored Petri nets allow more precise specification of systems, which also leads to reduced abilities for applying formal techniques. So the basic method of investigation is simulation. Our case study concerns modern technology of networking and models are supplied with measuring components which compute statistical characteristics directly in the process of simulation. Finally, a review of modern theory of infinite Petri nets and Sleptsov net computing are provided with a view on cybersecurity of intelligent grids and clouds and hyper-performance concurrent computations.

Organizational issues
Die Veranstaltung findet auf Englisch statt. Die Bewerbung erfolgt über das WiWi-Portal: https://portal.wiwi.kit.edu/ys/6074

Literature
Tools:
CPN Tools [https://cpntools.org/](https://cpntools.org/)

References:
Recent developments in papers on [http://daze.ho.ua](http://daze.ho.ua)

Seminar Knowledge Discovery and Data Mining (Master)
2513309, SS 2022, 3 SWS, Language: English, Open in study portal

Content
In this seminar different machine learning and data mining methods are implemented.

The seminar includes different methods of machine learning and data mining. Participants of the seminar should have basic knowledge of machine learning and programming skills.

Domains of interest include, but are not limited to:

- Medicine
- Social Media
- Finance Market
- Scientific Publications

Further Information: [https://aifb.kit.edu/web/Lehre/Praktikum_Knowledge_Discovery_and_Data_Science](https://aifb.kit.edu/web/Lehre/Praktikum_Knowledge_Discovery_and_Data_Science)

The exact dates and information for registration will be announced at the event page.

Organizational issues
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- Students can evaluate, document and present their concepts and results.

Recommendations:
Attendance of the lecture machine learning

Workload:
The workload of 3 credit points consists of the time spent on literature research and planning/specifying the proposed solution. In addition, a short report and a presentation of the work carried out will be prepared.

Organizational issues
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Registration and further information can be found in the WiWi-portal.
Organizational issues
Die Anmeldung für das Seminar ist bis zum Sonntag 03.04.2022, 23:59 Uhr, über die Seite https://portal.wiwi.kit.edu/ys/5915 möglich.

Security and Privacy Awareness
2400125, WS 22/23, 2 SWS, Open in study portal
Seminar (S) Blended (On-Site/Online)

Content
Within the framework of this interdisciplinary seminar, the topics security awareness and privacy awareness are to be considered from different perspectives. It deals with legal, information technology, psychological, social as well as philosophical aspects.

Note: The link to enrol is for every student, regardless of the study background!

Dates:
- Kick-Off: 22.10.21, 14:00 o'clock
- Final version: 23.01.2022
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Topics will be assigned after the enrolment deadline, before the Kick-Off.

Consider that legal focused topics require you to speak and understand German legal texts.

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- Wann wird Marketing im Security-Kontext ethisch bedenklich?
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- Data-Governance-Act – Fluch oder Segen für den Datenschutz?
- Würde lieber kein Thema anbieten, notfalls “Was ist der Wert von Privatheit?”
- Massenüberwachung von Kommunikationsknotenpunkten und Chilling Effects -- Eine rechtliche und ethische Auseinandersetzung
- Verletzt algorithmische Analyse von personenbezogenen Daten durch KI Privatheit -- und wenn ja, wie schlimm ist das?

ATTENTION: The seminar is only for MASTER students!

Seminar Verification of Software (Master)
2513220, WS 22/23, 2 SWS, Language: English, Open in study portal
Seminar (S) Blended (On-Site/Online)

Content
The course presents a balance of theory and practice of software verification, including verification of parallel and distributed programs. These methods are the basis for the development of reliable (secure) software. Most information about the reliability of modern programs is based on testing methods that guarantee a certain probability of the program performing a given function. Formal proof of software correctness is the next step in improving the reliability of software for special applications in real-time systems, as well as in vital areas.

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Topic 1. Tools for verification of serial and parallel programs written on algorithmic languages.
Topic 2. Verification of parallel software by Petri nets (PN).
Topic 3. Algebra and calculus of processes as verification technique of distributed programs.

Organizational issues

Literature
Laboratory work uses Tina modeling system, mCRL2 (http://projects.laas.fr/tina, https://www.mcrl2.org), modern open source software and models located in the GitHub.

Seminar Linked Data and the Semantic Web (Master)
2513313, WS 22/23, 3 SWS, Language: German/English, Open in study portal
Seminar (S) On-Site
Content
Linked Data is a way of publishing data on the web in a machine-understandable fashion. The aim of this practical seminar is to build applications and devise algorithms that consume, provide, or analyse Linked Data.

The Linked Data principles are a set of practices for data publishing on the web. Linked Data builds on the web architecture and uses HTTP for data access, and RDF for describing data, thus aiming towards web-scale data integration. There is a vast amount of data available published according to those principles: recently, 4.5 billion facts have been counted with information about various domains, including music, movies, geography, natural sciences. Linked Data is also used to make web-pages machine-understandable, corresponding annotations are considered by the big search engine providers. On a smaller scale, devices on the Internet of Things can also be accessed using Linked Data which makes the unified processing of device data and data from the web easy.

In this practical seminar, students will build prototypical applications and devise algorithms that consume, provide, or analyse Linked Data. Those applications and algorithms can also extend existing applications ranging from databases to mobile apps.

For the seminar, programming skills or knowledge about web development tools/technologies are highly recommended. Basic knowledge of RDF and SPARQL are also recommended, but may be acquired during the seminar. Students will work in groups. Seminar meetings will take place as 'Block-Seminar'.

Topics of interest include, but are not limited to:
- Travel Security
- Geo data
- Linked News
- Social Media

The exact dates and information for registration will be announced at the event page.

Seminar Real-World Challenges in Data Science and Analytics (Bachelor)
2513314, WS 22/23, 3 SWS, Language: German/English, Open in study portal

Seminar Real-World Challenges in Data Science and Analytics (Master)
2513315, WS 22/23, 3 SWS, Language: German/English, Open in study portal

Seminar Cognitive Automobiles and Robots (Master)
2513500, WS 22/23, 2 SWS, Language: German/English, Open in study portal
Content
The seminar is intended as a theoretical supplement to lectures such as "Machine Learning". The theoretical basics will be deepened in the seminar. The aim of the seminar is that the participants work individually to analyze a subsystem from the field of robotics and cognitive systems using one or more procedures from the field of AI/ML.

The individual projects require the analysis of the task at hand, selection of suitable procedures, specification and theoretical evaluation of the approach taken. Finally, the chosen solution has to be documented and presented in a short presentation.

Learning objectives:
- Students can apply knowledge from the Machine Learning lecture in a selected field of current research in robotics or cognitive automobiles for theoretical analysis.
- Students can evaluate, document and present their concepts and results.

Recommendations:
Attendance of the lecture machine learning

Workload:
The workload of 3 credit points consists of the time spent on literature research and planning/specifying the proposed solution. In addition, a short report and a presentation of the work carried out will be prepared.

Organizational issues
Anmeldung und weitere Informationen sind im WiWi-Portal zu finden.
Registration and further information can be found in the WiWi-portal.
### 8.236 Course: Seminar in Operations Research A (Master) [T-WIWI-103481]

**Responsible:** Prof. Dr. Stefan Nickel  
Prof. Dr. Steffen Rebennack  
Prof. Dr. Oliver Stein

**Organisation:** KIT Department of Economics and Management

**Part of:** M-WIWI-102973 - Seminar

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**Events**

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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, x Cancelled

**Competence Certificate**

Alternative exam assessment (§ 4(2), 3 SPO 2015). The following aspects are included:

- Regular participation in the seminar dates
- Preparation of a seminar paper on a partial aspect of the seminar topic according to scientific methods
- Lecture on the topic of the seminar paper.

The point scheme for the assessment is determined by the lecturer of the respective course. It will be announced at the beginning of the course.

**Prerequisites**

None.

**Recommendation**

See seminar description in the course catalogue of the KIT ([https://campus.kit.edu/](https://campus.kit.edu/))

**Annotation**

The listed seminar titles are placeholders. Currently offered seminars of each semester will be published on the websites of the institutes and in the course catalogue of the KIT. In general, the current seminar topics of each semester are already announced at the end of the previous semester. Furthermore for some seminars there is an application required.

The available places are listed on the internet: [https://portal.wiwi.kit.edu](https://portal.wiwi.kit.edu).

**Below you will find excerpts from events related to this course:**

#### Seminar: Modern OR and Innovative Logistics

2550491, SS 2022, 2 SWS, Language: German, [Open in study portal](https://campus.kit.edu/)
Content
The seminar aims at the presentation, critical evaluation and exemplary discussion of recent questions in discrete optimization. The focus lies on optimization models and algorithms, also with regard to their applicability in practical cases (especially in Supply Chain and Health Care Management). The students get in touch with scientific working: The in-depth work with a special scientific topic makes the students familiar with scientific literature research and argumentation methods. As a further aspect of scientific work, especially for Master students the emphasis is put on a critical discussion of the seminar topic. Regarding the seminar presentations, the students will be familiarized with basic presentational and rhetoric skills.

The topics of the seminar will be announced at the beginning of the term in a preliminary meeting. Attendance is compulsory for the preliminary meeting as well for all seminar presentations.

Exam:
The assessment consists of a written seminar thesis of 20-25 pages and a presentation of 35-40 minutes (according to §4(2), 3 of the examination regulation).

The final mark for the seminar consists of the seminar thesis, the seminar presentation, the handout, and if applicable further material such as programming code.

The seminar can be attended both by Bachelor and Master students. A differentiation will be achieved by different valuation standards for the seminar thesis and presentation.

Requirements:
If possible, at least one module of the institute should be taken before attending the seminar.

Objectives:
The student
- illustrates and evaluates classic and current research questions in discrete optimization,
- applies optimization models and algorithms in discrete optimization, also with regard to their applicability in practical cases (especially in Supply Chain and Health Care Management),
- successfully gets in touch with scientific working by an in-depth working on a special scientific topic which makes the student familiar with scientific literature research and argumentation methods,
- acquires good rhetorical and presentation skills.

As a further aspect of scientific work, especially for Master students the emphasis is put on a critical discussion of the seminar topic.

Organizational issues
wird auf der Homepage dol.io.rit.edu bzw. auf dem WiWi-Portal bekannt gegeben

Literature
Die Literatur und die relevanten Quellen werden zu Beginn des Seminars bekannt gegeben.

Seminar on Methodical Foundations of Operations Research (B)
2550131, WS 22/23, 2 SWS, Language: German, Open in study portal

Content
The seminar aims at describing, evaluating, and discussing recent as well as classical topics in continuous optimization. The focus is on the treatment of optimization models and algorithms, also with respect to their practical application.

Bachelor students are introduced to the style of scientific work. By focussed treatment of a scientific topic they deal with the basics of scientific investigation and reasoning.

For further development of a scientific work style, master students are particularly expected to critically question the seminar topics.

With regard to the oral presentations the students become acquainted with presentation techniques and basics of scientific reasoning. Also rhetorical abilities may be improved.

Remarks:
Attendance at all oral presentations is compulsory.

Preferably at least one module offered by the Institute of Operations Research should have been chosen before attending this seminar.

Assessment:
The assessment is composed of a 15-20 page paper as well as a 40-60 minute oral presentation according to §4(2), 3 of the examination regulation. The grade is composed of the equally weighted assessments of the paper and the oral presentation.

The seminar is appropriate for bachelor as well as for master students. Their differentiation results from different assessment criteria for the seminar paper and the oral presentation.

Workload:
The total workload for this course is approximately 90 hours. For further information see German version.
Literature
Die Literatur und die relevanten Quellen werden gegen Ende des vorausgehenden Semesters im Wiwi-Portal und in einer Seminarvorbereitung bekannt gegeben.

References and relevant sources are announced at the end of the preceding semester in the Wiwi-Portal and in a preparatory meeting.

Seminar: Modern OR and Innovative Logistics
2550491, WS 22/23, 2 SWS, Language: German, Open in study portal

Seminar (S)
Blended (On-Site/Online)

Content
The seminar aims at the presentation, critical evaluation and exemplary discussion of recent questions in discrete optimization. The focus lies on optimization models and algorithms, also with regard to their applicability in practical cases (especially in Supply Chain and Health Care Management). The students get in touch with scientific working: The in-depth work with a special scientific topic makes the students familiar with scientific literature research and argumentation methods. As a further aspect of scientific work, especially for Master students the emphasis is put on a critical discussion of the seminar topic. Regarding the seminar presentations, the students will be familiarized with basic presentational and rhetoric skills.

Organizational issues
wird auf der Homepage bekannt gegeben

Literature
Die Literatur und die relevanten Quellen werden zu Beginn des Seminars bekannt gegeben.
8.237 Course: Seminar in Operations Research B (Master) [T-WIWI-103482]

**Responsible:** Prof. Dr. Stefan Nickel  
Prof. Dr. Steffen Rebennack  
Prof. Dr. Oliver Stein

**Organisation:** KIT Department of Economics and Management  
**Part of:** M-WIWI-102974 - Seminar

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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

**Competence Certificate**
Alternative exam assessment (§ 4(2), 3 SPO 2015). The following aspects are included:
- Regular participation in the seminar dates
- Preparation of a seminar paper on a partial aspect of the seminar topic according to scientific methods
- Lecture on the topic of the seminar paper.

The point scheme for the assessment is determined by the lecturer of the respective course. It will be announced at the beginning of the course.

**Prerequisites**
None.

**Recommendation**
See seminar description in the course catalogue of the KIT (https://campus.kit.edu/)

**Annotation**
The listed seminar titles are placeholders. Currently offered seminars of each semester will be published on the websites of the institutes and in the course catalogue of the KIT. In general, the current seminar topics of each semester are already announced at the end of the previous semester. Furthermore for some seminars there is an application required.

The available places are listed on the internet: https://portal.wiwi.kit.edu.

Below you will find excerpts from events related to this course:

**Seminar: Modern OR and Innovative Logistics**  
2550491, SS 2022, 2 SWS, Language: German, Open in study portal
Content
The seminar aims at the presentation, critical evaluation and exemplary discussion of recent questions in discrete optimization. The focus lies on optimization models and algorithms, also with regard to their applicability in practical cases (especially in Supply Chain and Health Care Management). The students get in touch with scientific working: The in-depth work with a special scientific topic makes the students familiar with scientific literature research and argumentation methods. As a further aspect of scientific work, especially for Master students the emphasis is put on a critical discussion of the seminar topic. Regarding the seminar presentations, the students will be familiarized with basic presentational and rhetoric skills.

The topics of the seminar will be announced at the beginning of the term in a preliminary meeting. Attendance is compulsory for the preliminary meeting as well as for all seminar presentations.

Exam:
The assessment consists of a written seminar thesis of 20-25 pages and a presentation of 35-40 minutes (according to §4(2), 3 of the examination regulation).

The final mark for the seminar consists of the seminar thesis, the seminar presentation, the handout, and if applicable further material such as programming code.

The seminar can be attended both by Bachelor and Master students. A differentiation will be achieved by different valuation standards for the seminar thesis and presentation.

Requirements:
If possible, at least one module of the institute should be taken before attending the seminar.

Objectives:
The student

- illustrates and evaluates classic and current research questions in discrete optimization,
- applies optimization models and algorithms in discrete optimization, also with regard to their applicability in practical cases (especially in Supply Chain and Health Care Management),
- successfully gets in touch with scientific working by an in-depth working on a special scientific topic which makes the student familiar with scientific literature research and argumentation methods,
- acquires good rhetorical and presentation skills.

As a further aspect of scientific work, especially for Master students the emphasis is put on a critical discussion of the seminar topic.

Organizational issues
wird auf der Homepage dol.ior.kit.edu bzw. auf dem WiWi-Portal bekannt gegeben

Literature
Die Literatur und die relevanten Quellen werden zu Beginn des Seminars bekannt gegeben.

### Seminar on Methodical Foundations of Operations Research (B)
2550131, WS 22/23, 2 SWS, Language: German, [Open in study portal](#)

**On-Site**

Content
The seminar aims at describing, evaluating, and discussing recent as well as classical topics in continuous optimization. The focus is on the treatment of optimization models and algorithms, also with respect to their practical application.

Bachelor students are introduced to the style of scientific work. By focussed treatment of a scientific topic they deal with the basics of scientific investigation and reasoning.

For further development of a scientific work style, master students are particularly expected to critically question the seminar topics.

With regard to the oral presentations the students become acquainted with presentation techniques and basics of scientific reasoning. Also rhetoric abilities may be improved.

Remarks:
Attendance at all oral presentations is compulsory.

Preferably at least one module offered by the Institute of Operations Research should have been chosen before attending this seminar.

Assessment:
The assessment is composed of a 15-20 page paper as well as a 40-60 minute oral presentation according to §4(2), 3 of the examination regulation. The grade is composed of the equally weighted assessments of the paper and the oral presentation.

The seminar is appropriate for bachelor as well as for master students. Their differentiation results from different assessment criteria for the seminar paper and the oral presentation.

Workload:
The total workload for this course is approximately 90 hours. For further information see German version.
Literature
Die Literatur und die relevanten Quellen werden gegen Ende des vorausgehenden Semesters im Wiwi-Portal und in einer Seminarvorbereitung bekannt gegeben.
References and relevant sources are announced at the end of the preceding semester in the Wiwi-Portal and in a preparatory meeting.

Seminar: Modern OR and Innovative Logistics
2550491, WS 22/23, 2 SWS, Language: German, Open in study portal
Seminar (S)
Blended (On-Site/Online)

Content
The seminar aims at the presentation, critical evaluation and exemplary discussion of recent questions in discrete optimization. The focus lies on optimization models and algorithms, also with regard to their applicability in practical cases (especially in Supply Chain and Health Care Management). The students get in touch with scientific working: The in-depth work with a special scientific topic makes the students familiar with scientific literature research and argumentation methods. As a further aspect of scientific work, especially for Master students the emphasis is put on a critical discussion of the seminar topic. Regarding the seminar presentations, the students will be familiarized with basic presentational and rhetoric skills.

Organizational issues
wird auf der Homepage bekannt gegeben

Literature
Die Literatur und die relevanten Quellen werden zu Beginn des Seminars bekannt gegeben.
8 COURSES

Course: Seminar in Statistics A (Master) [T-WIWI-103483]

8.238 Course: Seminar in Statistics A (Master) [T-WIWI-103483]

Responsible: Prof. Dr. Oliver Grothe
Prof. Dr. Melanie Schienle

Organisation: KIT Department of Economics and Management

Part of: M-WIWI-102971 - Seminar

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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

Competence Certificate

Alternative exam assessment (§ 4(2), 3 SPO 2015). The following aspects are included:

- Regular participation in the seminar dates
- Preparation of a seminar paper on a partial aspect of the seminar topic according to scientific methods
- Lecture on the topic of the seminar paper.

The point scheme for the assessment is determined by the lecturer of the respective course. It will be announced at the beginning of the course.

Prerequisites

None.

Recommendation

See seminar description in the course catalogue of the KIT (https://campus.kit.edu/)

Annotation

The listed seminar titles are placeholders. Currently offered seminars of each semester will be published on the websites of the institutes and in the course catalogue of the KIT. In general, the current seminar topics of each semester are already announced at the end of the previous semester. Furthermore for some seminars there is an application required.

The available places are listed on the internet: https://portal.wiwi.kit.edu.

Below you will find excerpts from events related to this course:

Predictive Data Analytics - An Introduction to Machine Learning
2500013, SS 2022, SWS, Language: English, Open in study portal
Seminar (S) Blended (On-Site/Online)
Content
Modern methods from artificial intelligence and machine learning, in particular deep learning methods based on multi-layered artificial neural networks, provide unprecedented tools for data analysis and prediction. Over the past years, they have transformed many scientific fields and have become ubiquitous in real-world applications from speech recognition to self-driving cars.

This seminar will provide a broad introduction to machine learning from statistical foundations to applications in the sciences, economics and engineering. The focus will be on modern machine learning methods for predictive data analytics such as random forests, gradient boosting machines and neural networks, their trans-disciplinary application to supervised learning tasks, and approaches to gain insight into the 'black box' of machine learning models. Lectures on the theoretical background will be accompanied by hands-on programming exercises in Python that will cover practical aspects of implementing machine learning methods for analyzing scientific and real-world datasets.

Organizational issues
The seminar consists of three parts:

1. A 3-day block course of lectures and hands-on programming exercises will take place on April 11-13, 2022, either online or in person at Campus South, depending on the Covid-19 situation and regulations. Participation is mandatory. Some familiarity with basic concepts of probability theory and statistics is expected, as well as basic programming skills in Python. For the programming exercises, participants are expected to bring their own laptop with Python and relevant libraries installed.

2. Afterwards, all students will conduct a project for which they will choose a dataset from a list of scientific and real-world datasets and apply what they have learned in the course. Exemplary tasks include predictions of AirBnB prices, wine ratings, salaries, air quality, electricity prices or wildfires. The (potentially preliminary) results will be presented in a meeting during the semester (0.5 days, date to be determined, either online or in person), in a presentation of max. 15 minutes. Participation is mandatory.

3. A final report on the project of 10-20 pages and the code has to be submitted by September 30, 2022. The final grade will be based on the active participation in the seminar (10%), the presentation (30%) and the final report (60%).

Organizational issues
Blockveranstaltung. Termine werden bekannt gegeben
8 COURSES

Course: Seminar in Statistics B (Master) [T-WIWI-103484]

Responsibility: Prof. Dr. Oliver Grothe
Prof. Dr. Melanie Schienle

Organisation: KIT Department of Economics and Management

Part of: M-WIWI-102972 - Seminar

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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ❌ Cancelled

Competence Certificate
Alternative exam assessment (§ 4(2), 3 SPO 2015). The following aspects are included:

- Regular participation in the seminar dates
- Preparation of a seminar paper on a partial aspect of the seminar topic according to scientific methods
- Lecture on the topic of the seminar paper.

The point scheme for the assessment is determined by the lecturer of the respective course. It will be announced at the beginning of the course.

Prerequisites
None.

Recommendation
See seminar description in the course catalogue of the KIT (https://campus.kit.edu/)

Annotation
The listed seminar titles are placeholders. Currently offered seminars of each semester will be published on the websites of the institutes and in the course catalogue of the KIT. In general, the current seminar topics of each semester are already announced at the end of the previous semester. Furthermore for some seminars there is an application required.

The available places are listed on the internet: https://portal.wiwi.kit.edu.

Below you will find excerpts from events related to this course:

Predictive Data Analytics - An Introduction to Machine Learning
2500013, SS 2022, SWS, Language: English, Open in study portal

Seminar (S)
Blended (On-Site/Online)
Content
Modern methods from artificial intelligence and machine learning, in particular deep learning methods based on multi-layered artificial neural networks, provide unprecedented tools for data analysis and prediction. Over the past years, they have transformed many scientific fields and have become ubiquitous in real-world applications from speech recognition to self-driving cars.

This seminar will provide a broad introduction to machine learning from statistical foundations to applications in the sciences, economics and engineering. The focus will be on modern machine learning methods for predictive data analytics such as random forests, gradient boosting machines and neural networks, their trans-disciplinary application to supervised learning tasks, and approaches to gain insight into the ‘black box’ of machine learning models. Lectures on the theoretical background will be accompanied by hands-on programming exercises in Python that will cover practical aspects of implementing machine learning methods for analyzing scientific and real-world datasets.

Organizational issues
The seminar consists of three parts:

1. A 3-day block course of lectures and hands-on programming exercises will take place on April 11-13, 2022, either online or in person at Campus South, depending on the Covid-19 situation and regulations. Participation is mandatory. Some familiarity with basic concepts of probability theory and statistics is expected, as well as basic programming skills in Python. For the programming exercises, participants are expected to bring their own laptop with Python and relevant libraries installed.
2. Afterwards, all students will conduct a project for which they will choose a dataset from a list of scientific and real-world datasets and apply what they have learned in the course. Exemplary tasks include predictions of AirBnB prices, wine ratings, salaries, air quality, electricity prices or wildfires. The (potentially preliminary) results will be presented in a meeting during the semester (0.5 days, date to be determined, either online or in person), in a presentation of max. 15 minutes. Participation is mandatory.
3. A final report on the project of 10-20 pages and the code has to be submitted by September 30, 2022. The final grade will be based on the active participation in the seminar (10%), the presentation (30%) and the final report (60%).
### 8.240 Course: Seminar Mathematics [T-MATH-105686]

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**Responsible:** PD Dr. Stefan Kühnlein  
**Organisation:** KIT Department of Mathematics  
**Part of:** M-MATH-102730 - Seminar
8.241 Course: Simulation Game in Energy Economics [T-WIWI-108016]

**Responsible:** Dr. Massimo Genoese  
**Organisation:** KIT Department of Economics and Management  
**Part of:** M-WIWI-101451 - Energy Economics and Energy Markets

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**Events**

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<th>ST 2022</th>
<th>2581025</th>
<th>Simulation Game in Energy Economics</th>
<th>3 SWS</th>
<th>Lecture / Practice (VU) On-Site</th>
</tr>
</thead>
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Legend: 🗣 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

**Competence Certificate**  
Examination as written assignment and oral presentation (§4 (2), 1 SPO).

**Prerequisites**  
None

**Recommendation**  
Visiting the course "Introduction to Energy Economics"

**Annotation**  
The number of participants is limited.  
There is a registration procedure via CAS followed by a selection of the participants.

**Below you will find excerpts from events related to this course:**

**Simulation Game in Energy Economics**  
2581025, SS 2022, 3 SWS, Language: German, Open in study portal

**Lecture / Practice (VU)**  
On-Site

**Content**

- Introduction  
- Agents and market places in the electricity industry  
- Selected planning tasks of energy service companies  
- Methods of modelling in the energy sector  
- Agent-based simulation: The PowerACE model  
- Simulation game: Simulation in energy economics (electricity and emission trading, investment decisions)

The lecture is structured in a theoretical and a practical part. In the theoretical part, the students are taught the basics to carry out simulations themselves in the practical part which comprises amongst others the simulation of the power exchange. The participants of the simulation game take a role as a power trader in the power market. Based on various sources of information (e.g. prognosis of power prices, available power plants, fuel prices), they can launch bids in the power exchange.

**Assessment:** presentation and written summary

**Prerequisites:** Basics in Energy economics ad markets are advantageous.

**Organizational issues**  
CIP-Pool West, Raum 102, Geb. 06.41 - siehe Institutsaushang

**Literature**  
**Weiterführende Literatur:**

8.242 Course: Smart Energy Infrastructure [T-WIWI-107464]

**Responsible:**
Dr. Armin Ardone  
Dr. Dr. Andrej Marko Pustisek

**Organisation:**
KIT Department of Economics and Management

**Part of:**
M-WIWI-101452 - Energy Economics and Technology

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**Events**

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<td>Lecture</td>
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**Responsible:**
Ardone, Pustisek

**Competence Certificate**
The assessment consists of a written exam (60 minutes). The exam takes place in every semester. Re-examinations are offered at every ordinary examination date.

**Prerequisites**
None.

**Below you will find excerpts from events related to this course:**

### (Smart) Energy Infrastructure
2581023, WS 22/23, 2 SWS, Language: German, [Open in study portal](#)

**Lecture (V)**
On-Site

**Content**

- Basic terms and concepts
- Meaning of infrastructure
- Excursus: regulation of infrastructure
- Natural gas transportation
- Natural gas storage
- Electricity transmission
- (Overview) Crude oil and oil product transportation

**Organizational issues**
Blockveranstaltung, Termine s. Aushang
8.243 Course: Smart Grid Applications [T-WIWI-107504]

**Responsible:** Prof. Dr. Christof Weinhardt

**Organisation:** KIT Department of Economics and Management

**Part of:** M-WIWI-103720 - eEnergy: Markets, Services and Systems

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**Events**

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<td>Lecture / 🗣</td>
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**Legend:** Online, Blended (On-Site/Online), On-Site, Cancelled

**Competence Certificate**
The assessment consists of a written exam (60 min) (according to §4(2), 1 of the examination regulations). By successful completion of the exercises (§4 (2), 3 SPO 2007 respectively §4 (3) SPO 2015) a bonus can be obtained. If the grade of the written exam is at least 4.0 and at most 1.3, the bonus will improve it by one grade level (i.e. by 0.3 or 0.4).

**Prerequisites**
None

**Recommendation**
None

**Annotation**
The lecture will be read for the first time in winter term 2018/19.
8.244 Course: Sobolev Spaces [T-MATH-105896]

**Responsible:** Prof. Dr. Andreas Kirsch

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-102926 - Sobolev Spaces

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<tr>
<td>Oral exam</td>
<td>5</td>
<td>Grade to a third</td>
<td>1</td>
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</table>
Course: Social Choice Theory [T-WIWI-102859]

**Responsible:** Prof. Dr. Clemens Puppe  
**Organisation:** KIT Department of Economics and Management  
**Part of:**  
M-WIWI-101500 - Microeconomic Theory  
M-WIWI-101504 - Collective Decision Making

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**Events**

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<td>Social Choice Theory</td>
<td>Lecture</td>
<td>2 SWS</td>
<td>Grade to a third</td>
<td>Each summer term</td>
<td>Müller, Kretz</td>
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<td>2520539</td>
<td>Übung zu Social Choice Theory</td>
<td>Practice</td>
<td>1 SWS</td>
<td>Grade to a third</td>
<td>Each summer term</td>
<td>Kretz, Müller</td>
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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

**Competence Certificate**
The assessment consists of an alternative exam assessment (open book exam). The exam takes place in every summer semester.

**Prerequisites**
None

**Below you will find excerpts from events related to this course:**

**Social Choice Theory**  
2520537, SS 2022, 2 SWS, Language: English, [Open in study portal](#)

**Content**
How should (political) candidates be elected? What are good ways of merging individual judgments into collective judgments? Social Choice Theory is the systematic study and comparison of how groups and societies can come to collective decisions.

The course offers a rigorous and comprehensive treatment of judgment and preference aggregation as well as voting theory. It is divided into two parts. The first part deals with (general binary) aggregation theory and builds towards a general impossibility result that has the famous Arrow theorem as a corollary. The second part treats voting theory. Among other things, it includes proving the Gibbard-Satterthwaite theorem.

**Literature**
Main texts:

Secondary texts:
8.246 Course: Sociotechnical Information Systems Development [T-WIWI-109249]

**Responsible:** Prof. Dr. Ali Sunyaev

**Organisation:** KIT Department of Economics and Management

**Part of:** M-WIWI-101472 - Informatics

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**Events**

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<td>Grade to a third</td>
<td>Each term</td>
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<td>ST 2022</td>
<td>2512401</td>
<td>Development of Sociotechnical Information Systems (Master)</td>
<td>3</td>
<td>Practical course / 🖥</td>
<td>4.5</td>
<td>Grade to a third</td>
<td>Each term</td>
<td>Sunyaev, Pandl, Goram</td>
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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

**Competence Certificate**
The alternative exam assessment consists of an implementation and a final thesis documenting the development and use of the application.

**Prerequisites**
None.

Below you will find excerpts from events related to this course:

**Advanced Lab Development of Sociotechnical Information Systems (Bachelor)**
2512400, SS 2022, 3 SWS, Language: German/English, [Open in study portal](#)

**Development of Sociotechnical Information Systems (Master)**
2512401, SS 2022, 3 SWS, Language: German/English, [Open in study portal](#)

**Content**
The aim of the lab is to get to know the development of socio-technical information systems in different application areas. In the event framework, you should develop a suitable solution strategy for your problem alone or in group work, collect requirements, and implement a software artifact based on it (for example, web platform, mobile apps, desktop application). Another focus of the lab is on the subsequent quality assurance and documentation of the implemented software artifact.

Registration information will be announced on the course page.
Course: Software Quality Management [T-WIWI-102895]

8.247 Course: Software Quality Management [T-WIWI-102895]

**Responsible:** Prof. Dr. Andreas Oberweis  
**Organisation:** KIT Department of Economics and Management  
**Part of:** M-WIWI-101472 - Informatics

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**Events**

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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

**Competence Certificate**
The assessment of this course is a written examination (60 min) according to §4 (2), 1 of the examination regulation in the first week after lecture period.

**Prerequisites**
None

Below you will find excerpts from events related to this course:

**Software Quality Management**

2511208, SS 2022, 2 SWS, Language: German, Open in study portal

**Content**
This lecture imparts fundamentals of active software quality management (quality planning, quality testing, quality control, quality assurance) and illustrates them with concrete examples, as currently applied in industrial software development. Keywords of the lecture content are: software and software quality, process models, software process quality, ISO 9000-3, CMM(I), BOOTSTRAP, SPICE, software tests.

**Learning objectives:**
Students

- explain the relevant quality models,
- apply methods to evaluate the software quality and evaluate the results,
- know the mail models of software certification, compare and evaluate these models,
- write scientific theses in the area of software quality management and find own solutions for given problems.

**Recommendations:**
Programming knowledge in Java and basic knowledge of computer science are expected.

**Workload:**
- Lecture 30h
- Exercise 15h
- Preparation of lecture 24h
- Preparation of exercises 25h
- Exam preparation 40h
- Exam 1h

**Literature**
- Peter Liggesmeyer: Software-Qualität, Testen, Analysieren und Verifizieren von Software. Spektrum Akademischer Verlag 2002
- Mauro Pezzè, Michal Young: Software testen und analysieren. Oldenbourg Verlag 2009

Weitere Literatur wird in der Vorlesung bekanntgegeben.
### 8.248 Course: Space and Time Discretization of Nonlinear Wave Equations [T-MATH-112120]

**Responsible:** Prof. Dr. Marlis Hochbruck  
**Organisation:** KIT Department of Mathematics  
**Part of:** M-MATH-105966 - Space and Time Discretization of Nonlinear Wave Equations

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**Prerequisites**: none
**8.249 Course: Spatial Economics [T-WIWI-103107]**

**Responsible:** Prof. Dr. Ingrid Ott  
**Organisation:** KIT Department of Economics and Management  
**Part of:** M-WIWI-101496 - Growth and Agglomeration

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**Events**

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<td>Spatial Economics</td>
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<td>2561261</td>
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<td>Practice / 🗣</td>
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**Competence Certificate**  
Depending on further pandemic developments, the examination will be offered either as an open-book examination, or as a 60-minute written examination.

**Prerequisites**  
None

**Recommendation**  
Basic knowledge of micro- and macroeconomics is assumed, as taught in the courses "Economics I" [2600012], and "Economics II" [2600014]. In addition, an interest in quantitative-mathematical modeling is required. The attendance of the course "Introduction to economic policy" [2560280] is recommended.

**Annotation**  
Due to the research semester of Prof. Dr. Ingrid Ott, the course will not be offered in the winter semester 2021/22. The exam will take place. Preparation materials can be found in ILIAS.

*Below you will find excerpts from events related to this course:*

**Spatial Economics**  
2561260, WS 22/23, 2 SWS, Language: English, [Open in study portal](#)  
Lecture (V)  
On-Site
Content
The course covers the following topics:

- Geography, trade and development
- Geography and economic theory
- Core models of economic geography and empirical evidence
- Agglomeration, home market effect, and spatial wages
- Applications and extensions

Learning objectives:
The student

- analyses how spatial distribution of economic activity is determined.
- uses quantitative methods within the context of economic models.
- has basic knowledge of formal-analytic methods.
- understands the link between economic theory and its empirical applications.
- understands to what extent concentration processes result from agglomeration and dispersion forces.
- is able to determine theory based policy recommendations.

Recommendations:
Basic knowledge of micro- and macroeconomics is assumed, as taught in the courses Economics I [2600012], and Economics II [2600014]. An interest in mathematical modeling is advantageous.

Workload:
The total workload for this course is approximately 135 hours.

- Classes: ca. 30 h
- Self-study: ca. 45 h
- Exam and exam preparation: ca. 60 h

Assessment:
The assessment consists of a written exam (60 minutes) (following §4(2), 1 of the examination regulation).

Literature

Weitere Literatur wird in der Vorlesung bekanntgegeben.
(Further literature will be announced in the lecture.)
8.250 Course: Spatial Stochastics [T-MATH-105867]

**Responsible:** Prof. Dr. Daniel Hug  
Prof. Dr. Günter Last  
PD Dr. Steffen Winter

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-102903 - Spatial Stochastics

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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ❌ Cancelled

**Prerequisites**

none
8.251 Course: Special Functions and Applications in Potential Theory [T-MATH-102274]

**Responsible:** Prof. Dr. Andreas Kirsch  
**Organisation:** KIT Department of Mathematics  
**Part of:** M-MATH-101335 - Special Functions and Applications in Potential Theory

- **Type:** Oral examination  
- **Credits:** 5  
- **Grading scale:** Grade to a third  
- **Version:** 1

**Prerequisites**  
None
8.252 Course: Special Topics in Information Systems [T-WIWI-109940]

Responsible: Prof. Dr. Christof Weinhardt
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-103720 - eEnergy: Markets, Services and Systems

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<td>4,5</td>
<td>Grade to a third</td>
<td>Each term</td>
<td>2</td>
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**Competence Certificate**
The assessment of this course is in form of a written documentation, a presentation of the outcome of the conducted practical components and an active participation in class.
Please take into account that, beside the written documentation, also a practical component (such as a survey or an implementation of an application) is part of the course. Please examine the course description for the particular tasks.
The overall grade is composed as follows:
A total of 60 points can be achieved, of which
- A maximum of 30 points for the written documentation
- A maximum of 30 points for the practical component

In order to pass the success control, at least 15 points (written documentation / practical component) must be achieved.

**Prerequisites**
see below

**Recommendation**
None

**Annotation**
All the practical seminars offered at the chair of Prof. Dr. Weinhardt can be chosen in the Special Topics in Information Systems course. The current topics of the practical seminars are available at the following homepage: www.iism.kit.edu/im/lehre.
The Special Topics Information Systems is equivalent to the practical seminar, as it was only offered for the major in "Information Systems" so far. With this course students majoring in "Industrial Engineering and Management" and "Economics Engineering" also have the chance of getting practical experience and enhance their scientific capabilities.
The Special Topics Information Systems can be chosen instead of a regular lecture (see module description). Please take into account, that this course can only be accounted once per module.
8.253 Course: Special Topics of Numerical Linear Algebra [T-MATH-105891]

**Responsible:**
PD Dr. Volker Grimm  
Prof. Dr. Marlis Hochbruck  
PD Dr. Markus Neher

**Organisation:**
KIT Department of Mathematics

**Part of:**
M-MATH-102920 - Special Topics of Numerical Linear Algebra

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<td>Grade to a third</td>
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**Prerequisites**
none
8 COURSES

8.254 Course: Spectral Theory - Exam [T-MATH-103414]

Responsible: Prof. Dr. Dorothee Frey
PD Dr. Gerd Herzog
apl. Prof. Dr. Peer Kunstmann
Dr. Christoph Schmoeger
Prof. Dr. Roland Schnaubelt

Organisation: KIT Department of Mathematics
Part of: M-MATH-101768 - Spectral Theory

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Events

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<td>Spectral Theory</td>
<td>4 SWS</td>
<td>Plum</td>
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<tr>
<td>ST 2022</td>
<td>0163710</td>
<td>Übung zu 0163700</td>
<td>2 SWS</td>
<td>Plum</td>
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</table>

Below you will find excerpts from events related to this course:

V Spectral Theory 0163700, SS 2022, 4 SWS, Language: German, Open in study portal

Literature

- J.B. Conway: A Course in Functional Analysis.
- D. Werner: Funktionalanalysis.
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**Responsible:** Stephan Klaus
Prof. Dr. Wilderich Tuschmann

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-102958 - Spin Manifolds, Alpha Invariant and Positive Scalar Curvature
8.256 Course: Splitting Methods for Evolution Equations [T-MATH-110805]

**Responsible:** Prof. Dr. Tobias Jahnke  
**Organisation:** KIT Department of Mathematics  
**Part of:** M-MATH-105325 - Splitting Methods for Evolution Equations

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<td>Lecture</td>
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**Prerequisites:** none
Course: Statistical Learning [T-MATH-111726]

**Responsible:** Prof. Dr. Mathias Trabs

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-105840 - Statistical Learning

### Type
Oral examination

### Credits
8

### Grading scale
Grade to a third

### Version
1

---

**Competence Certificate**
The module will be completed with an oral exam (approx. 30 min).

**Prerequisites**
none

**Recommendation**
The module “Introduction to Stochastics” is recommended. The module “Probability theory” is preferable.
### 8.258 Course: Statistical Modeling of Generalized Regression Models [T-WIWI-103065]

<table>
<thead>
<tr>
<th>Responsible</th>
<th>apl. Prof. Dr. Wolf-Dieter Heller</th>
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<tbody>
<tr>
<td>Organisation</td>
<td>KIT Department of Economics and Management</td>
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| Part of              | M-WIWI-101638 - Econometrics and Statistics I  
M-WIWI-101639 - Econometrics and Statistics II |

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#### Competence Certificate
The assessment of this course is a written examination (60 min) according to §4(2), 1 of the examination regulation.

#### Prerequisites
The course T-MATH-105870 "Generalized Regression Models" must not have been selected.

#### Recommendation
Knowledge of the contents covered by the course "Economics III: Introduction in Econometrics" [2520016] is recommended.

Below you will find excerpts from events related to this course:

#### Statistical Modeling of Generalized Regression Models
2521350, WS 22/23, 2 SWS, [Open in study portal](#)

**Lecture (V)**

### Content

#### Learning objectives:
The student has profound knowledge of generalized regression models.

#### Requirements:
Knowledge of the contents covered by the course "Economics III: Introduction in Econometrics" [2520016].

### Workload:
Total workload for 4.5 CP: approx. 135 hours
- Attendance: 30 hours
- Preparation and follow-up: 65 hours
8.259 Course: Steins Method with Applications in Statistics [T-MATH-111187]

**Responsible:**  
Dr. rer. nat. Bruno Ebner  
Prof. Dr. Daniel Hug

**Organisation:**  
KIT Department of Mathematics

**Part of:**  
M-MATH-105579 - Steins Method with Applications in Statistics

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</table>

**Prerequisites**

none
8.260 Course: Stochastic Calculus and Finance [T-WIWI-103129]

Responsible: Dr. Mher Safarian
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101639 - Econometrics and Statistics II

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Events

| WT 22/23 | 2521331 | Stochastic Calculus and Finance | 2 SWS | Lecture | Safarian |

Competence Certificate
The assessment of this course consists of a written examination (§4(2), 1 SPOs, 180 min.).

Prerequisites
None

Annotation
For more information see http://statistik.econ.kit.edu/

Below you will find excerpts from events related to this course:

Stochastic Calculus and Finance
2521331, WS 22/23, 2 SWS, Language: English, Open in study portal

Lecture (V)

Content
Learning objectives:
After successful completion of the course students will be familiar with many common methods of pricing and portfolio models in finance. Emphasis will be put on both finance and the theory behind it.

Content:
The course will provide rigorous yet focused training in stochastic calculus and mathematical finance. Topics to be covered:


Workload:
Total workload for 4.5 CP: approx. 135 hours
Attendance: 30 hours
Preparation and follow-up: 65 hours

Organizational issues
Blockveranstaltung, Termine werden über Ilias bekannt gegeben

Literature
- Stochastic Finance: An Introduction in Discrete Time by H. Föllmer, A. Schied, de Gruyter, 2011
- Introduction to Stochastic Calculus Applied to Finance by D. Lamberton, B. Lapeyre, Chapman&Hall, 1996
### 8.261 Course: Stochastic Control [T-MATH-105871]

**Responsible:** Prof. Dr. Nicole Bäuerle  
**Organisation:** KIT Department of Mathematics  
**Part of:** M-MATH-102908 - Stochastic Control

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**Prerequisites**  
none
8.262 Course: Stochastic Differential Equations [T-MATH-105852]

**Responsible:** Prof. Dr. Dorothee Frey
Prof. Dr. Roland Schnaubelt

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-102881 - Stochastic Differential Equations

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**Events**

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<td>Introduction to Stochastic Differential Equations</td>
<td>2</td>
<td>Lecture</td>
<td>Janák</td>
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<td>WT 22/23</td>
<td>0105510</td>
<td>Tutorial for 0105500 (Introduction to Stochastic Differential Equations)</td>
<td>1</td>
<td>Practice</td>
<td>Janák</td>
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</table>
8.263 Course: Stochastic Evolution Equations [T-MATH-105910]

**Responsible:** Prof. Dr. Lutz Weis

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-102942 - Stochastic Evolution Equations

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</table>

**Prerequisites**

none
8.264 Course: Stochastic Geometry [T-MATH-105840]

**Responsible:** Prof. Dr. Daniel Hug  
Prof. Dr. Günter Last  
PD Dr. Steffen Winter

**Organisation:** KIT Department of Mathematics  
**Part of:** M-MATH-102865 - Stochastic Geometry

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**Events**

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<td>Lecture</td>
<td>Winter</td>
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<td>Tutorial for 0152600 (Stochastic Geometry)</td>
<td>2</td>
<td>Practice</td>
<td>Winter</td>
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8.265 Course: Stochastic Simulation [T-MATH-112242]

Responsible: TT-Prof. Dr. Sebastian Krumscheid
Organisation: KIT Department of Mathematics
Part of: M-MATH-106053 - Stochastic Simulation

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<td>Grade to a third</td>
<td>Each winter term</td>
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Competence Certificate
oral exam of ca. 30 min

Prerequisites
none
8.266 Course: Strategic Finance and Technology Change [T-WIWI-110511]

**Responsible:** Prof. Dr. Martin Ruckes

**Organisation:** KIT Department of Economics and Management

**Part of:**
- M-WIWI-101480 - Finance 3
- M-WIWI-101483 - Finance 2

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<td>Grade to a third</td>
<td>Each summer term</td>
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**Competence Certificate**
The assessment consists of a written exam (60 min.) according to § 4 paragraph 2 Nr. 1 of the examination regulation. The exam is offered each semester. If there are only a small number of participants registered for the exam, we reserve the right to hold an oral examination instead of a written one.

**Prerequisites**
None

**Recommendation**
Attending the lecture "Financial Management" is strongly recommended.
8.267 Course: Strategy and Management Theory: Developments and “Classics” [T-WIWI-106190]

**Responsible:** Prof. Dr. Hagen Lindstädt

**Organisation:** KIT Department of Economics and Management

**Part of:** M-WIWI-103119 - Advanced Topics in Strategy and Management

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**Events**

| WT 22/23 | 2577921 | Strategy and Management Theory: Developments and “Classics” (Master) | 2 SWS | Seminar / On-Site | Lindstädt |

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

**Competence Certificate**
The control of success according to § 4(2), 3 SPO takes place by writing a scientific work and a presentation of the results of the work in the context of a conclusion meeting. Details on the design of the performance review will be announced during the lecture.

**Prerequisites**
None

**Recommendation**
Basic knowledge as conveyed in the bachelor module „Strategy and Organization” is recommended.

**Annotation**
This course is admission restricted. If you were already admitted to another course in the module ”Advanced Topics in Strategy and Management” the participation at this course will be guaranteed.

The course is planned to be held for the first time in the winter term 2017/18.

Below you will find excerpts from events related to this course:

**Strategy and Management Theory: Developments and "Classics" (Master)**
2577921, WS 22/23, 2 SWS, Language: German, Open in study portal

 Seminar (S)
On-Site
Content
In this lecture, students discuss and evaluate models in the field of strategic management with a focus on applicability and theory based limitations. Critical examination of current research results will be a substantial part of this course.

Learning Objectives:
Students
- are able to explain and evaluate theoretical approaches and models in the field of strategic management and can illustrate them by tangible examples
- learn to express their position in structured discussions

Recommendations:
Basic knowledge as conveyed in the bachelor module “Strategy and Organization” is recommended.

Workload:
The total workload for this course is approximately 90 hours.
Lecture: 15 hours
Preparation of lecture: 75 hours
Exam preparation: n/a

Assessment:
The control of success according to § 4(2), 3 SPO takes place by writing a scientific work and a presentation of the results of the work in the context of a final meeting. Details on the design of the success control will be announced during the lecture.

Note:
This course is admission restricted. If you were already admitted to another course in the module “Advanced Topics in Strategy and Management” the participation at this course will be guaranteed. Further information on the application process can be found on the IBU website.

The examinations are offered at least every second semester, so that the entire module can be completed in two semesters.

Organizational issues
siehe Homepage
### 8.268 Course: Structural Graph Theory [T-MATH-111004]

**Responsible:** Prof. Dr. Maria Aksenovich  
**Organisation:** KIT Department of Mathematics  
**Part of:** M-MATH-105463 - Structural Graph Theory

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<td>Grade to a third</td>
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**Prerequisites**  
none
## 8.269 Course: Supplement Enterprise Information Systems [T-WIWI-110346]

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<tr>
<th>Responsible</th>
<th>Prof. Dr. Andreas Oberweis</th>
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<td>Organisation</td>
<td>KIT Department of Economics and Management</td>
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<td>Part of</td>
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### Competence Certificate

The assessment of this course is a written or (if necessary) oral examination.

### Prerequisites

None

### Annotation

This course can be used in particular for the acceptance of external courses whose content is in the broader area of applied informatics, but is not equivalent to another course of this topic.
8.270 Course: Supplement Software- and Systemsengineering [T-WIWI-110372]

**Responsible:** Prof. Dr. Andreas Oberweis

**Organisation:** KIT Department of Economics and Management

**Part of:** M-WIWI-101472 - Informatics

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**Competence Certificate**
The assessment of this course is a written or (if necessary) oral examination.

**Prerequisites**
None

**Annotation**
This course can be used in particular for the acceptance of external courses whose content is in the broader area of software and systems engineering, but cannot be assigned to another course of this topic.
8.271 Course: Tactical and Operational Supply Chain Management [T-WIWI-102714]

**Responsible:** Prof. Dr. Stefan Nickel  
**Organisation:** KIT Department of Economics and Management  
**Part of:** M-WIWI-101413 - Applications of Operations Research

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**Competence Certificate**
Depending on further pandemic developments, the exam will be offered either as an open-book exam, or as a written exam (60 min).
The exam takes place in every semester.
Prerequisite for admission to examination is the successful completion of the online assessments.

**Prerequisites**
Prerequisite for admission to examination is the successful completion of the online assessments.

**Recommendation**
None

**Annotation**
The lecture is held in every summer term. The planned lectures and courses for the next three years are announced online.

Below you will find excerpts from events related to this course:

**Tactical and operational SCM**
2550486, SS 2022, 3 SWS, Language: German, Open in study portal

**Content**
The planning of material transport is an essential element of Supply Chain Management. By linking transport connections across different facilities, the material source (production plant) is connected with the material sink (customer). The general supply task can be formulated as follows (cf. Gudehus): For given material flows or shipments, choose the optimal (in terms of minimal costs) distribution and transportation chain from the set of possible logistics chains, which asserts the compliance of delivery times and further constraints. The main goal of the inventory management is the optimal determination of order quantities in terms of minimization of fixed and variable costs subject to resource constraints, supply availability and service level requirements. Similarly, the problem of lot sizing in production considers the determination of the optimal amount of products to be produced in a time slot. The course includes an introduction to basic terms and definitions of Supply Chain Management and a presentation of fundamental quantitative planning models for distribution, vehicle routing, inventory management and lot sizing. Furthermore, case studies from practice will be discussed in detail.

**Literature**
Weiterführende Literatur

- Domschke: Logistik; Transporte, 5. Auflage, Oldenbourg, 2005
- Domschke: Logistik; Rundreisen und Touren, 4. Auflage, Oldenbourg, 1997
- Ghiani, Laporte, Musmanno: Introduction to Logistics Systems Planning and Control, Wiley, 2004
- Gudehus: Logistik, 3. Auflage, Springer, 2005
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**8.272 Course: The Riemann Zeta Function [T-MATH-105934]**

**Responsible:** Dr. Fabian Januszewski  
**Organisation:** KIT Department of Mathematics  
**Part of:** M-MATH-102960 - The Riemann Zeta Function
8.273 Course: Time Series Analysis [T-MATH-105874]

**Responsible:**
- Dr. rer. nat. Bruno Ebner
- Prof. Dr. Vicky Fasen-Hartmann
- Prof. Dr. Tilmann Gneiting
- PD Dr. Bernhard Klar
- Prof. Dr. Mathias Trabs

**Organisation:**
- KIT Department of Mathematics

**Part of:**
- M-MATH-102911 - Time Series Analysis

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**Events**

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<td>0161100</td>
<td>Time Series Analysis</td>
<td>2</td>
<td>Lecture</td>
<td>Schulz, Gneiting</td>
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<td>ST 2022</td>
<td>0161110</td>
<td>Tutorial for 0161100 (Time Series Analysis)</td>
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<td>Practice</td>
<td>Gneiting</td>
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</table>
Course: Topics in Experimental Economics [T-WIWI-102863]

**Competence Certificate**
The assessment consists of a written exam (following §4(2), 1 of the examination regulation).

**Prerequisites**
None

**Recommendation**
Basic knowledge of Experimental Economics is assumed. Therefore, it is strongly recommended to attend the course Experimental Economics beforehand.

**Annotation**
The course is offered in summer 2020 for the next time, not in summer 2018.
8.275 Course: Topics in Stochastic Optimization [T-WIWI-112109]

**Responsible:** Prof. Dr. Steffen Rebennack

**Organisation:** KIT Department of Economics and Management

**Part of:**
- M-WIWI-101473 - Mathematical Programming
- M-WIWI-101637 - Analytics and Statistics
- M-WIWI-102832 - Operations Research in Supply Chain Management
- M-WIWI-103289 - Stochastic Optimization

<table>
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<td>Grade to a third</td>
<td>Each winter term</td>
<td>1</td>
</tr>
</tbody>
</table>

**Competence Certificate**

Students will be given problem sets on which they work in groups. The problem sets will involve the implementation of the models presented in the course, and exploring features of these models. The groups will present their findings in front of the class. The grading will be based on the presentation.

**Recommendation**

A solid understanding of Stochastic Optimization and/or Optimization under Uncertainty as well as optimization in general is highly recommended, since we will heavily build upon basics of these areas.
8.276 Course: Topological Data Analysis [T-MATH-111031]

**Responsible:** Prof. Dr. Tobias Hartnick
Prof. Dr. Roman Sauer

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-105487 - Topological Data Analysis

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**Prerequisites**
none
8.277 Course: Topological Genomics [T-MATH-112281]

| Responsible: | Dr. Andreas Ott |
| Organisation: | KIT Department of Mathematics |
| Part of: | M-MATH-106064 - Topological Genomics |

<table>
<thead>
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</table>

**Competence Certificate**
oral exam of ca. 20 min

**Prerequisites**
none
8.278 Course: Topological Groups [T-MATH-110802]

**Responsible:** Dr. rer. nat. Rafael Dahmen
Prof. Dr. Wilderich Tuschmann

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-105323 - Topological Groups

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</table>

**Prerequisites**

none
# 8.279 Course: Translation Surfaces [T-MATH-112128]

**Responsible:** Prof. Dr. Frank Herrlich  
**Organisation:** KIT Department of Mathematics  
**Part of:** M-MATH-105973 - Translation Surfaces  

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**Prerequisites**
none
T 8.280 Course: Traveling Waves [T-MATH-105897]

Responsible: Dr. Björn de Rijk  
Prof. Dr. Wolfgang Reichel

Organisation: KIT Department of Mathematics

Part of: M-MATH-102927 - Traveling Waves

Type: Oral examination  
Credits: 6  
Grading scale: Grade to a third  
Version: 2

Competence Certificate
The module examination takes place in form of an oral exam of about 30 minutes. Please see under "Modulnote" for more information about the bonus regulation.

Prerequisites
none

Recommendation
The following background is strongly recommended: Analysis 1-4.
8.281 Course: Uncertainty Quantification [T-MATH-108399]

**Responsible:** Prof. Dr. Martin Frank  
**Organisation:** KIT Department of Mathematics  
**Part of:** M-MATH-104054 - Uncertainty Quantification

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**Events**

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<th>0164400</th>
<th>Uncertainty Quantification</th>
<th>2 SWS</th>
<th>Lecture / Online</th>
<th>Frank</th>
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<td>ST 2022</td>
<td>0164410</td>
<td>Tutorial for 0164400 (Uncertainty quantification)</td>
<td>1 SWS</td>
<td>Practice / On-Site</td>
<td>Frank</td>
</tr>
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Legend: 🧩 Online, 🕒 Blended (On-Site/Online), 🔄 On-Site, ✗ Cancelled

**Prerequisites**

none

Below you will find excerpts from events related to this course:

### Uncertainty Quantification

0164400, SS 2022, 2 SWS, Language: English, [Open in study portal](#)

**Lecture (V) Blended (On-Site/Online)**

**Content**

"There are known knowns; there are things we know we know. We also know there are known unknowns; that is to say we know there are some things we do not know. But there are also unknown unknowns – there are things we do not know we don’t know." (Donald Rumsfeld)

In this class, we learn to deal with the known unknowns, a field called Uncertainty Quantification (UQ). We particularly focus on the propagation of uncertainties (e.g. unknown data, unknown initial or boundary conditions) through models (mostly differential equations) and leave other important questions of UQ (especially inference) aside. Given uncertain input, how uncertain is the output? The uncertainties are modeled as random variables, and thus the solutions of the equations become random variables themselves.

Thus we summarize the necessary foundations of probability theory, with a focus on modeling correlated and uncorrelated random vectors. Further, we will see that every uncertain parameter becomes a dimension in the problem. We are thus quickly led to high-dimensional problems. Standard numerical methods suffer from the so-called curse of dimensionality, i.e. to reach a certain accuracy one needs excessively many model evaluations. Thus we study the fundamentals of approximation theory.

The first part of the course ("how to do it") gives an overview on techniques that are used. Among these are:

- Sensitivity analysis
- Monte-Carlo methods
- Spectral expansions
- Stochastic Galerkin method
- Collocation methods, sparse grids

The second part of the course ("why to do it like this") deals with the theoretical foundations of these methods. The so-called "curse of dimensionality" leads us to questions from approximation theory. We look back at the very standard numerical algorithms of interpolation and quadrature, and ask how they perform in many dimensions.

**Organizational issues**

The course will be offered in flipped classroom format. This means that the lectures will be made available as videos; students will also have lecture notes. We meet in presence for the tutorials, and there will also be office hours. The first meeting will be on April 25 in presence.
Literature

8.282 Course: Valuation [T-WIWI-102621]

**Responsible:** Prof. Dr. Martin Ruckes

**Organisation:** KIT Department of Economics and Management

**Part of:**
- M-WIWI-101480 - Finance 3
- M-WIWI-101482 - Finance 1
- M-WIWI-101483 - Finance 2

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<td>Each winter term</td>
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**Events**

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<th>Duration</th>
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<td>Valuation</td>
<td>2</td>
<td>Lecture</td>
<td>Online</td>
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<td>Übungen zu Valuation</td>
<td>1</td>
<td>Practice</td>
<td>Online</td>
<td>Ruckes, Luedecke</td>
</tr>
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</table>

Legend: 🛥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

**Competence Certificate**
See German version.

**Prerequisites**
None

**Recommendation**
None

*Below you will find excerpts from events related to this course:*

**Valuation**

<table>
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**Literature**

**Weiterführende Literatur**

Course: Variational Methods [T-MATH-110302]

**Responsible:** Prof. Dr. Wolfgang Reichel

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-105093 - Variational Methods

<table>
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<tr>
<td>Oral examination</td>
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<td>Grade to a third</td>
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Economathematics M.Sc.
Module Handbook as of 06/09/2022
### 8.284 Course: Wave Propagation in Periodic Waveguides [T-MATH-111002]

**Responsible:** Prof. Dr. Roland Griesmaier  
**Organisation:** KIT Department of Mathematics  
**Part of:** M-MATH-105462 - Wave Propagation in Periodic Waveguides

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**Prerequisites**  
none
8.285 Course: Wavelets [T-MATH-105838]

**Responsible:** Prof. Dr. Andreas Rieder

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-102895 - Wavelets

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<td>Grade to a third</td>
<td>Irregular</td>
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</table>

**Competence Certificate**
Mündliche Prüfung im Umfang von ca. 30 Minuten.

**Prerequisites**
none

Responsible: TT-Prof. Dr. Julian Thimme
Organisation: KIT Department of Economics and Management
Part of:
  - M-WIWI-101480 - Finance 3
  - M-WIWI-101483 - Finance 2

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<td>Once</td>
<td>1</td>
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Competence Certificate
Non exam assessment according to § 4 paragraph 3 of the examination regulation. (Anmerkung: gilt nur für SPO 2015). The grade is made up as follows: 50% result of the project (R-code), 50% presentation of the project.

Prerequisites
None

Recommendation
The content of the bachelor course Investments is assumed to be known and necessary to follow the course.
8 COURSES
Course: Workshop Business Wargaming – Analyzing Strategic Interactions [T-WIWI-106189]

8.287 Course: Workshop Business Wargaming – Analyzing Strategic Interactions [T-WIWI-106189]

<table>
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<tr>
<th>Responsible</th>
<th>Prof. Dr. Hagen Lindstädt</th>
</tr>
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<tr>
<td>Organisation</td>
<td>KIT Department of Economics and Management</td>
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<tr>
<td>Part of</td>
<td>M-WIWI-103119 - Advanced Topics in Strategy and Management</td>
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<td>ST 2022</td>
<td>Workshop Business Wargaming - Analyse strategischer Interaktionen (Master)</td>
<td>2 SWS</td>
<td>Seminar / 🗣</td>
<td>Lindstädt</td>
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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, x Cancelled

Competence Certificate
In this course, real conflict situations are simulated and analyzed using various methods from business wargaming. Details on the design of the performance review will be announced during the lecture.

Prerequisites
None

Recommendation
Basic knowledge as conveyed in the bachelor module „Strategy and Organization“ is recommended.

Annotation
This course is admission restricted. If you were already admitted to another course in the module “Advanced Topics in Strategy and Management” the participation at this course will be guaranteed.

The course is planned to be held for the first time in the summer term 2018.

Below you will find excerpts from events related to this course:

Workshop Business Wargaming - Analyse strategischer Interaktionen (Master)
2577922, SS 2022, 2 SWS, Language: German, Open in study portal
Content
In this lecture, current economic trends will be discussed from a perspective of competition analysis and corporate strategies. Using appropriate frameworks, the students will be able to analyze collectively selected case studies and derive business strategies.

Learning Objectives:
Students

- are able to analyze business strategies and derive recommendations for the management
- learn to express their position through compelling reasoning in structured discussions

Recommendations:
Basic knowledge as conveyed in the bachelor module "Strategy and Organization" is recommended.

Workload:
The total workload for this course is approximately 90 hours.
Lecture: 15 hours
Preparation of lecture: 75 hours
Exam preparation: n/a

Assessment:
In this course, real conflict situations are simulated and analyzed using various methods from business wargaming. Details on the design of the success control will be announced during the lecture.

Note:
This course is admission restricted. If you were already admitted to another course in the module "Advanced Topics in Strategy and Management" the participation at this course will be guaranteed. Further information on the application process can be found on the IBU website.
The examinations are offered at least every second semester, so that the entire module can be completed in two semesters.
8.288 Course: Workshop Current Topics in Strategy and Management [T-WIWI-106188]

**Responsible:** Prof. Dr. Hagen Lindstädt  
**Organisation:** KIT Department of Economics and Management  
**Part of:** M-WIWI-103119 - Advanced Topics in Strategy and Management

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<td>Seminar / 🗣️</td>
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</table>

### Competence Certificate
The evaluation of the performance takes place through the active participation in the discussion rounds; an appropriate preparation is expressed here and a clear understanding of the topic and framework becomes recognizable. Further details on the design of the performance review will be announced during the lecture.

### Prerequisites
None

### Recommendation
Basic knowledge as conveyed in the bachelor module „Strategy and Organization“ is recommended.

### Annotation
This course is admission restricted. If you were already admitted to another course in the module “Advanced Topics in Strategy and Management” the participation at this course will be guaranteed.

The course is planned to be held for the first time in the winter term 2017/18.

Below you will find excerpts from events related to this course:

**Workshop aktuelle Themen Strategie und Management (Master)**

2577923, SS 2022, 2 SWS, Language: German, Open in study portal
Content
In this lecture, students discuss and evaluate models in the field of strategic management with a focus on applicability and theory based limitations. Critical examination of current research results will be a substantial part of this course.

Learning Objectives:
Students
- are able to explain and evaluate theoretical approaches and models in the field of strategic management and can illustrate them by tangible examples
- learn to express their position in structured discussions

Recommendations:
Basic knowledge as conveyed in the bachelor module "Strategy and Organization" is recommended.

Workload:
The total workload for this course is approximately 90 hours.
Lecture: 15 hours
Preparation of lecture: 75 hours
Exam preparation: n/a

Assessment:
The assessment of performance is made through active participation in the discussion rounds; adequate preparation is expressed here and a clear understanding of the topic and framework becomes evident. Further details on the design of the success control will be announced during the lecture.

Note:
This course is admission restricted. If you were already admitted to another course in the module "Advanced Topics in Strategy and Management" the participation at this course will be guaranteed. Further information on the application process can be found on the IBU website.

The examinations are offered at least every second semester, so that the entire module can be completed in two semesters.

Workshop aktuelle Themen Strategie und Management (Master)
2577923, WS 22/23, 2 SWS, Language: German, Open in study portal

Content
In this lecture, students discuss and evaluate models in the field of strategic management with a focus on applicability and theory based limitations. Critical examination of current research results will be a substantial part of this course.

Learning Objectives:
Students
- are able to explain and evaluate theoretical approaches and models in the field of strategic management and can illustrate them by tangible examples
- learn to express their position in structured discussions

Recommendations:
Basic knowledge as conveyed in the bachelor module "Strategy and Organization" is recommended.

Workload:
The total workload for this course is approximately 90 hours.
Lecture: 15 hours
Preparation of lecture: 75 hours
Exam preparation: n/a

Assessment:
The assessment of performance is made through active participation in the discussion rounds; adequate preparation is expressed here and a clear understanding of the topic and framework becomes evident. Further details on the design of the success control will be announced during the lecture.

Note:
This course is admission restricted. If you were already admitted to another course in the module "Advanced Topics in Strategy and Management" the participation at this course will be guaranteed. Further information on the application process can be found on the IBU website.

The examinations are offered at least every second semester, so that the entire module can be completed in two semesters.