Module Handbook
Economathematics M.Sc.
SPO 2016
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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 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.
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 over-arching 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 (Seminar 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>Finance - Risk Management - Managerial Economics</td>
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### Election block: Analysis or Applied and Numerical Mathematics, Optimization (at least 8 credits)

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### 7 Modules

#### 7.1 Module: Adaptive Finite Element 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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**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

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**Prerequisites**

none
7 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

### Credits
9

### Grading scale
Grade to a tenth

### Recurrence
Each term

### Duration
1 term

### Language
English

### Level
4

### Version
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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".

**Competence Goal**
Students with good technological knowledge and an affinity for IT applications solve a data science problem using modern machine learning methods. Students learn to organize themselves in a team in a goal-oriented manner and to bring an extensive software project in the field of data science and machine learning to success. In addition, students deepen their data science and machine learning skills. Students of this module are particularly well prepared for management tasks in various data science and machine learning projects.

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

**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.

**Recommendation**
None

**Workload**
Total effort for 9 credit points: approx. 270 hours. The total workload for this module is approx. 270 hours (9 credit points). The total number of hours results from the effort for attending the internship events and the independent creation of the software solution, as well as the examination times and the time required to achieve the learning objectives of the module for an average student for an average performance.
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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**Election block: Compulsory Elective Courses (9 credits)**

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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.

**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

**Prerequisites**

None

**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.

**Recommendation**

None

**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.
Module: Algebra [M-MATH-101315]

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-102253 | Algebra | 8 CR | Herrlich, Kühnlein |

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

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Mandatory

| T-MATH-103340 | Algebraic Geometry | 8 CR | Herrlich, Kühlein |

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### 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**

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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

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Mandatory

| T-MATH-105915 | Algebraic Topology | 8 CR | Kammeyer, 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**

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<th>Duration</th>
<th>Level</th>
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<td>1 term</td>
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</table>

**Mandatory**

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

**Prerequisites**

none
7.10 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**

<table>
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**Mandatory**

| T-MATH-111272 | Analytical and Numerical Homogenization | 6 CR | Hochbruck |

**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.

**Prerequisites**

none

**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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<th>Credits</th>
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Mandatory

T-WIWI-103123 Advanced Statistics 4,5 CR Grothe

Election block: Supplementary Courses (between 4,5 and 5 credits)

T-WIWI-106341 Machine Learning 2 – Advanced Methods 4,5 CR Zöllner
T-WIWI-111247 Mathematics for High Dimensional Statistics 4,5 CR Grothe
T-WIWI-103124 Multivariate Statistical Methods 4,5 CR Grothe

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.

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.

Prerequisites

The course “Advanced Statistics” is compulsory.

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.
### 7.12 Module: Applications of Operations Research [M-WIWI-101413]

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

<table>
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**Election block: Compulsory Elective Courses (between 1 and 2 items)**

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<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>
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**Election block: Supplementary Courses (at most 1 item)**

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<td>Global Optimization I</td>
<td>4,5 CR</td>
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<td>T-WIWI-106199</td>
<td>Modeling and OR-Software: Introduction</td>
<td>4,5 CR</td>
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<td>T-WIWI-106545</td>
<td>Optimization Under Uncertainty</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.

**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.

**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.

**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.

**Recommendation**

The courses Introduction to Operations Research I and II are helpful.
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.
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

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Mandatory

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

Prerequisites
None
### Module: Asymptotic Stochastics [M-MATH-102902]

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

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**Prerequisites**

none
7.15 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
# 7.16 Module: Bott Periodicity [M-MATH-104349]

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

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<td>5 CR</td>
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**Prerequisites**

None
### 7.17 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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<th>Frey, Hundertmark, Lamm, Plum, Reichel, Schnaubelt</th>
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</table>
### 7.18 Module: Boundary Element Methods [M-MATH-103540]

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

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**Prerequisites**  
None
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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**Prerequisites**

none
7.20 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**

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**Mandatory**

| T-MATH-105832 | Classical Methods for Partial Differential Equations | 8 CR | Frey, Hundertmark, Lamm, Plum, Reichel, Schnaubelt |
## 7.21 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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**Election block: Compulsory Elective Courses ()**

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

**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.

**Prerequisites**

None

**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.
### 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).

### 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.

### Prerequisites
none

### 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.

### Annotation
- Regular cycle: every 2nd year, summer semester
- Course is held in English
# 7.23 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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### Mandatory

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<td>Commutative Algebra</td>
<td>8 CR</td>
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</table>

**Prerequisites**

None
7.24 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

<table>
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**Mandatory**

| T-MATH-105917 | Comparison Geometry | 5 CR | Tuschmann |

**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.
7.26 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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**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
7.27 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

<table>
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### 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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<th>Duration</th>
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| Mandatory |  |
|-----------|-----------------|---------|
| T-MATH-105854 | **Computer-Assisted Analytical Methods for Boundary and Eigenvalue Problems** | 8 CR Plum |
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>
<thead>
<tr>
<th>Credits</th>
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**Mandatory**

| T-MATH-105930 | Continuous Time Finance | 8 CR Bäuerle, Fasen-Hartmann |
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

<table>
<thead>
<tr>
<th>Credits</th>
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</table>

Mandatory

| T-MATH-105909 | Control Theory | 6 CR | Schnaubelt |

Prerequisites
none
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

<table>
<thead>
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<th>Mandatory</th>
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<tbody>
<tr>
<td>T-MATH-105831</td>
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</tbody>
</table>

**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
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**

<table>
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<tr>
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**Election block: Wahlpflichtangebot (9 credits)**

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<tr>
<td>T-WIWI-102613</td>
<td>Auction Theory</td>
<td>4,5 CR</td>
<td>Ehrhart</td>
</tr>
<tr>
<td>T-WIWI-102614</td>
<td>Experimental Economics</td>
<td>4,5 CR</td>
<td>Weinhardt</td>
</tr>
<tr>
<td>T-WIWI-102861</td>
<td>Advanced Game Theory</td>
<td>4,5 CR</td>
<td>Ehrhart, Puppe, Reiß</td>
</tr>
</tbody>
</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.

**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.

**Prerequisites**
None

**Content**
See German version.

**Workload**
The total workload for this module is approximately 270 hours. For further information see German version.
7.33 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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<th>Duration</th>
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<tr>
<td>T-MATH-102275</td>
<td>Differential Geometry</td>
<td>8 CR</td>
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</table>

**Prerequisites**

None
7.34 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>
<thead>
<tr>
<th>Credits</th>
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Mandatory

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

Prerequisites
none
# 7.35 Module: Discrete Time Finance [M-MATH-102919]

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

<table>
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<tr>
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## Mandatory

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<tr>
<td>T-MATH-105839</td>
<td>Discrete Time Finance</td>
<td>8 CR</td>
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**Prerequisites**  
none
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**

<table>
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<th>Duration</th>
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**Mandatory**

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<tbody>
<tr>
<td>T-MATH-109001</td>
<td>Dispersive Equations</td>
<td>6 CR</td>
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</table>

**Prerequisites**
None
7.37 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>
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<th>Grading scale</th>
<th>Recurrence</th>
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**Mandatory**

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

**Prerequisites**

none
7.38 Module: Econometrics and Statistics I [M-WIWI-101638]

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

<table>
<thead>
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<th>Duration</th>
<th>Language</th>
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**Mandatory**

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

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<th>Module Name</th>
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<tr>
<td>T-WIWI-103064</td>
<td>Financial Econometrics</td>
<td>4,5 CR</td>
<td>Schienle</td>
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<tr>
<td>T-WIWI-103126</td>
<td>Non- and Semiparametrics</td>
<td>4,5 CR</td>
<td>Schienle</td>
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<tr>
<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>
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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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**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.

**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.

**Prerequisites**

The course "Advanced Statistics" [2520020] is compulsory and must be examined.

**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.
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**

<table>
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<th>Credits</th>
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**Recurrence:** Each term

**Duration:** 1 term

**Language:** German

**Level:** 4

**Version:** 4

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

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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>Non- and Semiparametrics</td>
<td>4,5 CR</td>
<td>Schienle</td>
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<td>Portfolio and Asset Liability Management</td>
<td>4,5 CR</td>
<td>Safarian</td>
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<td>Predictive Modeling</td>
<td>4,5 CR</td>
<td>Krüger</td>
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<td>T-WIWI-111387</td>
<td>Probabilistic Time Series Forecasting Challenge</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.

**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.

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

**Content**
This module 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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**Election block: Compulsory Elective Courses (1 item)**

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<th>Course</th>
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<td>Advanced Topics in Economic Theory</td>
<td>4,5 CR</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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**Election block: Supplementary Courses (1 item)**

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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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<tr>
<td>T-WIWI-102622</td>
<td>Corporate Financial Policy</td>
<td>4,5 CR</td>
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<td>T-WIWI-109050</td>
<td>Corporate Risk Management</td>
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<td>Financial Intermediation</td>
<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 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.

**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

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

**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.
Economathematics M.Sc.
Module Handbook as of 30/09/2021

### 7.41 Module: eEnergy: Markets, Services and Systems [M-WIWI-103720]

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

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

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

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

<table>
<thead>
<tr>
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<th>Course</th>
<th>Credits</th>
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<tbody>
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<td>Energy Market Engineering</td>
<td>4,5</td>
<td>Weinhardt</td>
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<td>T-WIWI-107503</td>
<td>Energy Networks and Regulation</td>
<td>4,5</td>
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<td>T-WIWI-107504</td>
<td>Smart Grid Applications</td>
<td>4,5</td>
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<td>T-WIWI-109940</td>
<td>Special Topics in Information Systems</td>
<td>4,5</td>
<td>Weinhardt</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.

**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.

**Prerequisites**

None.

**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.
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

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

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

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<tr>
<td>T-WIWI-102793</td>
<td>Efficient Energy Systems and Electric Mobility</td>
<td>3.5</td>
<td>Jochem</td>
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<td>T-WIWI-102650</td>
<td>Energy and Environment</td>
<td>4.5</td>
<td>Karl</td>
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<td>T-WIWI-102830</td>
<td>Energy Systems Analysis</td>
<td>3</td>
<td>Ardone, Fichtner</td>
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<tr>
<td>T-WIWI-107464</td>
<td>Smart Energy Infrastructure</td>
<td>3</td>
<td>Ardone, Pustisek</td>
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<tr>
<td>T-WIWI-102695</td>
<td>Heat Economy</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.

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.

Prerequisites

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

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)  

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**Mandatory**

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<tr>
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<td>Evolution Equations</td>
<td>8 CR</td>
<td>Frey, Kunstmann, Schnaubelt</td>
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</table>
### 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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**Election block: Compulsory Elective Courses (2 items)**

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<td>T-WIWI-105781</td>
<td>Incentives in Organizations</td>
<td>4,5 CR</td>
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<td>Predictive Mechanism and Market Design</td>
<td>4,5 CR</td>
<td>Reiß</td>
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<td>T-WIWI-102863</td>
<td>Topics in Experimental Economics</td>
<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 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.

**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.

**Prerequisites**

None.

**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.

**Recommendation**

Basic knowledge in mathematics, statistics, and game theory is assumed.

**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.
7.45 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)

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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.
## 7.46 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**

<table>
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**Mandatory**

| T-MATH-105931 Extremal Graph Theory | 8 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.

**Recommendation**
Basic knowledge of linear algebra, analysis and graph theory is recommended.

**Annotation**
Course is held in English
### 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>Prerequisites</th>
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<td>Fasen-Hartmann, Henze</td>
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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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<td>Each term</td>
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**Election block: Compulsory Elective Courses (9 credits)**

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<td>4.5 CR</td>
<td>Uhrig-Homburg</td>
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<td>T-WIWI-102621</td>
<td>Valuation</td>
<td>4.5 CR</td>
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<td>T-WIWI-102647</td>
<td>Asset Pricing</td>
<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 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.

**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

**Prerequisites**

None

**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

### Credits

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### Grading scale

Grade to a tenth

### Recurrence

Each term

### Duration

1 term

### Language

German/English

### Level

4

### Version

6

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

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<td>T-WIWI-102647</td>
<td>Asset Pricing</td>
<td>4.5 CR</td>
<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>4.5 CR</td>
<td>Uhrig-Homburg</td>
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<td>Business Strategies of Banks</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.

### 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.

### 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.

### 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.
7.50 Module: Finance 3 [M-WIWI-101480]

**Responsibility:**
- 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

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**Recurrence:** Each term

**Duration:** 1 term

**Language:** German/English

**Level:** 4

**Version:** 6

**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.

**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.

**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.

**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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7.53 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

Credits | Grading scale | Recurrence | Duration | Language | Level | Version
--- | --- | --- | --- | --- | --- | ---
8 | Grade to a tenth | Irregular | 2 terms | English | 4 | 2

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
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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**Prerequisites**

none
7.55 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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**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:** Jun.-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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**Mandatory**

| T-MATH-109850 | Fourier Analysis and its Applications to PDEs | 6 CR  
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**Prerequisites**

None
7.57 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
7.58 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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**Prerequisites**

None
7.59 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**

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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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### 7.61 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
### 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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7.63 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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**Prerequisites**

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### 7.64 Module: Geometry of Schemes [M-MATH-102866]

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

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### 7.65 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
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).

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.

Prerequisites
None

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

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**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.

**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

**Prerequisites**

None

**Content**

The module includes the contents of the lectures *Endogenous Growth Theory* [2561503], *Spatial Economics* [2561260] and *International Economic Policy* [2560254]. While the first two lectures have a more formal-analytic focus, the third lecture approaches fundamental ideas and problems from the field of international economic policy from a more verbal perspective.

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

**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.

**Workload**

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

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**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
7.70 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

**Credits:** 8

**Grading scale:** Grade to a tenth

**Recurrence:** Irregular

**Duration:** 1 term

**Level:** 4

**Version:** 1

**Mandatory**

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**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.

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Module Handbook as of 30/09/2021
### 7.71 Module: Homotopy Theory [M-MATH-102959]

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# 7.72 Module: Informatics [M-WIWI-101472]

**Responsible:** 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
E-Field

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**Election block: Compulsory Elective Area ()**

<table>
<thead>
<tr>
<th>Module Code</th>
<th>Module Title</th>
<th>Credits</th>
<th>Teacher</th>
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<tbody>
<tr>
<td>T-WIWI-102680</td>
<td>Computational Economics</td>
<td>4,5 CR</td>
<td>Shukla</td>
</tr>
<tr>
<td>T-WIWI-109248</td>
<td>Critical Information Infrastructures</td>
<td>4,5 CR</td>
<td>Sunyaev</td>
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<tr>
<td>T-WIWI-109246</td>
<td>Digital Health</td>
<td>4,5 CR</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 CR</td>
<td>Volkamer</td>
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<tr>
<td>T-WIWI-102661</td>
<td>Database Systems and XML</td>
<td>4,5 CR</td>
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<td>T-WIWI-110346</td>
<td>Supplement Enterprise Information Systems</td>
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<td>T-WIWI-109372</td>
<td>Supplement Software- and Systemsengineering</td>
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<tr>
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<td>Information Service Engineering</td>
<td>4,5 CR</td>
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<td>Knowledge Discovery</td>
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<td>Machine Learning 1 - Basic Methods</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-109799</td>
<td>Process Mining</td>
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<td>T-WIWI-110848</td>
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<td>T-WIWI-103112</td>
<td>Web Science</td>
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**Election block: Seminars and Advanced Labs (between 0 and 1 items)**

<table>
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<tr>
<td>T-WIWI-110144</td>
<td>Emerging Trends in Digital Health</td>
<td>4,5 CR</td>
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<td>T-WIWI-110143</td>
<td>Emerging Trends in Internet Technologies</td>
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<td>T-WIWI-109249</td>
<td>Sociotechnical Information Systems Development</td>
<td>4,5 CR</td>
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<tr>
<td>T-WIWI-111126</td>
<td>Advanced Lab Blockchain Hackathon (Master)</td>
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<tr>
<td>T-WIWI-111125</td>
<td>Advanced Lab Sociotechnical Information Systems Development (Master)</td>
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<tr>
<td>T-WIWI-110548</td>
<td>Advanced Lab Informatics (Master)</td>
<td>4,5 CR</td>
<td>Professorenschaft des Instituts AIFB</td>
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<td>T-WIWI-108439</td>
<td>Advanced Lab Security, Usability and Society</td>
<td>4,5 CR</td>
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<td>T-WIWI-109786</td>
<td>Advanced Lab Security</td>
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<td>T-WIWI-109985</td>
<td>Project Lab Cognitive Automobiles and Robots</td>
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<td>Project Lab Machine Learning</td>
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<td>T-WIWI-109251</td>
<td>Selected Issues in Critical Information Infrastructures</td>
<td>4,5 CR</td>
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</table>
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.

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.

Please note the following information about the module component exams of Prof. Dr. H. Schmeck:


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.

Prerequisites
It is only allowed to choose one lab.

Content
The thematic focus will be based on the choice of courses in the areas of Effiziente Algorithmen, Betriebliche Informations- und Kommunikationssysteme, Wissensmanagement, Komplexitätsmanagement and Software- und Systems Engineering.

Annotation
Detailed information on the recognition of examinations in the field of Informatics can be found at http://www.aifb.kit.edu/web/Auslandsaufenthalt.

Workload
The total workload for this module is approximately 270 hours. For further information see German version.
### 7.73 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**

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<th>Credits</th>
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<th>Duration</th>
<th>Language</th>
<th>Level</th>
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#### Election block: Compulsory Elective Courses (at least 9 credits)

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<tr>
<td>T-WIWI-105777</td>
<td>Business Intelligence Systems</td>
<td>4,5 CR</td>
<td>Mädche, Nadj. Toreini</td>
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<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.

#### 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

#### Prerequisites

None

#### 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.
7.74 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**

<table>
<thead>
<tr>
<th>Credits</th>
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<th>Language</th>
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**Election block: Compulsory Elective Courses (between 9 and 10 credits)**

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<thead>
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<tr>
<td>T-WIWI-109194</td>
<td>Dynamic Macroeconomics</td>
<td>4,5 CR</td>
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<tr>
<td>T-WIWI-102840</td>
<td>Innovation Theory and Policy</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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</table>

**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.

**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

**Prerequisites**

None

**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.

**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.

**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.
7.75 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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<tr>
<th>Credits</th>
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Mandatory

<table>
<thead>
<tr>
<th>T-MATH-105834</th>
<th>Integral Equations</th>
<th>8 CR</th>
<th>Arens, Griesmaier, Hettlich</th>
</tr>
</thead>
</table>
7.76 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>
<thead>
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<th>Credits</th>
<th>Grading scale</th>
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**Mandatory**

- **T-MATH-105911** Introduction into Particulate Flows 3 CR Dörfler

**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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<td>T-MATH-110811</td>
<td>Introduction to Aperiodic Order</td>
<td>3 CR</td>
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</table>

**Prerequisites**  
None
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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</table>

**Competition 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.

**Prerequisites**
None

**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
7.79 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

<table>
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Mandatory

| T-MATH-105918 | Introduction to Geometric Measure Theory | 6 CR | Winter |

Prerequisites

none
### 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

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**Mandatory**

| T-MATH-110323 | Introduction to Homogeneous Dynamics | 6 CR | Hartnick |

**Prerequisites**

None
7.81 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)

**Elective Field**

<table>
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</table>

**Mandatory**

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

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

**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.

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

**Prerequisites**
none

**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.

**Recommendation**
The course "Classical Methods for Partial Differential Equations" should be studied beforehand.

**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.
7.82 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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<td>English</td>
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</table>

**Mandatory**

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

**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.

**Prerequisites**

None

**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**

<table>
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<tr>
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**Mandatory**

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<tbody>
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<td>Introduction to Matlab and Numerical Algorithms</td>
<td>5 CR</td>
<td>Weiß, Wieners</td>
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</table>

**Prerequisites**

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

**Responsible:** Jun.-Prof. Dr. Xian Liao  
**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-111722</td>
<td>Introduction to Microlocal Analysis</td>
<td>3 CR</td>
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</table>

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

**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.

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

**Prerequisites**
none

**Content**

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

**Recommendation**
The following courses should be studied beforehand: “Classical Methods for Partial Differential Equations” und “Functional Analysis”.

**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
Module: Introduction to Scientific Computing [M-MATH-102889]

**M** 7.85 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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<td>Introduction to Scientific Computing</td>
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**Prerequisites**

None
# 7.86 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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**Mandatory**

| T-MATH-105835 | Inverse Problems | 8 CR | Arens, Griesmaier, Hettlich, Rieder |

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### 7.87 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
7.88 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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**Mandatory**

| T-MATH-105924 | L2-Invariants | 5 CR | Kammeyer, Sauer |

**Prerequisites**

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

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

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**Mandatory**

| T-MATH-108799 | Lie Groups and Lie Algebras | 8 CR | Leuzinger |

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7.90 Module: Lie-Algebras (Linear Algebra 3) [M-MATH-105839]

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

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<th>Lie-Algebras (Linear Algebra 3)</th>
<th>8 CR</th>
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7.91 Module: Marketing and Sales Management [M-WIWI-105312]

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

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

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

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

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<td>T-WIWI-107720</td>
<td>Market Research</td>
<td>4,5</td>
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<td>T-WIWI-109864</td>
<td>Product and Innovation Management</td>
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**Election block: Supplementary Courses (at most 1 item)**

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<td>Digital Marketing and Sales in B2B</td>
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<td>T-WIWI-110985</td>
<td>International Business Development and Sales</td>
<td>6</td>
<td>Casenave, Klarmann, Terzidis</td>
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<td>T-WIWI-102835</td>
<td>Marketing Strategy Business Game</td>
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<td>T-WIWI-102891</td>
<td>Price Negotiation and Sales Presentations</td>
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<td>Klarmann, Schröder</td>
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<td>T-WIWI-111246</td>
<td>Pricing Excellence</td>
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<td>Bill, Klarmann</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.

**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

**Prerequisites**

The course "Market Research" is obligatory.

**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.
7.92 Module: Markov Decision Processes [M-MATH-102907]

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

**Organisation:** KIT Department of Mathematics

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

**Elective Field**

<table>
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**Mandatory**

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

**Prerequisites**

none
7.93 Module: Master Thesis [M-MATH-102917]

**Responsible:** Dr. Sebastian Grensing

**Organisation:** KIT Department of Mathematics

**Part of:** Master Thesis

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7.94 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

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<th>Duration</th>
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Prerequisites
none
### 7.95 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:**

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<td>Mathematical Methods of Imaging</td>
<td>5 CR</td>
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**Prerequisites**

None
7.96 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

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

Prerequisites
None
7.97 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**

<table>
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**Recurrence:** Each term

**Duration:** 1 term

**Language:** German/English

**Level:** 4

**Version:** 7

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

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<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-103638</td>
<td>Global Optimization I and II</td>
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<td>Stein</td>
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<td>T-WIWI-102856</td>
<td>Convex Analysis</td>
<td>4,5 CR</td>
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<td>T-WIWI-111587</td>
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<td>4,5 CR</td>
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<td>T-WIWI-102724</td>
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<td>Parametric Optimization</td>
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**Election block: Supplementary Courses (at most 2 items)**

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<td>4,5 CR</td>
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<td>Global Optimization II</td>
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<td>Stein</td>
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<td>T-WIWI-102723</td>
<td>Graph Theory and Advanced Location Models</td>
<td>4,5 CR</td>
<td>Nickel</td>
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<td>Large-scale Optimization</td>
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<td>Mathematics for High Dimensional Statistics</td>
<td>4,5 CR</td>
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<td>T-WIWI-110162</td>
<td>Optimization Models and Applications</td>
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<td>Sudermann-Merx</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.

**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.

**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.
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.
7.98 Module: Mathematical Statistics [M-MATH-102909]

**Responsible:** PD Dr. Bernhard Klar

**Organisation:** KIT Department of Mathematics

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

**Elective Field**

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<td>Mathematical Statistics</td>
<td>4 CR</td>
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**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.

### Prerequisites

None

### Content

- Boltzmann equation: Cauchy problem and properties of solutions
- entropy and H theorem
- equilibrium and convergence to equilibrium
- other models of kinetic theory

---

**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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### Mandatory

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### 7.100 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**

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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

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Mandatory

| T-MATH-105861 | Medical Imaging | 8 CR | Rieder |

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

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Election block: Compulsory Elective Courses (at least 1 item as well as between 4.5 and 9 credits)

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Election block: Supplementary Courses ()

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<td>Facility Location and Strategic Supply Chain Management</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 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.

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 choose 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.

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

Content
The module 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.

Recommendation
The courses Introduction to Operations Research I and II are helpful.

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.
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: 2 terms
Language: German/English
Level: 4
Version: 3

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

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<td>T-WIWI-102861</td>
<td>Advanced Game 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.

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?

Prerequisites
None

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.
7.104 Module: Moduli Spaces of Translation Surfaces [M-MATH-105635]

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-111271 | Moduli Spaces of Translation Surfaces | 8 CR |

Prerequisites
None
7.105 Module: Monotonicity Methods in Analysis [M-MATH-102887]

**Responsible:** PD Dr. Gerd Herzog

**Organisation:** KIT Department of Mathematics

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

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Herzog
Module: Nonlinear Analysis [M-MATH-103539]

**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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**Mandatory**

| T-MATH-107065 | Nonlinear Analysis | 8 CR | Lamm |

**Prerequisites**

None
### 7.107 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**

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**Prerequisites**
none

**Content**

- Short introduction to nonlinear contraction semigroups in Hilbert spaces and to the spaces $H(\text{curl})$ and $H(\text{div})$.
- **Semilinear case:**
- **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.
7.108 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)

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**Mandatory**

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

**Prerequisites**

none
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
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### Mandatory

| T-MATH-105873 | Nonparametric Statistics | 4 CR | Henze, Klar |

### Prerequisites

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

**Responsible:** 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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**Mandatory**

| T-MATH-111514 | Numerical Analysis of Helmholtz Problems | 3 CR | Verfürth |

**Competence Certificate**

oral examination of circa 30 minutes

**Module grade calculation**

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

**Prerequisites**

none
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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**Prerequisites**

none
## 7.113 Module: Numerical Linear Algebra for Scientific High Performance Computing

### Responsible:
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
### 7.114 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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**Mandatory**

| T-MATH-108402 | Numerical Linear Algebra in Image Processing | 6 CR | Grimm |

**Prerequisites**  
None
### 7.115 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  

**Competence Goal**

- 

**Prerequisites**

- none
# 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:**

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**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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**Mandatory**

| T-MATH-105899 | Numerical Methods for Time-Dependent Partial Differential Equations | 8 CR | Hochbruck, Jahnke |
7.120 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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**Mandatory**

| T-MATH-105860 | Numerical Methods in Computational Electrodynamics | 6 CR Dörfler, Hochbruck, Jahnke, Rieder, Wieners |

**Prerequisites**

none
### 7.121 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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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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**Prerequisites**

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

**Responsibility:** 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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**Prerequisites**

none
7.124 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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Dörfler, Hochbruck, Jahnke, Rieder, Wieners
### 7.125 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 block: Compulsory Elective Courses (at most 2 Items)**

- T-WIWI-102723  Graph Theory and Advanced Location Models  4,5 CR  Nickel
- T-WIWI-106200  Modeling and OR-Software: Advanced Topics  4,5 CR  Nickel
- T-WIWI-102715  Operations Research in Supply Chain Management  4,5 CR  Nickel

**Election block: Supplementary Courses (at most 2 Items)**

- T-WIWI-106546  Introduction to Stochastic Optimization  4,5 CR  Rebennack
- T-WIWI-102718  Discrete-Event Simulation in Production and Logistics  4,5 CR  Nickel
- T-WIWI-102719  Mixed Integer Programming I  4,5 CR  Stein
- T-WIWI-102720  Mixed Integer Programming II  4,5 CR  Stein
- T-WIWI-110162  Optimization Models and Applications  4,5 CR  Sudermann-Merx
- T-WIWI-106549  Large-scale Optimization  4,5 CR  Rebennack

**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.

**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.

**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.

**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 assures 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.
Recommendation
Basic knowledge as conveyed in the module *Introduction to Operations Research* is assumed.

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
7.127 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)

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**Mandatory**

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

**Prerequisites**

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

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<tr>
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**Mandatory**

| T-MATH-105893 | Optimization in Banach Spaces | 8 CR | Griesmaier, Hettlich |

**Prerequisites**

none
### 7.129 Module: Parallel Computing [M-MATH-101338]

| Responsible          | Dr. rer. nat. 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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**Prerequisites**

None
7.130 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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**Mandatory**

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**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.

**Prerequisites**

none
7.131 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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Competence Certificate
oral exam

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.

Module grade calculation
Marking: grade of exam

Prerequisites
none

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
### 7.132 Module: Potential Theory [M-MATH-102879]

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

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**Prerequisites**

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

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**Prerequisites**
none
7.135 Module: Random Graphs [M-MATH-102951]

**Responsible:** Dr. Matthias Schulte

**Organisation:** KIT Department of Mathematics

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

**Elective Field**

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**Prerequisites**

none
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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**Prerequisites**

None
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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</table>
# 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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<th>Level</th>
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<td>1 term</td>
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**Mandatory**

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

**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.

**Prerequisites**

None

**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
7.139 Module: Seminar [M-MATH-102730]

**Responsible:** PD Dr. Stefan Kühnlein

**Organisation:** KIT Department of Mathematics

**Part of:** Mathematical Seminar

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**Election block: Elective Seminar (1 item)**

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### 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

<table>
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<th>Duration</th>
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**Election block: Wahlpflichtangebot (3 credits)**

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<tr>
<td>T-WIWI-103478</td>
<td>Seminar in Economics A (Master)</td>
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<tr>
<td>T-WIWI-103483</td>
<td>Seminar in Statistics A (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.

**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.

**Prerequisites**
None.

**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.

**Recommendation**
None.

**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.
### 7.141 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

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#### Election block: Wahlpflichtangebot (3 credits)

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<tr>
<td>T-WIWI-103481</td>
<td>Seminar in Operations Research A (Master)</td>
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<td>Nickel, Rebennack, Stein</td>
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**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.

**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.

**Prerequisites**

None.

**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.

**Recommendation**

None.

**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.
### 7.142 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

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**Competence Certificate**

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

**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.

**Prerequisites**

None.

**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.
### 7.143 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  

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**Election block: Wahlpflichtangebot (1 item)**

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**Professorenschaft des Fachbereichs Betriebswirtschaftslehre**  

**Professorenschaft des Fachbereichs Volkswirtschaftslehre**  

**Prof. Dr. Grothe, Schienle**  

**Course Characterization**

**Competence Certificate**

The modul 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.

**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.

**Prerequisites**

None.

**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](https://portal.wiwi.kit.edu).

**Workload**

The total workload for this module is approximately 90 hours.
7.144 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

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

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### Election block: Supplementary Courses (at most 2 items)

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**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.

**Competence Goal**

**Students**

- knows the theoretical bases and the key components of Business Intelligence systems,
- acquires 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

**Prerequisites**

At least one of the fourcourses 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.

**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.

**Recommendation**
The course Practical Seminar Health Care should be combined with the course OR in Health Care Management.

**Annotation**
This module is part of the KSRI teaching profile “Digital Service Systems”. Further information on a service-specific profiling is available under www.csri.kit.edu/teaching.

**Workload**
The total workload for this module is approximately 270 hours. For further information see German version.
# 7.145 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**

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**Mandatory**

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Module: Spatial Stochastics [M-MATH-102903]

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

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**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.

**Prerequisites**
none

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

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

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

**Organisation:** KIT Department of Mathematics

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

**Elective Field**

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**Prerequisites**

None
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**

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**Prerequisites**

none
## 7.149 Module: Spectral Theory [M-MATH-101768]

**Responsible:** Prof. Dr. Dorothee Frey  
**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-103414 | Spectral Theory - Exam | 8 CR  
Frey, Herzog, Kunstmann, Schmoeger, Schnaubelt |

**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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<th>CR</th>
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<tbody>
<tr>
<td>T-MATH-105932</td>
<td>Spin Manifolds, Alpha Invariant and Positive Scalar Curvature</td>
<td>5 CR</td>
<td>Klaus, Tuschmann</td>
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</tbody>
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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>
<thead>
<tr>
<th>Credits</th>
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<th>Duration</th>
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<td>1 term</td>
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Mandatory

| T-MATH-110805 | Splitting Methods for Evolution Equations | 6 CR | Jahnke |

Prerequisites

None
Module: Statistical Learning [M-MATH-105840]

**Responsible:** Prof. Dr. Daniel Hug

**Organisation:** KIT Department of Mathematics

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

**Mandatory**

<table>
<thead>
<tr>
<th>CR</th>
<th>T-MATH-111726</th>
<th>Statistical Learning</th>
<th>8 CR</th>
<th>Hug</th>
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</table>

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

**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.

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

**Prerequisites**
none

**Content**
1 Classification
   1.1 Bayes classifier
   1.2 k nearest neighbour
   1.3 discrimination analysis
   1.4 Support vector machines
2 Regression
   2.1 Lasso
   2.2 Neuronal networks
   2.3 Random forests
3 Unsupervised learning
   3.1 Principal component analysis
   3.2 Generative networks

**Recommendation**
The module "Introduction to Stochastics" is recommended. The module "Probability theory" is preferable.

**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
Module: Stein's Method [M-MATH-102946]

**Responsible:** Dr. Matthias Schulte

**Organisation:** KIT Department of Mathematics

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

**Elective Field**

<table>
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**Mandatory**

| T-MATH-105914 | Stein's Method | 5 CR | Schulte |

**Prerequisites**

none
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**

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**Mandatory**

| T-MATH-111187 | Steins Method with Applications in Statistics | 4 CR | Ebner |

**Prerequisites**

None
7.155 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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**Mandatory**

| T-MATH-105871 | Stochastic Control | 4 CR | Bäuerle |

**Prerequisites**

none
### 7.156 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

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#### Mandatory

| T-MATH-105852 | Stochastic Differential Equations | 8 CR | Frey, Schnaubelt |

#### 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
### 7.157 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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#### Mandatory

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**Prerequisites**

none
7.158 Module: Stochastic Geometry [M-MATH-102865]

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

Credits: 8
Grading scale: Grade to a tenth
Recurrence: Each summer term
Duration: 1 term
Level: 5
Version: 1

Mandatory

| T-MATH-105840 | Stochastic Geometry | 8 CR | Hug, Last |

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' previously.
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**

<table>
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**Election block: Compulsory Elective Courses (between 1 and 2 items)**

- **T-WIWI-106546** Introduction to Stochastic Optimization  
  4,5 CR  
  Rebennack
- **T-WIWI-106548** Advanced Stochastic Optimization  
  4,5 CR  
  Rebennack
- **T-WIWI-106549** Large-scale Optimization  
  4,5 CR  
  Rebennack

**Election block: Supplementary Courses (at most 1 item)**

- **T-WIWI-102723** Graph Theory and Advanced Location Models  
  4,5 CR  
  Nickel
- **T-WIWI-102719** Mixed Integer Programming I  
  4,5 CR  
  Stein
- **T-WIWI-102720** Mixed Integer Programming II  
  4,5 CR  
  Stein
- **T-WIWI-111247** Mathematics for High Dimensional Statistics  
  4,5 CR  
  Grothe
- **T-WIWI-103124** Multivariate Statistical Methods  
  4,5 CR  
  Grothe
- **T-WIWI-102715** Operations Research in Supply Chain Management  
  4,5 CR  
  Nickel
- **T-WIWI-106545** Optimization Under Uncertainty  
  4,5 CR  
  Rebennack
- **T-WIWI-110162** Optimization Models and Applications  
  4,5 CR  
  Sudermann-Merx

**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.

**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.

**Prerequisites**

At least one of the courses "Advanced Stochastic Optimization", "Large-scale Optimization" or "Introduction to Stochastic Optimization" has to be taken.

**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.

**Recommendation**

It is recommended to listen to the lecture "Introduction to Stochastic Optimization" before the lecture "Advanced Stochastic Optimization" is visited.
Annotation
The course "Introduction to Stochastic Optimization" will be offered until the winter semester 2020/21 as an additional option in the elective offer of the module. Thereafter, the course can only be selected in the supplementary offer.

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.
7.160 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

<table>
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Mandatory

| T-MATH-111004 | Structural Graph Theory | 4 CR | Aksenovich |

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.

Prerequisites
None

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.
7.161 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

<table>
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Mandatory
T-MATH-105934  The Riemann Zeta Function  4 CR Januszewski
### 7.162 Module: Time Series Analysis [M-MATH-102911]

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

<table>
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**Prerequisites**
None
### 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

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

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**Mandatory:** Topological Data Analysis  
**CR:** Hartnick, Sauer
7.164 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

<table>
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**Prerequisites**

None
### 7.165 Module: Traveling Waves [M-MATH-102927]

**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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7.166 Module: Uncertainty Quantification [M-MATH-104054]

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

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

Mandatory

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<td>Uncertainty Quantification</td>
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Franks

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.

Prerequisites
None

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
7.167 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)

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7.168 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)

<table>
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**Mandatory**

| T-MATH-111002 | Wave Propagation in Periodic Waveguides | 8 CR | Griesmaier |

**Prerequisites**

None
7.169 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 Elemente Methods

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Prerequisites
none
Course: Advanced Empirical Asset Pricing [T-WIWI-110513]

8.2 Course: Advanced Empirical Asset Pricing [T-WIWI-110513]

**Responsible:** Jun.-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>Grade to a third</td>
<td>Each winter term</td>
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**Events**

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<tr>
<th>WT 21/22</th>
<th>2530569</th>
<th>Advanced Empirical Asset Pricing</th>
<th>2 SWS</th>
<th>Lecture</th>
<th>Thimme</th>
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<td>Übung zu Advanced Empirical Asset Pricing</td>
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<td>Practice</td>
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</table>

**Exams**

| WT 21/22 | 7900319 | Advanced Empirical Asset Pricing | Thimme |

**Competence Certificate**

The success control takes place in form of a written examination (60 min) during the semester break (according to §4(2), 1 SPO). If the number of participants is low, an oral examination (according to §4 (2), 2 SPO) may also be offered. The examination is offered every semester and can be repeated at any regular examination date. A bonus can be acquired through successful participation in the practice. 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 21/22, 2 SWS, Language: English, Open in study portal] Lecture (V)

**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.

**Literature**

**Basisliteratur**


**zu Verzierung/Wiederholung**


8 COURSES
Course: Advanced Game Theory [T-WIWI-102861]

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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**Exams**

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</table>

**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**
2521533, WS 21/22, 2 SWS, Language: English, Open in study portal

Legend: 🖥 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
8.5 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

<table>
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<td>2512403</td>
<td>Advanced Lab BlockchainHackathon (Bachelor)</td>
<td>Practical course / ✓</td>
<td>Sunyaev, Kannengießer, Sturm, Beyene</td>
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<td>WT 21/22</td>
<td>7900141</td>
<td>Advanced Lab Blockchain Hackathon (Master)</td>
<td>Sunyaev</td>
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</table>

**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

<table>
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#### Events

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<td>2512205</td>
<td>Lab Realisation of innovative services (Master)</td>
<td>3 SWS</td>
<td>Practical course</td>
<td>Oberweis, Schiefer, Schüler, Toussaint</td>
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<tr>
<td>ST 2021</td>
<td>2512207</td>
<td>Lab Automation in Everyday Life (Master)</td>
<td>3 SWS</td>
<td>Practical course</td>
<td>Oberweis, Forell, Frister</td>
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<tr>
<td>ST 2021</td>
<td>2512401</td>
<td>Development of Sociotechnical Information Systems (Master)</td>
<td>3 SWS</td>
<td>Practical course</td>
<td>Sunyaev, Pandl</td>
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<tr>
<td>ST 2021</td>
<td>2512403</td>
<td>Advanced Lab Blockchain Hackathon (Master)</td>
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<td>Practical course</td>
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<td>ST 2021</td>
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<td>3 SWS</td>
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<td>2512555</td>
<td>Practical lab Security, Usability and Society (Master)</td>
<td>3 SWS</td>
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<td>Strufe, Mayer, Arias Cabarcos, Berens, Mossano, Düzgün, Beckmann</td>
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<td>2512205</td>
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<td>3 SWS</td>
<td>Practical course</td>
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<td>2512401</td>
<td>Practical Course Sociotechnical Information Systems Development (Master)</td>
<td>3 SWS</td>
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<td>WT 21/22</td>
<td>2512501</td>
<td>Practical Course Cognitive automobiles and robots (Master)</td>
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<td>2512557</td>
<td>Practical Course Security (Master)</td>
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<td>WT 21/22</td>
<td>2512600</td>
<td>Project lab Information Service Engineering (Master)</td>
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#### Exams

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<td>ST 2021</td>
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<td>WT 21/22</td>
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**Economathematics M.Sc.**  
Module Handbook as of 30/09/2021
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 2021, 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 2021, 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 2021, 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 2021, 3 SWS, Language: German/English, 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.
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.
Content
The internship “Security, Usability and Society” will cover topics both of usable security and privacy programming, and how to conduct user studies. This internship will be only in English. The kick-off, the presentations, and every written material to be graded must be in English. Communications with supervisors can be in German.

WiWi link: https://portal.wiwi.kit.edu/ys/4629

Important dates:
Kick-off: 06.04.2021, 10:00-11:00 CET in Microsoft Teams - Link
Report + code submission: 07.09.2021, 23:59 CET
Presentation deadline: 20.09.2021, 23:59 CET
Presentation day: 24.09.2021, 09:00 CET

Topics:
Privacy Friendly apps
In this subject, students complete an app (or an extension of an app) among our Privacy-Friendly Apps. Please click the following link to know more about them: https://secuso.aifb.kit.edu/english/105.php. 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.

- Notes 2.0

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.

- Password Manager Enrolment Add-On
- Portfolio Graphical Recognition-Based Passwords with Gamepads
- Visualization app to explore Facebook behavioral data collection
- 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.

- Neurotechnologies, Neuroprivacy, and User Acceptance
- Expert feedback for an anti-phishing webpage template (English only)
- “Your website has been hacked” - How to inform business owners about security issues on their webpages in more sensitive ways

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.

Lab Realisation of innovative services (Master)
2512305, WS 21/22, 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).

Organizational issues
Die genauen Termine und Informationen zur Anmeldung werden auf der Veranstaltungsseite bekannt gegeben.

Practical Course Sociotechnical Information Systems Development (Master)
2512401, WS 21/22, 3 SWS, Language: German/English, Open in study portal
Content
The aim of this course is to provide a practical introduction into developing socio-technical information systems, such as web platforms, mobile apps, or desktop applications. Course participants will create (individually or in groups) software solutions for specific problems from various practical domains. The course tasks comprise requirements assessment, system design, and software implementation. Furthermore, course participants will gain insights into software quality assurance methods and software documentation.

Learning objectives:
- Independent and self-organized realization of a software development project
- Evaluation and selection of suitable development tools and methods
- Application of modern software development methods
- Planning and execution of different development tasks: requirements assessment, system design, implementation, and quality assurance
- Project documentation
- Presentation of project results in an comprehensible and structured form

Practical Course Cognitive automobiles and robots (Master)
2512501, WS 21/22, 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.

Project lab Information Service Engineering (Master)
2512600, WS 21/22, 3 SWS, Language: English, 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]

**Responsibility:** Prof. Dr. Melanie Volkamer  
**Organisation:** KIT Department of Economics and Management  
**Part of:** M-WIWI-101472 - Informatics

<table>
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**Events**

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<th>Lecturers</th>
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<td>Practical Course Security (Master)</td>
<td>4 SWS</td>
<td>Practical course, Baumgart, Volkamer, Mayer, Leinweber, Schiff</td>
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**Practical Course Security (Master)**  
2512557, WS 21/22, 4 SWS, Language: German, [Open in study portal](#)

**Exams**

<table>
<thead>
<tr>
<th>Event</th>
<th>Credits</th>
<th>Grading scale</th>
<th>Recurrence</th>
<th>Lecturer</th>
</tr>
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<tbody>
<tr>
<td>WT 21/22</td>
<td>7900046</td>
<td>Advanced Lab Security (Master)</td>
<td></td>
<td>Volkamer</td>
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</table>

**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)**

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

<table>
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Events

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<tr>
<td>ST 2021</td>
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<td>Practical lab Security, Usability and Society (Bachelor)</td>
<td>3</td>
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<tr>
<td>WT 21/22</td>
<td>2500024</td>
<td>Praktikum Security, Usability and Society (Master)</td>
<td>3</td>
<td>Practical course</td>
<td>Volkamer, Mayer, Ghiglieri, Aldag, Beckmann, Mossano</td>
<td></td>
</tr>
<tr>
<td>WT 21/22</td>
<td>2512554</td>
<td>Praktikum Security, Usability and Society (Bachelor)</td>
<td>3</td>
<td>Practical course</td>
<td>Volkamer, Mayer, Ghiglieri, Aldag, Beckmann, Mossano</td>
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Exams

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<td>7900307</td>
<td>Advanced Lab Security, Usability and Society (Master)</td>
<td>Volkamer</td>
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</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 2021, 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. This internship will be only in English. The kick-off, the presentations, and every written material to be graded must be in English. Communications with supervisors can be in German.
WiWi portal: https://portal.wiwi.kit.edu/ys/4628

Important dates:
Kick-off: 06.04.2021, 10:00-11:00 CET in Microsoft Teams - Link
Report + code submission: 07.09.2021, 23:59 CET
Presentation deadline: 20.09.2021, 23:59 CET
Presentation day: 24.09.2021, 09:00 CET

Topics:

Privacy Friendly apps
In this subject, students complete an app (or an extension of an app) among our Privacy-Friendly Apps. Please click the following link to know more about them: https://secuso.aifb.kit.edu/english/105.php. 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.

• Notes 2.0

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.

• Password Manager Enrolment Add-On
• Portfolio Graphical Recognition-Based Passwords with Gamepads
• Visualization app to explore Facebook behavioral data collection

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.

• Neurotechnologies, Neuroprivacy, and User Acceptance
• Expert feedback for an anti-phishing webpage template (English only)
• "Your website has been hacked" - How to inform business owners about security issues on their webpages in more sensitive ways

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.

V Praktikum Security, Usability and Society (Master)
2500024, WS 21/22, 3 SWS, Language: German/English, Open in study portal

Practical course (P)
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 melanie.volkamer@kit.edu. Topics are assigned first-come-first-served until all of them are filled. Topics in italics have been already assigned.

Important dates:
Kick-off: 04.10.2021, 10:00-11:00 CET in Microsoft Teams - Link
Report + code submission: 06.02.2022, 23:59 CET
Presentation deadline: 06.02.2022, 23:59 CET
Presentation day: 08.02.2022

Topics:
Privacy Friendly apps
In this subject, students complete an app (or an extension of an app) among our Privacy-Friendly Apps. Please click the following link to know more about them: https://secuso.aifb.kit.edu/english/105.php. 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.
- Notes 2.0

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. as 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.
- Password Manager Enrolment Add-On
- Portfolio Graphical Recognition-Based Passwords with Gamepads
- Cookie Consent Manager for Websites

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.
- How to display URLs to support people's ability to detect phishing (English)
- Studying the Effect of Static vs. Dynamic Phishing Detection
- How effective are QR-scanners in helping users detecting phishing emails?

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.

Praktikum Security, Usability and Society (Bachelor)
2512554, WS 21/22, 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 backup one, to melanie.volkmaker@kit.edu. Topics are assigned first-come-first-served until all of them are filled. Topics in italics have already been assigned.

Important dates:
Kick-off: 04.10.2021, 10:00-11:00 CET in Microsoft Teams - [Link]
Report + code submission: 06.02.2022, 23:59 CET
Presentation deadline: 06.02.2022, 23:59 CET
Presentation day: 08.02.2022

Topics:
Privacy Friendly apps
In this subject, students complete an app (or an extension of an app) among our Privacy-Friendly Apps. Please click the following link to know more about them: [https://secuso.aifb.kit.edu/english/105.php](https://secuso.aifb.kit.edu/english/105.php). 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.

- Notes 2.0

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](https://secuso.aifb.kit.edu/english/TORPEDO.php)) or PassSec + ([https://secuso.aifb.kit.edu/english/PassSecPlus.php](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.

- Password Manager Enrolment Add-On
- Portfolio Graphical Recognition-Based Passwords with Gamepads
- Cookie Consent Manager for Websites

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.

- How to display URLs to support people’s ability to detect phishing (English)
- Studying the Effect of Static vs. Dynamic Phishing Detection
- How effective are QR-scanners in helping users detecting phishing emails?

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](https://secuso.aifb.kit.edu/Studium_und_Lehre.php).
8 COURSES

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

<table>
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<th>Recurrence</th>
<th>Version</th>
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Events

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<td>Sunyaev, Pandl, Goram</td>
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Exams

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<th>Credits</th>
<th>Grade to a third</th>
<th>Recurrence</th>
<th>Responsible</th>
</tr>
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<tbody>
<tr>
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<td></td>
<td>Sunyaev</td>
</tr>
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</table>

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

Below you will find excerpts from events related to this course:

Practical Course Sociotechnical Information Systems Development (Master) 2512401, WS 21/22, 3 SWS, Language: German/English, Open in study portal

Content

The aim of this course is to provide a practical introduction into developing socio-technical information systems, such as web platforms, mobile apps, or desktop applications. Course participants will create (individually or in groups) software solutions for specific problems from various practical domains. The course tasks comprise requirements assessment, system design, and software implementation. Furthermore, course participants will gain insights into software quality assurance methods and software documentation.

Learning objectives:

- Independent and self-organized realization of a software development project
- Evaluation and selection of suitable development tools and methods
- Application of modern software development methods
- Planning and execution of different development tasks: requirements assessment, system design, implementation, and quality assurance
- Project documentation
- Presentation of project results in an comprehensible and structured form
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>Each term</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). The application will be accepted on a rolling basis.

**Below you will find excerpts from events related to this course:**

### ST 2021

**Advanced Machine Learning and Data Science**

- **Course number:** 2530357
- **Semester:** SS 2021
- **SWS:** 4
- **Language:** English
- **Type:** Practical course (P)
- **Organisation:** Online
- **Responsible:** Ulrich

**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**

14-tägig, tba

**Literature**
Literatur wird in der ersten Vorlesung bekannt gegeben.

### WT 21/22

**Advanced Machine Learning and Data Science**

- **Course number:** 2530357
- **Semester:** WS 21/22
- **SWS:** 4
- **Language:** English

**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**

14-tägig, tba

**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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**Events**

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<td>WT 21/22</td>
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<td>Statistik für Fortgeschrittene</td>
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<td>Lecture</td>
<td>Grothe</td>
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<td>Übung zu Statistik für Fortgeschrittene</td>
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<td>Practice</td>
<td>Grothe, Rieger</td>
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**Exams**

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<td>Lecture</td>
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</table>

**Competence Certificate**

The assessment of this course is a written examination (60 min) according to §4(2), 1 of the examination regulation. A bonus program can improve the grade by one grade level (i.e. by 0.3 or 0.4). The exam is offered every semester. Re-examinations are offered only for repeaters.

**Prerequisites**

None

**Annotation**

New course starting winter term 2015/2016

Below you will find excerpts from events related to this course:

**Statistik für Fortgeschrittene**

2550552, WS 21/22, 2 SWS, Open in study portal

**Literature**

Skrift zur Vorlesung
### 8.12 Course: Advanced Stochastic Optimization [T-WIWI-106548]

<table>
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<tr>
<th><strong>Responsible:</strong></th>
<th>Prof. Dr. Steffen Rebennack</th>
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<tr>
<td><strong>Organisation:</strong></td>
<td>KIT Department of Economics and Management</td>
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<tr>
<td><strong>Part of:</strong></td>
<td>M-WIWI-101473 - Mathematical Programming</td>
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<td></td>
<td>M-WIWI-103289 - Stochastic Optimization</td>
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<table>
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<td><strong>Version</strong></td>
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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.
8.13 Course: Advanced Topics in Economic Theory [T-WIWI-102609]

Responsible: Prof. Dr. Kay Mitusch
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101500 - Microeconomic Theory
M-WIWI-101502 - Economic Theory and its Application in Finance

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Course: Advanced Topics in Economic Theory [T-WIWI-102609]

ST 2021 2520527 Advanced Topics in Economic Theory 2 SWS Lecture / Online Mitusch, Brumm
ST 2021 2520528 Übung zu Advanced Topics in Economic Theory 1 SWS Practice / Online Pegorari

Exams
ST 2021 00227 Advanced Topics in Economic Theory Mitusch, Brumm
ST 2021 7900329 Advanced Topics in Economic Theory Mitusch, Brumm

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

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 2021, 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.
8.14 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

<table>
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- **Events**
  - WT 21/22 0102200  Algebra  4 SWS  Lecture  Herrlich
  - WT 21/22 0102210  Übungen zu 0102200 (Algebra)  2 SWS  Practice  Herrlich

- **Exams**
  - ST 2021 7700070  Algebra  Kühnlein
8.15 Course: Algebraic Geometry [T-MATH-103340]

**Responsible:** Prof. Dr. Frank Herrlich
PD Dr. Stefan Kühnlein

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-101724 - Algebraic Geometry

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## 8.16 Course: Algebraic Number Theory [T-MATH-103346]

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**Responsible:** PD Dr. Stefan Kühnlein  
**Organisation:** KIT Department of Mathematics  
**Part of:** M-MATH-101725 - Algebraic Number Theory

### Events

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<th>Algebraische Zahlentheorie</th>
<th>4 SWS</th>
<th>Lecture / 🔄</th>
<th>Kühnlein</th>
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<tr>
<td>ST 2021</td>
<td>0104615</td>
<td>Übungen zu 0104610 (Algebraische Zahlentheorie)</td>
<td>2 SWS</td>
<td>Practice / 🔄</td>
<td>Kühnlein</td>
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### Exams

<table>
<thead>
<tr>
<th>ST 2021</th>
<th>7700069</th>
<th>Algebraic Number Theory</th>
<th>Kühnlein</th>
</tr>
</thead>
</table>
8.17 Course: Algebraic Topology [T-MATH-105915]

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

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-102948 - Algebraic Topology

<table>
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<td>Grade to a third</td>
<td>Irregular</td>
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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

**Type:** Written examination  
**Credits:** 8  
**Grading scale:** Grade to a third  
**Recurrence:** Irregular  
**Version:** 1

**Prerequisites**  
none
8.19 Course: Analytical and Numerical Homogenization [T-MATH-111272]

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

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-105636 - Analytical and Numerical Homogenization

<table>
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<th>Recurrence</th>
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**Events**

| ST 2021 | 0165700 | Analytical and Numerical Homogenization | 3 SWS | Lecture | Verfürth, Goffi |

**Exams**

| ST 2021 | 7700088 | Analytical and Numerical Homogenization | Verfürth |

Legend: 🇺 Online, ⚪ Blended (On-Site/Online), 🔴 On-Site, ⓧ Cancelled

**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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<th>Version</th>
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</table>

**Exams**

| ST 2021 | 7700082 | Applications of Topological Data Analysis | Ott |

**Prerequisites**

none
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

<table>
<thead>
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<tr>
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<th>Code</th>
<th>Title</th>
<th>SWS</th>
<th>Type</th>
<th>Instructor(s)</th>
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<tbody>
<tr>
<td>WT 21/22</td>
<td>2520020</td>
<td>Applied Econometrics</td>
<td>2</td>
<td>Lecture</td>
<td>Krüger</td>
</tr>
<tr>
<td>WT 21/22</td>
<td>2520021</td>
<td>Tutorial in Applied Econometrics</td>
<td>2</td>
<td>Practice</td>
<td>Krüger, Koster</td>
</tr>
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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

**Annotation**
The course is not offered regularly.

Below you will find excerpts from events related to this course:

**Applied Econometrics**
2520020, WS 21/22, 2 SWS, Language: English, Open in study portal

**Lecture (V)**

**Content**

**Content:**
- Causal effects and prediction in the linear model, instrumental variables, analysis of natural experiments
- Theoretical exercises with computer-based illustrations

**Workload:**
Total workload for 4.5 CP: approx. 135 hours
Attendance: 30 hours
Independent Study: 105 hours

**Literature**
Weitere Literatur wird in der Vorlesung bekanntgegeben.

**Responsibility:** Prof. Dr. Ali Sunyaev

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

**Part of:** M-WIWI-101472 - Informatics

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<th>Version</th>
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<tr>
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<td>Grade to a third</td>
<td>Each summer term</td>
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**Events**

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<th>Type</th>
<th>Credits</th>
<th>Description</th>
<th>Responsible</th>
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<td>ST 2021</td>
<td>2511032</td>
<td>Applied Informatics - Principles of Internet Computing: Foundations for Emerging Technologies and Future Services</td>
<td>Lecture</td>
<td>2 SWS</td>
<td>Sunyaev</td>
<td>Online</td>
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<tr>
<td>ST 2021</td>
<td>2511033</td>
<td>Übungen zu Angewandte Informatik - Internet Computing</td>
<td>Practice</td>
<td>1 SWS</td>
<td>Sunyaev, Teigeler, Beyene</td>
<td>Online</td>
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**Exams**

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<thead>
<tr>
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<th>Code</th>
<th>Title</th>
<th>Type</th>
<th>Responsible</th>
</tr>
</thead>
<tbody>
<tr>
<td>ST 2021</td>
<td>7900025</td>
<td>Applied Informatics - Internet Computing (Registration until 12 July 2021)</td>
<td>Lecture</td>
<td>Sunyaev</td>
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<tr>
<td>WT 21/22</td>
<td>7900004</td>
<td>Applied Informatics – Principles of Internet Computing: Foundations for Emerging Technologies and Future Services</td>
<td>Lecture</td>
<td>Sunyaev</td>
</tr>
</tbody>
</table>

**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.

By successful processing the exercises 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

**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:*

**V**

**Applied Informatics - Principles of Internet Computing: Foundations for Emerging Technologies and Future Services**

2511032, SS 2021, 2 SWS, Language: German, [Open in study portal](#)
Content
The lecture Applied Computer Science II 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 COURSES

Course: Asset Pricing [T-WIWI-102647]

<table>
<thead>
<tr>
<th>8.23 Course: Asset Pricing [T-WIWI-102647]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responsible: Prof. Dr. Martin Ruckes</td>
</tr>
<tr>
<td>Prof. Dr. Marliese Uhrig-Homburg</td>
</tr>
<tr>
<td>Organisation: KIT Department of Economics and Management</td>
</tr>
<tr>
<td>Part of: M-WIWI-101480 - Finance 3</td>
</tr>
<tr>
<td>M-WIWI-101482 - Finance 1</td>
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<tr>
<td>M-WIWI-101483 - Finance 2</td>
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<tr>
<td>M-WIWI-101502 - Economic Theory and its Application in Finance</td>
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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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<th>Asset Pricing</th>
<th>2 SWS</th>
<th>Lecture / Online</th>
<th>Uhrig-Homburg</th>
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<tr>
<td>ST 2021</td>
<td>2530556</td>
<td>Übung zu Asset Pricing</td>
<td>1 SWS</td>
<td>Practice / Online</td>
<td>Uhrig-Homburg, Reichenbacher</td>
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<table>
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<th>7900110</th>
<th>Asset Pricing</th>
<th>Uhrig-Homburg, Thimme</th>
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<tr>
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<td>7900056</td>
<td>Asset Pricing</td>
<td>Uhrig-Homburg</td>
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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
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 2021, 2 SWS, Language: German, Open in study portal

Organizational issues

Literature
Basisliteratur

Zur Wiederholung/Vertiefung
8.24 Course: Asymptotic Stochastics [T-MATH-105866]

**Responsible:** Prof. Dr. Vicky Fasen-Hartmann
Prof. Dr. Norbert Henze
PD Dr. Bernhard Klar

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-102902 - Asymptotic Stochastics

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**Events**

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<td>Asymptotic Stochastics</td>
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<td>Lecture</td>
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<td>0118100</td>
<td>Tutorial for 0118000 (asymptotic Stochastics)</td>
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<td>Fasen-Hartmann</td>
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**Prerequisites**
none
### 8.25 Course: Auction Theory [T-WIWI-102613]

**Responsible:** 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

<table>
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**Events**

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<tr>
<td>WT 21/22</td>
<td>2520408</td>
<td>Auktionstheorie</td>
<td>2 SWS</td>
<td>Ehrhart</td>
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<td>WT 21/22</td>
<td>2520409</td>
<td>Übungen zu Auktionstheorie</td>
<td>1 SWS</td>
<td>Ehrhart</td>
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**Exams**

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<td>7900255</td>
<td>Auction Theory</td>
<td>Ehrhart</td>
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<tr>
<td>WT 21/22</td>
<td>7900216</td>
<td>Auction Theory</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 21/22, 2 SWS, [Open in study portal](#)  
Lecture (V)

**Literature**

- Ehrhart, K.-M. und S. Seifert: Auktionstheorie, Skript zur Vorlesung, KIT, 2011  
- Ausubel, L.M. und 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  
Prof. Dr. Marliese Uhrig-Homburg

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

**Part of:** M-WIWI-101480 - Finance 3  
M-WIWI-101483 - Finance 2

<table>
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**Exams**

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<tbody>
<tr>
<td>ST 2021</td>
<td>7900260</td>
<td>Blockchains &amp; Cryptofinance (second attempt only) Uhrig-Homburg</td>
</tr>
</tbody>
</table>

**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 acquired through successful participation in the practice. 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 according to SPO § 4 Abs. 2, Pkt. 3).

**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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<th>Version</th>
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<td>2530560</td>
<td>3 SWS</td>
<td>Lecture / Practice (VÜ)</td>
<td>Uhrig-Homburg, Müller</td>
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</table>

**Exams**

- ST 2021 7900280 Bond Markets Uhrig-Homburg
- WT 21/22 7900311 Bond Markets Uhrig-Homburg

**Competence Certificate**

The assessment consists of a written exam (75min.) A bonus can be earned through successful participation in the tutorial sessions. 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 according to SPO § 4 Abs. 2, Pkt. 3).

**Annotation**

This course will be held in English.

*Below you will find excerpts from events related to this course:*

**Bond Markets**

2530560, WS 21/22, 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 through successful participation in the tutorial sessions. 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**

Blockveranstaltung: Do 14:00-19:00 Uhr, Fr 9:45-17:15 Uhr

21./22.10., 04./05.11., 18./19.11.
**Course: Bond Markets - Models & Derivatives [T-WIWI-110997]**

**Responsiable:** Prof. Dr. Marliese Uhrig-Homburg  
**Organisation:** KIT Department of Economics and Management  
**Part of:** M-WIWI-101480 - Finance 3  
M-WIWI-101483 - Finance 2

<table>
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<th>Grading scale</th>
<th>Recurrence</th>
<th>Version</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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**Exams**

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<th>Type</th>
<th>Credits</th>
<th>Grading scale</th>
<th>Recurrence</th>
<th>Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>WT 21/22</td>
<td>Bond Markets - Models &amp; Derivatives</td>
<td>2 SWS</td>
<td>Lecture / Practice (Grauer, Uhrig-Homburg)</td>
<td></td>
<td></td>
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</table>

**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:*

**Bond Markets - Models & Derivatives**

2530565, WS 21/22, 2 SWS, Language: English, Open in study portal

**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).

**Organizational issues**

Blockveranstaltung, Kickoff am 03.12.21, Präsentation am 11.02.22
**8.30 Course: Bond Markets - Tools & Applications [T-WIWI-110996]**

**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>Bond Markets - Tools &amp; Applications</td>
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**Exams**

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<td>Bond Markets - Tools &amp; Applications</td>
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</table>

**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:

**Bond Markets - Tools & Applications**  
2530562, WS 21/22, 1 SWS, Language: English, Open in study portal

**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**

Blockveranstaltung, Kickoff am 21./22.10.21 in der Blockveranstaltung Bond Markets (Ort tba), Präsentation am 03.12.21  
Seminarraum 320 Geb. 09.21
### 8.31 Course: Bott Periodicity [T-MATH-108905]

<table>
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<tr>
<th>Responsible:</th>
<th>Prof. Dr. Wilderich Tuschmann</th>
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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**

| ST 2021 | 0157500    | Boundary and Eigenvalue Problems | 4 SWS | Lecture / 🖥 | Liao |
| ST 2021 | 0157510    | Übungen zu 0157500              | 2 SWS | Practice / 🖥 | Liao |

**Exams**

| ST 2021 | 7700062    | Boundary and Eigenvalue Problems | Plum, Reichel, Liao |

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

---

Economathematics M.Sc.  
Module Handbook as of 30/09/2021
**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  

| Type                  | Oral examination  
|-----------------------|------------------  
| Credits               | 4  
| Grading scale        | Grade to a third  
| Version               | 1  

#### Events

| ST 2021 | 0155700 | Brownsche Bewegung | 3 SWS | Lecture | Bäuerle  
|---------|---------|--------------------|-------|---------|---------  
| ST 2021 | 0155710 | Übungen zu 0155700 (Brownsche Bewegung) | 1 SWS | Practice | Bäuerle  

#### Exams

| ST 2021 | 7700051 | Brownian Motion | Bäuerle  

**Legend:** 📱 Online, 📊 Blended (On-Site/Online), 🗣️ On-Site, ✗ Cancelled

#### 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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**Exams**

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**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.

**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

**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.

**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 analytic 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.
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

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**Exams**

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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 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 21/22, 2 SWS, Language: German, Open in study portal

**Lecture (V)**

**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.
**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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<td>Müller, Ruckes</td>
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**Competence Certificate**
See German version.

**Prerequisites**
None

**Recommendation**
None

*Below you will find excerpts from events related to this course:*

**Business Strategies of Banks**  
2530299, SS 2021, 2 SWS, Language: German, [Open in study portal](#)  
Lecture (V)  
Cancelled

**Literature**

Weiterführende Literatur:

- Ein Skript wird im Verlauf der Veranstaltung kapitelweise ausgeteilt.
- Hartmann-Wendels, Thomas; Pfingsten, Andreas; Weber, Martin; 2014, Bankbetriebslehre, 6. Auflage, Springer

**Business Strategies of Banks**  
2530299, WS 21/22, 2 SWS, Language: German, [Open in study portal](#)  
Lecture (V)

**Organizational issues**

Die Veranstaltung findet nur statt, wenn sie in Präsenz stattfinden kann.

Termine und Räume laut Ankündigung am Institut.

**Literature**

Weiterführende Literatur:

- Ein Skript wird im Verlauf der Veranstaltung kapitelweise ausgeteilt.
- Hartmann-Wendels, Thomas; Pfingsten, Andreas; Weber, Martin; 2014, Bankbetriebslehre, 6. Auflage, Springer
8.38 Course: Challenges in Supply Chain Management [T-WIWI-102872]

Responsible: Esther Mohr
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-102805 - Service Operations

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Competence Certificate
The assessment consists of a written paper and an oral exam of ca. 30-40 min.

Prerequisites
None

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 2021, 3 SWS, Language: English, Open in study portal

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
Blockveranstaltung. Termine werden bekannt gegeben

Literature
Wird in Abhängigkeit vom Thema in den Projektteams bekanntgegeben.
### 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>WT 21/22</td>
<td>0105310</td>
<td>Tutorial for 0105300 (Classical Methods for Partial Differential Equations)</td>
<td>2 SWS</td>
<td>Practice</td>
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**Exams**

| ST 2021 | 7700052 | Classical Methods for Partial Differential Equations | Plum, Reichel, Anapolitanos, Liao |
### 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
### 8.41 Course: Commutative Algebra [T-MATH-108398]

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**Prerequisites**

none
Course: Comparison Geometry [T-MATH-105917]

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

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-102940 - Comparison Geometry

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**Prerequisites**
Keine
### 8.43 Course: Comparison of Numerical Integrators for Nonlinear Dispersive Equations [T-MATH-109040]

**Responsible:** Prof. Dr Katharina Schratz  
**Organisation:** KIT Department of Mathematics  
**Part of:**  
M-MATH-104426 - Comparison of Numerical Integrators for Nonlinear Dispersive Equations

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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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8.45 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:** PD Dr. Pradyumn Kumar Shukla

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

**Part of:** M-WIWI-101472 - Informatics

<table>
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### Exams

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</table>

### 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:

**Computational Economics**

2590458, WS 21/22, 2 SWS, Language: English, Open in study portal

### 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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8 COURSES

Course: Continuous Time Finance [T-MATH-105930]

8.48 Course: Continuous Time Finance [T-MATH-105930]

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

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-102860 - Continuous Time Finance

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**Events**

| ST 2021 | 0159400 | Finanzmathematik in stetiger Zeit | 4 SWS | Lecture / 🖥 | Fasen-Hartmann |
| ST 2021 | 0159500 | Übungen zu 0159400            | 2 SWS | Practice / 🖥 | Fasen-Hartmann |

**Exams**

| ST 2021 | 7700066 | Continuous Time Finance       | Fasen-Hartmann |

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗺 On-Site, ❌ Cancelled
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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## Events

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<td>2 SWS</td>
<td>Lecture / 📅</td>
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## Exams

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<td>ST 2021</td>
<td>7900273_SS2021_HK</td>
<td>Convex Analysis</td>
<td>Lecture</td>
<td>Stein</td>
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**Legend:** 📅 Online, 🏛 Blended (On-Site/Online), 🗣 On-Site, ❌ Canceled

## 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).

### Below you will find excerpts from events related to this course:

**Konvexe Analysis**  
2550120, SS 2021, 2 SWS, Language: German, [Open in study portal](#)

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## Content

Convex Analysis deals with properties of convex functions and convex sets, amongst others with respect to the minimization of convex functions over convex sets. That the involved functions are not necessarily assumed to be differentiable allows a number a applications which are not covered by techniques from smooth optimization, e.g. approximation problems with respect to the Manhattan or maximum norms, classification problems or the theory of statistical estimates. The lecture develops along another, geometrically intuitive example, where a nonsmooth obstacle set is to be described by a single smooth convex constraint such that minimal and maximal distances to the obstacle can be computed. The lecture is structured as follows:

- Introduction to entropic smoothing and convexity
- Global error bounds
- Smoothness properties of convex functions
- The convex subdifferential
- Global Lipschitz continuity
- Descent directions and stationarity conditions

## Remark:

Prior to the attendance of this lecture, it is strongly recommend to acquire basic knowledge on optimization problems in one of the lectures "Global Optimization I and II" and "Nonlinear Optimization I and II".

## Learning objectives:

The student

- knows and understands the fundamentals of convex analysis,
- is able to choose, design and apply modern techniques of convex analysis in practice.
Literature

## 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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<td>Lecture / Online</td>
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<td>0152810</td>
<td>Tutorial for 0152800</td>
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<td>Practice / Online</td>
<td>Prof. Hug</td>
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### Exams

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**Legend:** 🌐 Online, 🧩 Blended (On-Site/Online), 🔃 On-Site, ✗ Cancelled
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

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<td>2 SWS</td>
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<td>2530215</td>
<td>Übungen zu Corporate Financial Policy</td>
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**Exams**

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<td>Ruckes</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 (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:**

**Corporate Financial Policy**  
2530214, SS 2021, 2 SWS, Language: English, [Open in study portal](#)

**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

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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

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: Credit Risk [T-WIWI-102645]

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**Competence Certificate**

The examination is offered for first-time writers for the last time in the winter semester 2020/21 and (only) for repeaters in the summer semester 2021.

The assessment consists of a written exam (75 min.) according to § 4 paragraph 2 Nr. 1 of the examination regulation. The examination is offered every semester and can be repeated at every regular examination date.

A bonus can be acquired through successful participation in the practice. 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**

Knowledge from the course “Derivatives” is very helpful.

**Annotation**

The course will no longer be offered from winter semester 2020/21.
### 8.55 Course: Critical Information Infrastructures [T-WIWI-109248]

**Responsible:** Prof. Dr. Ali Sunyaev  
**Organisation:** KIT Department of Economics and Management  
**Part of:** M-WIWI-101472 - Informatics

<table>
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<td>Critical Information Infrastructures</td>
<td>2 SWS</td>
<td>Lecture</td>
<td>Sunyaev, Dehling, Lins</td>
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<td>WT 21/22</td>
<td>2511401</td>
<td>Exercises to Critical Information Infrastructures</td>
<td>1 SWS</td>
<td>Practice</td>
<td>Sunyaev, Dehling, Lins</td>
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#### Exams

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<td>7900067</td>
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<td>Sunyaev</td>
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#### 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


*Below you will find excerpts from events related to this course:*  

**Critical Information Infrastructures**  
2511400, WS 21/22, 2 SWS, Language: English, Open in study portal
Content
The course critical information infrastructures (CII) introduces students to the world of complex sociotechnical systems that permeate societies on a global scale. Students will learn to handle the complexities involved in the design, development, operation, and evaluation of critical information infrastructures. In the beginning of the course, critical information infrastructures will be introduced on a general level.

The following sessions will focus on an in-depth exploration of selected cases that represent current challenges in research and practice. Students will work (in a group of 4) on a selected topic and have to write a course paper. Students can choose a topic from a variety of topics. To answer the research questions, students can use literature reviews but also interviews, surveys, programming tasks, and other research methods.

There will be a short introduction to the topics for the course paper in the following topic areas. In addition, it will be possible to propose your own topics as a group in the topic areas:

- Distributed Ledger Technology
- Critical Cloud Services
- Health Information Infrastructures
- Vehicular Fog Computing
- Information Privacy
- Trustworthy Artificial Intelligence

Since we offer topics in this course that also correspond to the research interests in our research group, there may be the opportunity to work on the topics in more depth in the course of a final thesis.

Learning objectives:
Students know concepts and technologies relevant for the design and reliable operation of critical information infrastructures and can leverage them to develop solutions for real-world challenges.

Notes:
The number of participants is limited to 24 students. Please register via the WiWi portal: https://portal.wiwi.kit.edu/ys/5035
The registration will be opened from August 17, 2021 until October 1, 2021.

Please make sure that you are available at the following dates if you want to take the course:

- 21.10.2021, Noon–01:30 pm: 1. Introduction & Topic Area Presentations
- 04.11.2021, Noon–01:30 pm: 3. Critical Information Infrastructure Landscape
- 11.11.2021, Noon–01:30 pm: 4. Research on Information Systems & Group Assignment
- 10.12.2021, 10:00 am–06:00 pm: Interim Presentation (estimated)
- 28.01.2022, 10:00 am–06:00 pm: Final Presentation (estimated)

Further information on the course structure will be announced in the first session. Depending on the number of participants the individual sessions can have a shorter duration.

The meetings will take place online via MS Teams, as currently planned. We will provide a link to join the team if your registration was approved. Interim and final presentation may take a hybrid or real-life form.

If you have any questions regarding course registration, please contact lins@kit.edu or dehling@kit.edu
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

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<td>Database Systems and XML</td>
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<td>Exercises Database Systems and XML</td>
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**Exams**

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**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:

**Database Systems and XML**
2511202, WS 21/22, 2 SWS, Language: German, Open in study portal

**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 data base 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.
8.57 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>
<thead>
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<th>Recurrence</th>
<th>Version</th>
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<tr>
<td>WT 21/22</td>
<td>7900291</td>
<td>Demand-Driven Supply Chain Planning</td>
</tr>
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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.
8.58 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

**Type**
- Written examination

**Credits**
- 4.5

**Grading scale**
- Grade to a third

**Recurrence**
- Each summer term

**Version**
- 1

**Events**

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<td>Lecture</td>
<td>Uhrig-Homburg</td>
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<td>ST 2021</td>
<td>2530551</td>
<td>Übung zu Derivate</td>
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<td>Practice</td>
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**Exams**

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</table>

**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

**Below you will find excerpts from events related to this course:**

**Derivatives**

2530550, SS 2021, 2 SWS, Language: German, [Open in study portal](#)

**Organizational issues**


**Literature**


**Weiterführende Literatur:**

## 8.59 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

<table>
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<td>Each summer term</td>
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</table>

### Events

| ST 2021  | 2540558 | Designing Interactive Systems | 3 SWS | Lecture / 🖥 | Mädche, Gnewuch |

### Exams

| ST 2021  | 00009   | Designing Interactive Systems | Mädche |
| WT 21/22 | 7900205 | Designing Interactive Systems | Mädche |

**Legend:** 🖥 Online, 🧩 Blended (On-Site/Online), ☑️ On-Site, ⌚️ Cancelled

### 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

### Annotation

This course replaces T-WIWI-108461 "Interactive Information Systems" starting summer term 2020.
The course is held in english.

**Below you will find excerpts from events related to this course:**

<table>
<thead>
<tr>
<th>Designing Interactive Systems</th>
</tr>
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<tbody>
<tr>
<td>2540558, SS 2021, 3 SWS, Language: English, Open in study portal</td>
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</tbody>
</table>

Lecture (V) Online
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 systems 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.

Literature
Die Vorlesung basiert zu einem großen Teil auf
Weiterführende Literatur wird in der Vorlesung bereitgestellt.
# 8.60 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

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## Events

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<th>0100300</th>
<th>Differential Geometry</th>
<th>4 SWS</th>
<th>Lecture / Online</th>
<th>Leuzinger</th>
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<tbody>
<tr>
<td>ST 2021</td>
<td>0100310</td>
<td>Tutorial for 0100300 (Differential Geometry)</td>
<td>2 SWS</td>
<td>Practice / Online</td>
<td>Leuzinger</td>
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</table>

## Exams

| ST 2021   | 7700033 | Differential Geometry - Exam | | |
|-----------|---------|-------------------------------|---|---|---|

**Legend:** 🌐 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled
8.61 Course: Digital Health [T-WIWI-109246]

**Responsible:** Prof. Dr. Ali Sunyaev

**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>Digital Health</th>
<th>2 SWS</th>
<th>Lecture</th>
<th>Sunyaev, Thiebes, Schmidt-Kraepelin</th>
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</table>

**Exams**

<table>
<thead>
<tr>
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<th>Digital Health</th>
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<tbody>
<tr>
<td>WT 21/22</td>
<td>7900068</td>
<td>Digital Health</td>
<td>Sunyaev</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.

_Below you will find excerpts from events related to this course:_

<table>
<thead>
<tr>
<th>Digital Health</th>
<th>2511402, WS 21/22, 2 SWS, Language: English, <a href="#">Open in study portal</a></th>
<th>Lecture (V)</th>
</tr>
</thead>
</table>
Content
The master course Digital Health introduces master students to the subject of digitization in health care. Students will learn about the theoretical foundations and practical implications of various topics surrounding the digitization in health care, including health information systems, telematics, big health care data, and patient-centered health care.

After an introduction to the challenge of digitization in health care, the following sessions will focus on an in-depth exploration of selected cases that represent current challenges in research and practice. Students will work (in a group of 3-4) on a selected topic and have to write a course paper. Students can choose a topic from a variety of topics. To answer the research questions, students can use literature reviews but also interviews, surveys, programming tasks, and other research methods are possible.

There will be a short introduction to the topics for the course paper in the following topic areas. In addition, it will be possible to propose your own topics as a group in the topic areas:

- Mobile Health (mHealth) / Gamification
- Distributed Ledger Technology / Blockchain
- Artificial Intelligence / Machine Learning
- Genomics / Biomedical Data

Since we offer topics in this course that also correspond to the research interests in our research group, there may be the opportunity to work on the topics in more depth in the course of a final thesis.

Learning objectives:
Students know about the challenges of digitization in health care and can leverage relevant concepts and technologies to address these challenges. Students learn to work in teams and critically discuss digital health topics with fellow students, researchers, and practitioners.

Notes:
The number of participants is limited to 30 students. Please register here. The registration will be opened from September 7, 2021 until October 12, 2021.

Please make sure that you are available at the following dates if you want to take the course:

- 21.10.2021, 16:00–17:30 - 1. Introduction to Digital Health
- 28.10.2021, 16:00–17:30 - 2. Topic Area Presentation #1
- 04.11.2021, 16:00–17:30 - 3. Topic Area Presentation #2
- 11.11.2021, 16:00–17:30 - 4. Guest Lecture
- 10.02.2022, 10:00–17:00 - Final Presentation

Further information on the course structure will be announced in the first session. Depending on the number of participants the individual sessions can have a shorter duration.

The meetings will take place online via MS Teams. We will provide a link to join the team if your registration was approved.

If you have any questions regarding course registration, please contact scott.thiebes@kit.edu or manuel.schmidt-kraepelin@kit.edu
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

**Type:**
Examination of another type

**Credits:**
1.5

**Grading scale:**
Grade to a third

**Recurrence:**
Each summer term

**Version:**
1

### Events

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<td>Digital Marketing and Sales in B2B</td>
<td>Each summer term</td>
<td>1 SWS</td>
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<tr>
<td>ST 2021 7900297</td>
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<td>Digital Marketing and Sales in B2B</td>
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### Exams

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**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**

2571156, SS 2021, 1 SWS, Language: English, [Open in study portal](#)

**Others (sonst.)**

Online
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 levers 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
-
### 8.63 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

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**Prerequisites**

none
8.64 Course: Discrete Time Finance [T-MATH-105839]

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

**Organisation:** KIT Department of Mathematics  
**Part of:** M-MATH-102919 - Discrete Time Finance

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<td>4 SWS</td>
<td>Lecture</td>
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<td>WT 21/22 0108500</td>
<td>Übungen zu 0108400</td>
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<td>WT 21/22 6700054</td>
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<td>Bäuerle</td>
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**Prerequisites**
none
Course: Discrete-Event Simulation in Production and Logistics [T-WIWI-102718]

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

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

**Part of:**
- M-WIWI-102805 - Service Operations
- M-WIWI-102832 - Operations Research in Supply Chain Management

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<td>Each summer term</td>
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**Events**

| ST 2021 | 2550488 | Ereignisdiskrete Simulation in Produktion und Logistik | 3 SWS | Lecture Online | Spieckermann |

**Exams**

| ST 2021 | 7900267 | Discrete-Event Simulation in Production and Logistics | 3 SWS | Lecture On-Site | Spieckermann |

**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 2021, 3 SWS, Language: German, Open in study portal

**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.

**Literature**
8.66 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
8.67 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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<td>Brumm</td>
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<tr>
<td>WT 21/22 2560403</td>
<td>Practice</td>
<td>Übung zu Dynamic Macroeconomics</td>
<td>1</td>
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<td>Krause</td>
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**Exams**

<table>
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<tbody>
<tr>
<td>ST 2021 7900245</td>
<td>Dynamic Macroeconomics</td>
<td>Brumm</td>
</tr>
</tbody>
</table>

**Competence Certificate**  
The assessment consists of a oral exam (30 min.).

**Prerequisites**  
None.

*Below you will find excerpts from events related to this course:*

**Dynamic Macroeconomics**  
2560402, WS 21/22, 2 SWS, Language: English, Open in study portal

**Literature**  
Literatur und Skripte werden in der Veranstaltung angegeben.
8.68 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
8.69 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

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**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 2021, 2 SWS, Language: English, [Open in study portal](#)  
Lecture (V)  
Online

**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**

Freitag 09:45-11:15 Uhr

**Literature**

Wird in der Vorlesung bekanntgegeben.
### 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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**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 21/22, 2 SWS, Language: English, [Open in study portal](#)

**Literature**


**Weiterführende Literatur:**

8.71 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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**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: 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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**Exams**

| ST 2021 | 7900128 | Seminar Emerging Trends in Internet Technologies (Master) | Sunyaev |

Legend: 🛥️ Online, 🕵️ Blended (On-Site/Online), 🗣️ On-Site, ✗ Cancelled

**Competence Certificate**

The alternative exam assessment consists of a final thesis.

**Prerequisites**

None.

**Annotation**

The course is usually held as a block course.
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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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 2021, 2 SWS, Language: German, Open in study portal

Lecture (V)

Online

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)
### 8.74 Course: Energy Market Engineering [T-WIWI-107501]

**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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#### Exams

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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

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 2021, 2 SWS, Language: German, [Open in study portal](#)

### Literature

**8.75 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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**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 21/22, 2 SWS, 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”, redispach, 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


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

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Events

- **WT 21/22**  
  2581002  
  Energy Systems Analysis  
  2 SWS  
  Lecture  
  Fichtner, Ardone, Dengiz, Yilmaz

Exams

- **ST 2021**  
  7981002  
  Energy Systems Analysis  
  Fichtner

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**

- 2581002, WS 21/22, 2 SWS, Language: English, Open in study portal

Lecture (V)

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

Bitte Institutsaushang beachten.
Literature
Weiterführende Literatur:

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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8.78 Course: Experimental Economics [T-WIWI-102614]

**Responsibility:** 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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**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

*Below you will find excerpts from events related to this course:*

**Experimental Economics**

2540489, WS 21/22, 2 SWS, Language: German, [Open in study portal](#)

**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.
Course: Exponential Integrators [T-MATH-107475]

**Responsible:** Prof. Dr. Marlis Hochbruck  
**Organisation:** KIT Department of Mathematics  
**Part of:** M-MATH-103700 - Exponential Integrators

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<td>Dörich, Leibold</td>
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</tbody>
</table>

**Prerequisites**

none
## 8.80 Course: Extremal Graph Theory [T-MATH-105931]

| Responsible: | Prof. Dr. Maria Aksenovich |
| Organisation: | KIT Department of Mathematics |
| Part of: | M-MATH-102957 - Extremal Graph Theory |

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<td>Recurrence</td>
<td>Each term</td>
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<td>Version</td>
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## 8.81 Course: Extreme Value Theory [T-MATH-105908]

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

**Organisation:** KIT Department of Mathematics  

**Part of:** M-MATH-102939 - Extreme Value Theory

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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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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 21/22, 2 SWS, Language: German, Open in study portal

Literature
Weiterführende Literatur:

- Love, Morris, Wesolowsky: Facilities Location: Models and Methods, North Holland, 1988

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled
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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<td>Lecture / Online</td>
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<tr>
<td>ST 2021 2530206 Übungen zu Financial Analysis</td>
<td>2 SWS</td>
<td>Practice / Online</td>
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**Exams**

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<tr>
<td>WT 21/22 7900059 Financial Analysis</td>
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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 2021, 2 SWS, Language: English, [Open in study portal]

**Literature**

### 8.84 Course: Financial Econometrics [T-WIWI-103064]

<table>
<thead>
<tr>
<th>Responsible:</th>
<th>Prof. Dr. Melanie Schienle</th>
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<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 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 course takes place each second summer term: 2018/2020....
### 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 |

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**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 course takes place each second winter term starting in WS2020/21
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

### Type
- Written examination

### Credits
- 4,5

### Grading scale
- Grade to a third

### Recurrence
- Each winter term

### Version
- 1

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<td>1 SWS</td>
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<td>Each winter term</td>
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<td>Grade to a third</td>
<td>Each winter term</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

**Recommendation**
None

Below you will find excerpts from events related to this course:

**Financial Intermediation**
- 2530232, WS 21/22, 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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#### Events

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<td>Finite Element Methods</td>
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<td>0110310</td>
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<td>Practice</td>
<td>Dörfler</td>
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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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### 8.89 Course: Fixed Income Securities [T-WIWI-102644]

**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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<td>Grade to a third</td>
<td>see Annotations</td>
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</table>

**Competence Certificate**  
The examination is offered for first-time writers for the last time in the winter semester 2020/21 and (only) for repeaters in the summer semester 2021.

The assessment takes place in the form of a written examination (75 minutes) according to §4(2), 1 SPO. The examination takes place during the semester break. The examination is offered every semester and can be repeated at any regular examination date. A bonus can be acquired through successful participation in the 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**  
Knowledge from the course "Derivatives" is very helpful.

**Annotation**  
The course will no longer be offered from winter semester 2020/21.
8.90 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

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**Events**

| ST 2021 | 0178000 | Forecasting: Theory and Practice II | 2 SWS | Lecture / Online | Gneiting |
| ST 2021 | 0178010 | Tutorial for 0178010 (Forecasting: Theory and Practice II) | 1 SWS | Practice / Online | Gneiting |

**Exams**

| ST 2021 | 7700010 | Forecasting: Theory and Practice | Gneiting |

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ❌ Cancelled
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**

none
8.92 Course: Fourier Analysis [T-MATH-105845]

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

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-102873 - Fourier Analysis

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**Responsibility:** Jun.-Prof. Dr. Xian Liao

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-104827 - Fourier Analysis and its Applications to PDEs

**Prerequisites:**
none
Course: Fractal Geometry [T-MATH-111296]

Responsible: PD Dr. Steffen Winter
Organisation: KIT Department of Mathematics
Part of: M-MATH-105649 - Fractal Geometry

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Exams

| ST 2021 | 7700111 | Fractal Geometry | Winter |

Prerequisites
none
8.95 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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**Events**

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**Exams**

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8.96 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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**Prerequisites**
none
### 8.97 Course: Functions of Operators [T-MATH-105905]

**Organisation:** KIT Department of Mathematics  
**Part of:** M-MATH-102936 - Functions of Operators

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</table>
8.98 Course: Generalized Regression Models [T-MATH-105870]

**Responsible:** Prof. Dr. Norbert Henze  
PD Dr. Bernhard Klar

**Organisation:** KIT Department of Mathematics  
**Part of:** M-MATH-102906 - Generalized Regression Models

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<td>2 SWS Lecture</td>
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<td>ST 2021</td>
<td>0161410 Übungen zu 0161400</td>
<td>1 SWS Practice</td>
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<tr>
<td>ST 2021</td>
<td>7700012 Generalized Regression Models</td>
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<td>Ebner</td>
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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ⌚ Cancelled
# 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  

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**Events**

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<th>SWS</th>
<th>Type</th>
<th>Tutor</th>
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</table>
| ST 2021 0153300 | Geometric Group Theory | 4 SWS  
Lecture / Online | Llosa Isenrich |
| ST 2021 0153310 | Tutorial for 0153300 (Geometric Group Theory) | 2 SWS  
Practice / Online | Llosa Isenrich |

**Exams**

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<td>ST 2021 7700005</td>
<td>Geometric Group Theory - Exam</td>
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</table>

Llosa Isenrich  

Legend: 📇 Online, 🟢 Blended (On-Site/Online), 📋 On-Site, ✗ Cancelled
### 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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**Prerequisites**
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### 8.102 Course: Global Differential Geometry [T-MATH-105885]

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<th><strong>Type</strong></th>
<th><strong>Credits</strong></th>
<th><strong>Grading scale</strong></th>
<th><strong>Version</strong></th>
</tr>
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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>

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

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-102912 - Global Differential Geometry

**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

<table>
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<td>4.5</td>
<td>Grade to a third</td>
<td>Each summer term</td>
<td>1</td>
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</table>

**Events**

| ST 2021 | 2550134 | Globale Optimierung I | 2 SWS | Lecture / Online | Stein |

**Exams**

| ST 2021 | 7900270_SS2021_HK | Global Optimization I | Stein |

*Legend: Online, Blended (On-Site/Online), On-Site, Cancelled*

**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:

**Globale Optimierung I**

2550134, SS 2021, 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 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 COURSES

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 |

<table>
<thead>
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<tr>
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<td>Grade to a third</td>
<td>Each summer term</td>
<td>1</td>
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</table>

**Events**

| ST 2021 | 2550134 | Globale Optimierung I | 2 SWS | Lecture / Online | Stein |
| ST 2021 | 2550135 | Übung zu Globale Optimierung I und II | 2 SWS | Practice / Online | Stein, Schwarz, Beck |
| ST 2021 | 2550136 | Globale Optimierung II | 2 SWS | Lecture / Online | Stein |

**Exams**

| ST 2021 | 7900272_SS2021_HK | Global Optimization I and II | | Stein |

---

**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:

**V** Globale Optimierung I
2550134, SS 2021, 2 SWS, Language: German, Open in study portal

Lecture (V)  
Online
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
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

**Events**
<table>
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<th>ST 2021</th>
<th>2550136</th>
<th>Globale Optimierung II</th>
<th>2 SWS</th>
<th>Lecture / Online</th>
<th>Stein</th>
</tr>
</thead>
</table>

| Exams   | ST 2021 | 7900271_SS2021_HK | Global Optimization II | 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:

<table>
<thead>
<tr>
<th>Globale Optimierung II</th>
<th>Lecture (V)</th>
<th>2550136, SS 2021, 2 SWS, Language: German, Open in study portal</th>
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</table>
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
8.106 Course: Graph Theory [T-MATH-102273]

**Responsible:** Prof. Dr. Maria Aksenovich

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-101336 - Graph Theory

<table>
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**Events**

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<th>Course Name</th>
<th>SWS</th>
<th>Type</th>
<th>Lecturer</th>
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<td>0104500</td>
<td>Graph Theory</td>
<td>4</td>
<td>Lecture</td>
<td>Aksenovich, Weber</td>
</tr>
<tr>
<td>WT 21/22</td>
<td>0104510</td>
<td>Tutorial for 0104500 (Graph Theory)</td>
<td>2</td>
<td>Practice</td>
<td>Aksenovich</td>
</tr>
</tbody>
</table>

**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

<table>
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<th>Recurrence</th>
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<td>4.5</td>
<td>Grade to a third</td>
<td>Irregular</td>
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**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
8.109 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

<table>
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<td>4,5</td>
<td>Grade to a third</td>
<td>Each winter term</td>
<td>1</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.
### 8.110 Course: Harmonic Analysis [T-MATH-111289]

**Organisation:** KIT Department of Mathematics  
**Part of:** M-MATH-105324 - Harmonic Analysis

<table>
<thead>
<tr>
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<th>Credits</th>
<th>Grading scale</th>
<th>Version</th>
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</thead>
<tbody>
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<th>Harmonic Analysis</th>
<th>Frey</th>
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<td>Oral examination</td>
<td>8</td>
<td>Grade to a third</td>
<td>Irregular</td>
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</table>

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

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-103545 - Harmonic Analysis for Dispersive Equations

**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

<table>
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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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### Events

<table>
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<tr>
<th>Events</th>
</tr>
</thead>
<tbody>
<tr>
<td>ST 2021 2581001 Heat Economy 2 SWS Lecture / Online Fichtner</td>
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<table>
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<th>Exams</th>
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<tbody>
<tr>
<td>ST 2021 7981001 Heat Economy Fichtner</td>
</tr>
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</table>

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

### 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 2021, 2 SWS, Language: German, [Open in study portal](#)  
Lecture (V)  
Online

### Organizational issues

Seminarraum Standort West Mittwoch: 08:00 - 09:30
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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<th>Credits</th>
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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>
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</table>
8 COURSES

Course: Human Factors in Security and Privacy [T-WIWI-109270]

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

<table>
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<td>see Annotations</td>
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Events

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<tbody>
<tr>
<td>WT 21/22 2511554</td>
<td>Human Factors in Security and Privacy</td>
<td>2 SWS</td>
<td>Lecture, Volkamer</td>
</tr>
<tr>
<td>WT 21/22 2511555</td>
<td>Übungen zu Human Factors in Security and Privacy</td>
<td>1 SWS</td>
<td>Practice, Volkamer, Berens</td>
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Exams

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<tr>
<th>Events</th>
<th>Type</th>
<th>Credits</th>
<th>Lecturer</th>
</tr>
</thead>
<tbody>
<tr>
<td>WT 21/22 7900113</td>
<td>Human Factors in Security and Privacy</td>
<td></td>
<td>Volkamer</td>
</tr>
</tbody>
</table>

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 21/22, 2 SWS, Language: German/English, Open in study portal
Literature

- Security and Usability: Designing Secure Systems that People Can Use von Lorrie Faith Cranor und Simson Garfinkel. 2005
8 COURSES

Course: Incentives in Organizations [T-WIWI-105781]

**Responsible:** Prof. Dr. Petra Nieken

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

**Part of:**
- M-WIWI-101500 - Microeconomic Theory
- M-WIWI-101505 - Experimental Economics

<table>
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<tbody>
<tr>
<td>Written examination</td>
<td>4.5</td>
<td>Grade to a third</td>
<td>Each summer term</td>
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**Events**

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<th>Events</th>
<th>Credits</th>
<th>Recurrence</th>
<th>Type</th>
<th>Grade to a third</th>
<th>Organiser</th>
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<tr>
<td>ST 2021 2573003 Incentives in Organizations 2 SWS</td>
<td>Lecture / 🖥</td>
<td>Nieken</td>
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<tr>
<td>ST 2021 2573004 Übung zu Incentives in Organizations 2 SWS</td>
<td>Practice / 🖥</td>
<td>Nieken, Mitarbeiter</td>
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**Exams**

<table>
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<tr>
<th>Events</th>
<th>Credits</th>
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<th>Type</th>
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<th>Organiser</th>
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<tbody>
<tr>
<td>ST 2021 7900132 Incentives in Organizations</td>
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</tbody>
</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 2021, 2 SWS, Language: English, Open in study portal

**Lecture (V)**
Online
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

Organizational issues
There are recordings of the lecture contents. There will be live sessions on selected lecture dates. These will be announced at the start of the lecture time.
8 COURSES

**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

<table>
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<th>Grading scale</th>
<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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### Events

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<th>Course Name</th>
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<tr>
<td>ST 2021</td>
<td>2511606</td>
<td>Information Service Engineering</td>
<td>2 SWS</td>
<td>Lecture / Online</td>
<td>Sack</td>
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<td>ST 2021</td>
<td>2511607</td>
<td>Exercises to Information Service Engineering</td>
<td>1 SWS</td>
<td>Practice / Online</td>
<td>Sack</td>
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<table>
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<tr>
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<th>Course ID</th>
<th>Course Name</th>
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<tbody>
<tr>
<td>ST 2021</td>
<td>7900070</td>
<td>Information Service Engineering (Registration until 12 July 2021)</td>
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<td>WT 21/22</td>
<td>7900071</td>
<td>Information Service Engineering</td>
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</table>

**Examiners**

- Sack

**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 (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:**

<table>
<thead>
<tr>
<th>Course ID</th>
<th>SWS</th>
<th>Language</th>
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<tbody>
<tr>
<td>2511606</td>
<td>2</td>
<td>English</td>
<td>Open in study portal</td>
</tr>
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</table>

Economathematics M.Sc.  
Module Handbook as of 30/09/2021  
347
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

- 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

<table>
<thead>
<tr>
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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>Type</th>
<th>Lecturer</th>
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<tr>
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<td>Innovation theory and policy</td>
<td>2</td>
<td>Lecture / Online</td>
<td>Ott</td>
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<tr>
<td>ST 21</td>
<td>2560237</td>
<td>Innovation theory and policy</td>
<td>1</td>
<td>Practice / Online</td>
<td>Ott</td>
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**Exams**

<table>
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<tr>
<th>Term</th>
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<th>Title</th>
<th>SWS</th>
<th>Type</th>
<th>Lecturer</th>
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<td>Innovation theory and policy</td>
<td>1</td>
<td>Practice / Online</td>
<td>Ott</td>
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<td>WT 21/22</td>
<td>7900077</td>
<td>Innovation theory and policy</td>
<td>1</td>
<td>Practice / Online</td>
<td>Ott</td>
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</table>

**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**

2560236, SS 2021, 2 SWS, Language: German/English, [Open in study portal](#)
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

<table>
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**Events**

| ST 2021 | 0160510 | Übungen zu 0160500 (Numerische Methoden für Integralgleichungen) | 2 SWS | Practice | Arens |

Legend: 🖥 Online, 💻 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled
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 |  |
| WT 21/22 | 2572189 |
| International Business Development and Sales | 4 SWS |
| Block / 🗣 | Klarmann, Terzidis, Casenave |

Legend: 🖥 Online, ⚠️ Blended (On-Site/Online), 🗣 On-Site, X Cancelled

Competence Certificate
Non exam assessment. The grade is based on the presentation, the subsequent discussion and the written elaboration.

Annotation
Due to the Corona situation it is currently unclear whether the seminar can be offered in WS20 / 21.

Below you will find excerpts from events related to this course:

International Business Development and Sales
2572189, WS 21/22, 4 SWS, Language: English, Open in study portal

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.
8.120 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

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Events

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<th>Language</th>
<th>Type</th>
<th>Credits</th>
<th>Type</th>
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<th>Grading scale</th>
<th>Recurrence</th>
<th>Version</th>
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<td>German</td>
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<td>2 SWS</td>
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<td>2 SWS</td>
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<td>see Annotations</td>
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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:

International Finance
2530570, SS 2021, 2 SWS, Language: German, Open in study portal

Organizational issues
nach dem 21.04. nach Absprache

Literature

Weiterführende Literatur:

### 8.121 Course: Introduction into Particulate Flows [T-MATH-105911]

**Responsible:** Prof. Dr. Willy Dörfler  
**Organisation:** KIT Department of Mathematics  
**Part of:** M-MATH-102943 - Introduction into Particulate Flows

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</table>

**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 Fluid Dynamics [T-MATH-111297]

<table>
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<tr>
<th>Responsible</th>
<th>Prof. Dr. Wolfgang Reichel</th>
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<tbody>
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<td>KIT Department of Mathematics</td>
</tr>
<tr>
<td>Part of</td>
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#### Type | Credits | Grading scale | Recurrence | Version |
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**Exams**

| ST 2021 | 7700107 | Introduction to Fluid Dynamics | Zillinger |

**Prerequisites**

none
8.124 Course: Introduction to Geometric Measure Theory [T-MATH-105918]

**Responsible:** PD Dr. Steffen Winter

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-102949 - Introduction to Geometric Measure Theory

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**Prerequisites**
none
### Course: Introduction to Homogeneous Dynamics [T-MATH-110323]

<table>
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<tr>
<th>Responsible</th>
<th>Prof. Dr. Tobias Hartnick</th>
</tr>
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<td>KIT Department of Mathematics</td>
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<tr>
<td>Part of</td>
<td>M-MATH-105101 - Introduction to Homogeneous Dynamics</td>
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<td>Recurrence</td>
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</table>

**Prerequisites**
none
8.126 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

<table>
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<th>Recurrence</th>
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<td>Grade to a third</td>
<td>Irregular</td>
<td>1 terms</td>
<td>1</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.
8.127 Course: Introduction to Kinetic Theory [T-MATH-108013]

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

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-103919 - Introduction to Kinetic Theory

<table>
<thead>
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<td>Each winter term</td>
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**Events**

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<th>SWS</th>
<th>Type</th>
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<tr>
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<td>0155450</td>
<td>Introduction to Kinetic Theory</td>
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<td>Lecture</td>
<td>Frank</td>
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<tr>
<td>WT 21/22</td>
<td>0155460</td>
<td>Tutorial for 0155450 (Introduction to Kinetic Theory)</td>
<td>1</td>
<td>Practice</td>
<td>Frank</td>
</tr>
</tbody>
</table>

**Prerequisites**

none

*Below you will find excerpts from events related to this course:*  

**Introduction to Kinetic Theory**

0155450, WS 21/22, 2 SWS, Language: English, [Open in study portal](#)
8.128 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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**Prerequisites**
none
8.129 Course: Introduction to Microlocal Analysis [T-MATH-111722]

Responsible: Jun.-Prof. Dr. Xian Liao
Organisation: KIT Department of Mathematics
Part of: M-MATH-105838 - Introduction to Microlocal Analysis

Type: Oral examination
Credits: 3
Grading scale: Grade to a third
Recurrence: Irregular
Expansion: 1 terms
Version: 1

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.
### 8.130 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

<table>
<thead>
<tr>
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<th>Grading scale</th>
<th>Version</th>
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<tr>
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<td>Grade to a third</td>
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**Events**

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<th>0165000</th>
<th>Einführung in das Wissenschaftliche Rechnen</th>
<th>3 SWS</th>
<th>Lecture / 📱</th>
<th>Dörfler, Sukhova</th>
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</thead>
<tbody>
<tr>
<td>ST 2021</td>
<td>0166000</td>
<td>Praktikum zu 0165000 (Einführung in das Wissenschaftliche Rechnen)</td>
<td>3 SWS</td>
<td>Practical course / 📱</td>
<td>Dörfler</td>
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</table>

**Exams**

| ST 2021 | 7700089 | Introduction to Scientific Computing | Dörfler |

Legend: 📱 Online, 🤸‍♂️ Blended (On-Site/Online), 🗣 On-Site, ❌ Cancelled
8.131 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

**Type** | **Credits** | **Grading scale** | **Recurrence** | **Version**
---|---|---|---|---
Examination of another type | 4.5 | Grade to a third | Each summer term | 2

---

| Events | | |
|---|---|---|---|---|
| ST 2021 2550470 | **Einführung in die Stochastische Optimierung** | 2 SWS | Lecture / 🖥 | Rebennack |
| ST 2021 2550471 | **Übung zur Einführung in die Stochastische Optimierung** | 1 SWS | Practice / 🖥 | Rebennack, Sinske |
| ST 2021 2550474 | **Rechnerübung zur Einführung in die Stochastische Optimierung** | 2 SWS | Practice / 🖥 | Rebennack, Sinske |

| Exams | | |
|---|---|---|---|
| ST 2021 7900311 | **Introduction to Stochastic Optimization** | | Rebennack |

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

**Competence Certificate**
Alternative exam assessment (open book exam). The exam takes place in every semester.

**Prerequisites**
None.
### 8.132 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

<table>
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**Events**

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<th>Inverse Problems</th>
<th>4 SWS</th>
<th>Lecture</th>
<th>Rieder</th>
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<tr>
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<td>0105110</td>
<td>Tutorial for 0105100 (Inverse Problems)</td>
<td>2 SWS</td>
<td>Practice</td>
<td>Rieder</td>
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</tbody>
</table>
8.133 Course: Judgment 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

Type: Written examination
Credits: 4.5
Grading scale: Grade to a third
Recurrence: Each winter term
Expansion: 1 terms
Version: 1

Events

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Legend: 📚 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

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 21/22, 3 SWS, Language: English, Open in study portal

Lecture (V) 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.
8.134 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

**Type**
- Oral examination

**Credits**
- 5

**Grading scale**
- Grade to a third

**Recurrence**
- Irregular

**Version**
- 1

**Prerequisites**
none
8.135 Course: Knowledge Discovery [T-WIWI-102666]

Responsible: Michael Färber
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101472 - Informatics

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Exams

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Competence Certificate
The assessment consists of an 1h written exam following §4, Abs. 2, 1 of the examination regulation. Students can be awarded a bonus on their final grade if they successfully complete special assignments.

Prerequisites
None

Below you will find excerpts from events related to this course:

Knowledge Discovery
2511302, WS 21/22, 2 SWS, Language: English, Open in study portal

Content
The lecture gives an overview of approaches of machine learning and data mining for knowledge acquisition 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 21/22, 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:

- 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
### 8.136 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
### 8.137 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**  
Alternative exam assessment (open book exam). The exam takes place in every semester.

**Prerequisites**  
None.
8.138 Course: Lie Groups and Lie Algebras [T-MATH-108799]

**Responsible:** Prof. Dr. Enrico Leuzinger

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-104261 - Lie Groups and Lie Algebras

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8.139 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
8.140 Course: Machine Learning 1 - Basic Methods [T-WIWI-106340]

Responsibility: Prof. Dr.-Ing. Johann Marius Zöllner
Organisation: KIT Department of Economics and Management

Part of: M-WIWI-101472 - Informatics

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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 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

2511500, WS 21/22, 2 SWS, Language: German, Open in study portal

Lecture (V)

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 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.
8.141 Course: Machine Learning 2 – Advanced Methods [T-WIWI-106341]

**Responsible:** 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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Legend: Online, Blended (On-Site/Online), On-Site, X Cancelled

**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 2 - Advanced methods**

2511502, SS 2021, 2 SWS, Language: German, Open in study portal

**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.
**8.142 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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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Canceled

**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.

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.

The exact details will be announced in the lecture.

**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 2021, 2 SWS, Language: German, [Open in study portal](#)
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 2021, 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.
8.143 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

<table>
<thead>
<tr>
<th>Type</th>
<th>Credits</th>
<th>Grading scale</th>
<th>Recurrence</th>
<th>Version</th>
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<td>Written exam</td>
<td>4.5</td>
<td>Grade to a third</td>
<td>Each summer term</td>
<td>3</td>
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</table>

**Events**

| ST 2021 | 2571150 | Market Research | 2 SWS | Lecture / Online | Klarmann |
| ST 2021 | 2571151 | Market Research Tutorial | 1 SWS | Practice / Online | Honold |

**Exams**

| ST 2021 | 7900015 | Market Research | Klarmann |

Legend: 📲 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

**Competence Certificate**

The assessment of success takes place through a written exam (according to SPO § 4 Abs. 2, Pkt. 1) with additional aids in the sense of an open book exam. In the winter term 2021/22, 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 2021, 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
## 8.144 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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### Events

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<th>Recurrence</th>
<th>Credits</th>
<th>Type</th>
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<td>Marketing Strategy Business Game</td>
<td>Block / 🖥</td>
<td>Klarmann, Mitarbeiter</td>
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<td>ST 2021</td>
<td>2571183</td>
<td>Marketing Strategy Business Game</td>
<td>15WS</td>
<td>Block / 🖥</td>
<td>Klarmann, Mitarbeiter</td>
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### Examination of another type

- **Credits:** 1.5
- **Grading scale:** Grade to a third
- **Recurrence:** Each summer term
- **Version:** 1

### 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: 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.

Below you will find excerpts from events related to this course:

### Events

- **Marketing Strategy Business Game**
  - **2571183, SS 2021, 1 SWS, Language: German**, [Open in study portal]
Content
Using Markstrat, a marketing strategy business game, students work in groups representing a company that competes on a simulated market against the other groups’ companies.

Students
- are able to operate the strategic marketing simulation software "Markstrat"
- are able to take strategic marketing decisions in groups
- know how to apply strategic marketing concepts to practical contexts (e.g. for market segmentation, product launches, coordination of the marketing mix, market research, choice of the distribution channel or competitive behavior)
- are capable to collect and to select information usefully with the aim of decision-making
- are able to react appropriately to predetermined market conditions
- know how to present their strategies in a clear and consistent way
- are able to talk about the success, problems, critical incidents, external influences and strategy changes during the experimental game and to reflect and present their learning success

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.

- 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 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.

Organizational issues
Termine werden bekannt gegeben

Literature
8.145 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

<table>
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<th>3 SWS</th>
<th>Lecture</th>
<th>Bäuerle</th>
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<td>0159910</td>
<td>Übungen zu 0159900 (Markovsche Entscheidungsprozesse)</td>
<td>1 SWS</td>
<td>Practice</td>
<td>Bäuerle</td>
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**Exams**

<table>
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<th>77341</th>
<th>Markov Decision Processes</th>
<th>Bäuerle</th>
</tr>
</thead>
</table>

**Prerequisites**

none
8.146 Course: Master Thesis [T-MATH-105878]

**Responsible:** Dr. Sebastian Grensing  
**Organisation:** KIT Department of Mathematics  
**Part of:** M-MATH-102917 - Master Thesis

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<td>Grade to a third</td>
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</tbody>
</table>

**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
8.147 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

---

**Type**
Oral examination

**Credits**
8

**Grading scale**
Grade to a third

**Version**
1

**Prerequisites**
none
### 8.148 Course: Mathematical Methods of Imaging [T-MATH-106488]

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#### Responsible:
Prof. Dr. Andreas Rieder

#### Organisation:
KIT Department of Mathematics

#### Part of:
M-MATH-103260 - Mathematical Methods of Imaging

#### Events

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<thead>
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<th>ST 2021</th>
<th>0102900</th>
<th>Mathematische Methoden der Bildgebung</th>
<th>2+2 SWS</th>
<th>Lecture / 🖥</th>
<th>Rieder</th>
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<td></td>
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<td>0102910</td>
<td>Übungen zu 0102900</td>
<td>2 SWS</td>
<td>Practice / 🖥</td>
<td>Rieder</td>
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<td>Exams</td>
<td>ST 2021</td>
<td>7700091</td>
<td>Mathematical Methods of Imaging</td>
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<td>Rieder</td>
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</table>

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 📧 On-Site, ✗ Cancelled

#### Prerequisites
None
8.149 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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**Events**

| WT 21/22 | 0109400 | Mathematical Modelling and Simulation | 2 SWS | Lecture | Thäter  
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<td>0109410</td>
<td>Tutorial for 0109400</td>
<td>1 SWS</td>
<td>Practice</td>
<td>Thäter</td>
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*Below you will find excerpts from events related to this course:*

**Mathematical Modelling and Simulation**  
0109400, WS 21/22, 2 SWS, Language: English, [Open in study portal](#)  
Lecture (V)
### 8.150 Course: Mathematical Statistics [T-MATH-105872]

| Responsible          | Prof. Dr. Norbert Henze  
|                      | PD Dr. Bernhard Klar  
| Organisation         | KIT Department of Mathematics  
| Part of              | M-MATH-102909 - Mathematical Statistics  

| Type                  | Oral examination  
|-----------------------|-------------------  
| Credits               | 4  
| Grading scale         | Grade to a third  
| Version               | 1  

**Prerequisites**

none
8 COURSES

Course: Mathematical Topics in Kinetic Theory [T-MATH-108403]

8.151 Course: Mathematical Topics in Kinetic Theory [T-MATH-108403]

Responsible: Prof. Dr. Dirk Hundertmark
Organisation: KIT Department of Mathematics
Part of: M-MATH-104059 - Mathematical Topics in Kinetic Theory

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Prerequisites
none
8.152 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

<table>
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**Events**

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<th>2 SWS</th>
<th>Lecture / Online</th>
<th>Grothe</th>
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<td>Übung zu Mathematische Grundlagen hochdimensionaler Statistik</td>
<td>2 SWS</td>
<td>Practice / Online</td>
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**Exams**

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<th>Mathematics for High Dimensional Statistics</th>
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</table>

**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.

Below you will find excerpts from events related to this course:

**Mathematische Grundlagen hochdimensionaler Statistik**

Lecture (V)

Online

2550562, SS 2021, 2 SWS, Open in study portal

**Content**

The lecture focuses on modelling statistical objects (random vectors, random matrices and random graphs) in high dimensions. It deals with concentration inequalities that limit the fluctuations of such objects as well as complexity measures for quantities and functions. The theory is transferred to well-known and widespread applications such as neighbourhood detection in networks, statistical learning theory and LASSO.

**Learning objectives:**

Students are able to

- name and justify statistical properties of high-dimensional objects (vectors, matrices, functions).
- describe and explain differences in the behaviour between low- and high-dimensional random objects.
- name procedures for assess uncertainties in statistical models and apply them in simple examples.
- decide well-founded which modeling of high-dimensional structures is best suited in a specific situation.
- transform data into lower dimensions and quantify approximation errors.
- understand basic proofs in high-dimensional statistics using examples.
- develop, implement and evaluate smaller simulations in a programming language of their choice.
### 8.153 Course: Maxwell's Equations [T-MATH-105856]

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<tr>
<th>Responsible</th>
<th>PD Dr. Tilo Arens</th>
</tr>
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<tbody>
<tr>
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<td>Prof. Dr. Roland Griesmaier</td>
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<tr>
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<td>PD Dr. Frank Hettlich</td>
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<td>Part of</td>
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<td>Grade to a third</td>
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<tr>
<td>Version</td>
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</table>
### 8.154 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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<tbody>
<tr>
<td>Oral examination</td>
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<td>Grade to a third</td>
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</table>

**Prerequisites**  
none
8.155 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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<th>Version</th>
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**Events**

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<th>Credits</th>
<th>Grading scale</th>
<th>Recurrence</th>
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<tr>
<td>WT 21/22</td>
<td>2550138</td>
<td>Mixed-integer Programming I</td>
<td>Lecture</td>
<td>2 SWS</td>
<td></td>
<td></td>
<td>Stein</td>
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<tr>
<td>WT 21/22</td>
<td>2550139</td>
<td>Exercises Mixed Integer Programming I</td>
<td>Practice</td>
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<td>Grade to a third</td>
<td>Stein, Beck, Neumann</td>
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</table>

**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:*

**Mixed-integer Programming I**

2550138, WS 21/22, 2 SWS, Language: German, [Open in study portal](#)
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 linear optimization problems and is structured as follows:

- Introduction, solvability, and basic concepts
- LP relaxation and error bounds for roundings
- Branch-and-bound method
- Gomory's cutting plane method
- Benders decomposition

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 nonlinear optimization problems forms the contents of the lecture "Mixed-integer Programming II".

Learning objectives:
The student

- knows and understands the fundamentals of linear mixed integer programming,
- is able to choose, design and apply modern techniques of linear mixed integer programming in practice.

Literature

- J. Kallrath: Gemischt-ganzzahlige Optimierung, Vieweg, 2002
- D. Li, X. Sun: Nonlinear Integer Programming, Springer, 2006
8.156 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

<table>
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<td>4.5</td>
<td>Grade to a third</td>
<td>Irregular</td>
<td>1</td>
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</tbody>
</table>

**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).
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

<table>
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<tr>
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**Events**

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<td>WT 21/22</td>
<td>2550490</td>
<td>Modellieren und OR-Software: Fortgeschrittene Themen</td>
<td>3</td>
<td>Practical course / 🖥️</td>
<td>Pomes</td>
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Legend:  🖥️ Online,  🧩 Blended (On-Site/Online),  🗣 On-Site,  🗑️Cancelled

**Competence Certificate**
The assessment is a 120 minutes examination, including a written and a practical part (according to §4(2), 1 of the examination regulation).

The examination is held in the term of the software laboratory and the following term.

**Prerequisites**
None.

**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 21/22, 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**
die genauen Termine werden auf der Homepage bekannt gegeben
Link zur Bewerbung: http://go.wiwi.kit.edu/OR_Bewerbung
01.09.2021 09:00 - 25.09.2021 23:55
8.158 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

<table>
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<th>Recurrence</th>
<th>Version</th>
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Events

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<th>Responsible</th>
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<td>3 SWS</td>
<td>Practical course</td>
<td>Nickel, Pomes, Bakker, Zander</td>
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Exams

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<td>ST 2021</td>
<td>3 SWS</td>
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<td>Nickel</td>
</tr>
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</table>

Legends: 🌐 Online, 🏛 Blended (On-Site/Online), 🏡 On-Site, ✗ Cancelled

Competence Certificate
The assessment is a 120 minutes examination, including a written and a practical part (according to §4(2), 1 of the examination regulation).

The examination is held in the term of the software laboratory and the following term.

Prerequisites
None

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 2021, 3 SWS, Language: German, Open in study portal

Practical course (P)
Online

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.
### 8.159 Course: Moduli Spaces of Translation Surfaces [T-MATH-111271]

**Organisation:** KIT Department of Mathematics  
**Part of:** M-MATH-105635 - Moduli Spaces of Translation Surfaces

<table>
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**Exams**

| ST 2021 | 7700100 | Moduli Spaces of Translation Surfaces | Herrlich |

**Prerequisites**

none
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**Responsible:** PD Dr. Gerd Herzog  
**Organisation:** KIT Department of Mathematics  
**Part of:** M-MATH-102887 - Monotonicity Methods in Analysis
8.161 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

<table>
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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 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).
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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### Events

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Exams

<table>
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<tr>
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<th>Code</th>
<th>Description</th>
<th>Type</th>
<th>Location</th>
<th>Instructor</th>
</tr>
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</table>

### 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).

A bonus program can improve the grade by one grade level (i.e. by 0.3 or 0.4).

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:

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<thead>
<tr>
<th>Event</th>
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<th>Location</th>
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### Literature

Skript zur Vorlesung
### 8.163 Course: Nature-Inspired Optimization Methods [T-WIWI-102679]

**Responsible:** PD Dr. Pradyumn Kumar Shukla  
**Organisation:** KIT Department of Economics and Management  
**Part of:** M-WIWI-101472 - Informatics

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**Events**

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<th>2 SWS</th>
<th>Lecture / Online</th>
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<td>2511107</td>
<td>Übungen zu Nature-Inspired Optimization Methods</td>
<td>1 SWS</td>
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**Exams**

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<th>Nature-Inspired Optimization Methods (Registration until 12 July 2021)</th>
<th>Shukla</th>
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<tr>
<td>WT 21/22</td>
<td>7900016</td>
<td>Nature-Inspired Optimisation Methods</td>
<td>Shukla</td>
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</table>

**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 2021, 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'.  

Economathematics M.Sc.

Module Handbook as of 30/09/2021
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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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
### 8.165 Course: Nonlinear Analysis [T-MATH-107065]

**Responsible:** Prof. Dr. Tobias Lamm  
**Organisation:** KIT Department of Mathematics  
**Part of:** M-MATH-103539 - Nonlinear Analysis

<table>
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**Prerequisites:**  
none
# 8.166 Course: Nonlinear Maxwell Equations [T-MATH-110283]

<table>
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<th>Prof. Dr. Roland Schnaubelt</th>
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<td>Recurrence</td>
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</tr>
<tr>
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**Prerequisites**
none
8.167 Course: Nonlinear Maxwell Equations [T-MATH-106484]

**Responsible:** Prof. Dr. Roland Schnaubelt  
**Organisation:** KIT Department of Mathematics  
**Part of:** M-MATH-103257 - Nonlinear Maxwell Equations

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**Prerequisites**  
Keine
8.168 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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<td>Nonlinear Optimization I</td>
<td>Lecture</td>
<td>2 SWS</td>
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<td>2550112</td>
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<td>Stein, Beck, Schwarz, Neumann</td>
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</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 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**

<table>
<thead>
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<tbody>
<tr>
<td>2550111</td>
<td></td>
</tr>
<tr>
<td>2550112</td>
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</tbody>
</table>

**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
O. Stein, Grundzüge der Nichtlinearen Optimierung, SpringerSpektrum, 2018

Weiterführende Literatur:
- W. Alt, Nichtlineare Optimierung, Vieweg, 2002
- M.S. Bazaraa, H.D. Sherali, C.M. Shetty, Nonlinear Programming, Wiley, 1993
8.169 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

<table>
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**Events**

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<td>Lecture</td>
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**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 21/22, 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.
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
O. Stein, Grundzüge der Nichtlinearen Optimierung, SpringerSpektrum, 2018
Weiterführende Literatur:
- W. Alt, Nichtlineare Optimierung, Vieweg, 2002
- M.S. Bazaraa, H.D. Sherali, C.M. Shetty, Nonlinear Programming, Wiley, 1993
8.170 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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### Events

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<td>2550112</td>
<td>Exercises Nonlinear Optimization I + II</td>
<td>Practice</td>
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<td>Stein, Beck, Schwarze, Neumann</td>
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<td>2550113</td>
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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 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:**

### Nonlinear Optimization II

**2550113, WS 21/22, 2 SWS, Language: German, Open in study portal**

**Lecture (V)**

### 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
O. Stein, Grundzüge der Nichtlinearen Optimierung, SpringerSpektrum, 2018

Weiterführende Literatur:

- W. Alt, Nichtlineare Optimierung, Vieweg, 2002
- M.S. Bazaraa, H.D. Sherali, C.M. Shetty, Nonlinear Programming, Wiley, 1993
8.171 Course: Nonlinear Wave Equations [T-MATH-110806]

**Responsible:** Dr. Birgit Schörkhuber

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-105326 - Nonlinear Wave Equations

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**Prerequisites**

none
8.172 Course: Nonparametric Statistics [T-MATH-105873]

**Responsible:** Prof. Dr. Norbert Henze  
PD Dr. Bernhard Klar

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-102910 - Nonparametric Statistics

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**Events**

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**Exams**

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Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗿 On-Site, ✗ Cancelled
8.173 Course: Numerical Analysis of Helmholtz Problems [T-MATH-111514]

**Responsible:** Dr. Barbara Verfürth

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-105764 - Numerical Analysis of Helmholtz Problems

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T 8.174 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

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Prerequisites
none
8.175 Course: Numerical Linear Algebra for Scientific High Performance Computing [T-MATH-107497]

Responsible: Dr. Hartwig Anzt
Organisation: KIT Department of Mathematics
Part of: M-MATH-103709 - Numerical Linear Algebra for Scientific High Performance Computing

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Events

| Events | Credits | Type                                                                 | Recurrence | Responsible |
|--------|---------|                                                                     |            |             |
| ST 2021 | 2 SWS   | Numerical Linear Algebra for Scientific High Performance Computing |            | Anzt        |

Exams

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Prerequisites

none
### Course: Numerical Linear Algebra in Image Processing [T-MATH-108402]

**Responsible:** PD Dr. Volker Grimm  
**Organisation:** KIT Department of Mathematics  
**Part of:** M-MATH-104058 - Numerical Linear Algebra in Image Processing

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**Prerequisites:** none
8.177 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. Andreas Rieder

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-102888 - Numerical Methods for Differential Equations

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<td>Numerische Methoden für Differentialgleichungen</td>
<td>4 SWS</td>
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<td>0110800</td>
<td>Übungen zu 0110700</td>
<td>2 SWS</td>
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</table>
8.178 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
**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 |

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**Events**

| ST 2021 | 0160500 | Numerische Methoden für Integralgleichungen | 4 SWS | Lecture / 🖥 | Arens |

**Exams**

| ST 2021 | 7700092 | Numerical Methods for Integral Equations | Arens |

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled
### 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|

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<td>Grade to a third</td>
</tr>
<tr>
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### 8.181 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

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#### Events

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<td>4</td>
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<td>Lecture</td>
<td>Hochbruck</td>
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Legend: 📱 Online, 📘 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled
8.182 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

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<td>Grade to a third</td>
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Prerequisites
none
### 8.183 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  

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<td>Übungen zu 0164210 (Numerische Methoden in der Strömungsmechanik)</td>
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**Exams**

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<td>Numerical Methods in Fluid Mechanics</td>
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Legend: Online, Blended (On-Site/Online), On-Site, Cancelled
8.184 Course: Numerical Methods in Mathematical Finance [T-MATH-105865]

**Responsible:** Prof. Dr Tobias Jahnke

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-102901 - Numerical Methods in Mathematical Finance

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**Exams**

| ST 2021 | 7700055 | Numerical Methods in Mathematical Finance | Jahnke |

**Prerequisites**

none
8.185 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

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**Competence Certificate**
Mündliche Prüfung im Umfang von ca. 30 Minuten

**Prerequisites**
none
8.186 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

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8.187 Course: Numerical Simulation in Molecular Dynamics [T-MATH-110807]

**Responsible:** PD Dr. Volker Grimm

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-105327 - Numerical Simulation in Molecular Dynamics

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**Prerequisites**
none
8.188 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

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**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.
### 8.189 Course: Operations Research in Supply Chain Management [T-WIWI-102715]

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<tr>
<td>Part of</td>
<td>M-WIWI-101473 - Mathematical Programming</td>
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<td>M-WIWI-102805 - Service Operations</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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#### Exams

| ST 2021 | 7900283 | Operations Research in Supply Chain Management | Nickel |

#### 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.io.r.kit.edu/english/Courses.php.
8.190 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

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**Prerequisites**
none
### 8.191 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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**Prerequisites**  
none
### 8.192 Course: Optimization Models and Applications [T-WIWI-110162]

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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.
8.193 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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Exams

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<td>7900309</td>
<td>Optimization under Uncertainty</td>
<td>Rebennack</td>
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</table>

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.
8.194 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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**Events**

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**Exams**

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<td>ST 2021</td>
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<td>Panel Data</td>
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</table>

**Prerequisites**

None

Below you will find excerpts from events related to this course:

**Panel Data**

2520320, SS 2021, 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**

8.195 Course: Parallel Computing [T-MATH-102271]

**Responsible:** Dr. rer. nat. Mathias Krause
Prof. Dr. Christian Wieners

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-101338 - Parallel Computing

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</table>
**8.196 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

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**Exams**

ST 2021 7900274_SS2021_NK Parametric Optimization Stein

**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).
8.197 Course: Percolation [T-MATH-105869]

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

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-102905 - Percolation

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**Prerequisites**
none

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Economathematics M.Sc.
Module Handbook as of 30/09/2021
8.198 Course: Poisson Processes [T-MATH-105922]

**Responsible:** Prof. Dr. Vicky Fasen-Hartmann  
Prof. Dr. Daniel Hug  
Prof. Dr. Günter Last

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-102922 - Poisson Processes

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**Prerequisites**

none
8 COURSES

Course: Portfolio and Asset Liability Management [T-WIWI-103128]

8.199 Course: Portfolio and Asset Liability Management [T-WIWI-103128]

| Responsible: | Dr. Mher Safarian |
| Organisation: | KIT Department of Economics and Management |
| Part of: | M-WIWI-101639 - Econometrics and Statistics II |

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<td>Each summer term</td>
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| ST 2021 | 2520357 | Portfolio and Asset Liability Management | 2 SWS | Lecture / 📥 | Safarian |
| ST 2021 | 2520358 | Übungen zu Portfolio and Asset Liability Management | 2 SWS | Practice / 📥 | Safarian |

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Legend: 📥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

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 2021, 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, arbitragepricing 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

Literature
To be announced in the lecture
8.200 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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Class: 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

**Type:** Examination of another type

**Credits:** 4.5

**Grading scale:** Grade to a third

**Recurrence:** Each term

**Version:** 2

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<th>Recurrence</th>
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<td>3 SWS</td>
<td>Practical seminar: Health Care Management</td>
<td>Nickel, Mitarbeiter</td>
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<tr>
<td>WT 21/22</td>
<td>3 SWS</td>
<td>Practical seminar: Health Care Management</td>
<td>Nickel, Mitarbeiter</td>
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<td>Practical Seminar: Health Care Management (with Case Studies)</td>
<td>Nickel</td>
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<td>Practical Seminar: Health Care Management (with Case Studies)</td>
<td>Nickel</td>
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</table>

**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.

**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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#### Events

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<td>ST 2021</td>
<td>3 SWS</td>
<td>Practical Seminar: Information Systems &amp; Service Design (Master)</td>
<td>Lecture/🖥</td>
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**ST 2021** 2540554  
**Exams** 7900262

#### Competence 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.

#### 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.

---

**Below you will find excerpts from events related to this course:**

#### V Practical Seminar: Information Systems & Service Design (Master)

<table>
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<th>Term</th>
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Economathematics M.Sc.  
Module Handbook as of 30/09/2021
8.203 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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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.
8.204 Course: Predictive Modeling [T-WIWI-110868]

**Responsible:** Jun.-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>2521311</td>
<td>Predictive Modeling</td>
<td>2</td>
<td>Lecture / 🖥️</td>
<td>Krüger</td>
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<td>ST 2021</td>
<td>2521312</td>
<td>Predictive Modeling (Tutorial)</td>
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<td>Practice / 🖥️</td>
<td>Krüger, Koster</td>
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**Exams**

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<th>Course Name</th>
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<td>Lecture / 🖥️</td>
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<td>Lecture / 🖥️</td>
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Legend: 🖥️ Online, Blended (On-Site/Online), On-Site, X Cancelled

**Competence Certificate**
Open Book exam, online

**Prerequisites**
None

Below you will find excerpts from events related to this course:

**V Predictive Modeling**
2521311, SS 2021, 2 SWS, Language: English, [Open in study portal](#)

**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.

**V Predictive Modeling (Tutorial)**
2521312, SS 2021, 2 SWS, Language: English, [Open in study portal](#)
## 8.205 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

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### Events

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<th>SWS</th>
<th>Language</th>
<th>Content</th>
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</table>
| WT 21/22 | 1 SWS, German | Price Negotiation and Sales Presentations | 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  
Blockveranstaltung |
8.206 Course: Pricing Excellence [T-WIWI-111246]

**Responsible:** 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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<td>1 SWS</td>
<td>Others (sons / [T] Bill</td>
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<td>Klarmann</td>
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**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 2021, 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.

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
Competence Certificate
The assessment of this course is an alternative exam assessment. In order to pass the course, students are required to submit forecasts for each week of the semester (excluding the Christmas break). At the end of the course, students are required to write a report (10-15 pages) that describes the forecasting methods as well as their performance. This report is the basis for the final course grade.

Prerequisites
The course requires good basic knowledge in statistics and data science as well as knowledge in R, Python, Matlab or similar. Knowledge in time series analysis is helpful but not mandatory.

Below you will find excerpts from events related to this course:

Probabilistic Time Series Forecasting Challenge
00080, WS 21/22, SWS, Language: English, Open in study portal

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 setup. 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 energy demand 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). In mid October, we'll have a kick-off meeting and several lectures covering relevant background knowledge. During the semester, there will be a weekly meeting in which students and instructors discuss the current state of the forecasting challenge. Details on the logistics (precise dates, online versus offline format) are TBA.

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 new course format that requires regular, active participation over the whole semester.

Examination rules
The project seminar counts for 4.5 credit points (Leistungspunkte). The examination rules are as follows:

- In order to pass the course, students are required to submit forecasts for each week of the semester (excluding the Christmas break). Each week's submission is due on Wednesday, 6 p.m., and covers the seven following days (Thursday to Wednesday).
- At the end of the course, students are required to write a report (10-15 pages) that describes the forecasting methods as well as their performance. This report is the basis for the final course grade.
### Course: Probability Theory and Combinatorial Optimization [T-MATH-105923]

**Responsible:** 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
8.209 Course: Process Mining [T-WIWI-109799]

**Responsible:** Prof. Dr. Andreas Oberweis  
**Organisation:** KIT Department of Economics and Management  
**Part of:** M-WIWI-101472 - Informatics

<table>
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**Exams**

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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

**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 2021, 2 SWS, Language: German, [Open in study portal](#)
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.
8.210 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 2021 | 2571154 | Product and Innovation Management | 2 SWS | Lecture / Online | Klarmann |

**Exams**

| ST 2021 | 7900024 | Product and Innovation Management | Klarmann |

Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

**Competence Certificate**

The assessment of success takes place through a written exam (according to SPO § 4 Abs. 2, Pkt. 1) with additional aids in the sense of an open book exam.

In the winter term 2021/22, 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 2021, 2 SWS, Language: English, [Open in study portal](#)
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).

Literature
8.211 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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### Events

| ST 2021 | 0161700 | Projektorientiertes Softwarepraktikum | Practical course / 🖥 | Thäter, Krause |

| ST 2021 | 7700085 | Project Centered Software-Lab | Thäter |

**Exams**

Legend: 🖥 Online, 🧩 Blended (On-Site/Online), 🔊 On-Site, ✗ Cancelled

### Prerequisites

none
8.212 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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**Events**

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**Exams**

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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:**

**Cognitive Automobiles and Robots**

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</table>

**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.
8.213 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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### Events

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<th>Practical course / Zöllner</th>
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### Exams

| ST 2021 | 7900086 | Project Lab Machine Learning | Zöllner |

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:

**Project Lab Machine Learning**  
2512500, SS 2021, 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.
8.214 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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**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:*

**Public Management**

2561127, WS 21/22, 3 SWS, Language: German, [Open in study portal](#)

**Literature**

**Weiterführende Literatur:**

### 8.215 Course: Random Graphs [T-MATH-105929]

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<tr>
<th>Responsible</th>
<th>Dr. Matthias Schulte</th>
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**Prerequisites**

none
### 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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**Legend:** 🌐 Online, 🟢 Blended (On-Site/Online), 🗺 On-Site, ✗ Cancelled

**Prerequisites**

none
### 8.217 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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8.218 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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**Exams**

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**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".
8.219 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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**Prerequisites**  
none
8.220 Course: Semantic Web Technologies [T-WIWI-110848]

**Responsible:** Tobias Christof Käfer  
**Organisation:** KIT Department of Economics and Management  
**Part of:** M-WIWI-101472 - Informatics

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<th>Lecture / Online</th>
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### Exams

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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:*

**Semantic Web Technologies**  
2511310, SS 2021, 2 SWS, Language: English, [Open in study portal](#)  
Lecture (V) Online
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 preperation and postprocessing: 60 hours
- Exam and exam preparation: 30 hours

Literature


Weitere Literatur

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.

Literature


Weitere Literatur

**8.221 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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**Exams**

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Legend: Online, Blended (On-Site/Online), On-Site, Cancelled

**Competition 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 2021, 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 Teco/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
nach Vereinbarung

**Collaborative Development of Conversational Agents**
2500043, SS 2021, 3 SWS, Language: English, Open in study portal
Content
This course focuses on the design, development, deployment, and evaluation of conversational agents (e.g., chatbots or voice assistants) for a given problem domain (e.g., customer service, team collaboration). The aim of the course is to introduce conceptual and technical foundations of conversational agents, relevant theories of human-computer interaction, and design guidelines for different classes of conversational agents. In addition, the course will introduce the human-centered design approach adapted to the design of conversational agents, including several qualitative and quantitative evaluation approaches.

The entire course is held virtually with no physical meetings, providing a first experience for future workplace scenarios. The course is a joint offering together with Saarland University (Prof. Stefan Morana) and Technische Universität Dresden (Prof. Benedikt Brendel). Students will work collaboratively in virtual teams with students from the other universities (i.e., one student per university in one team). Each student team will iteratively design, develop, and evaluate a conversational agent using contemporary technology tools (e.g., Google Dialogflow, Microsoft Bot Framework, Rasa). The teams document their activities and results in a project report. The project report as well as the conversational agent prototype are the basis for the grading of the course.

The entire course is limited to 15 participants (5 per university) and requires a short registration. More details will be made available on our website.

After completing this course, the course participants will be able to:

- explain conceptual and technical foundations of conversational agents
- perform the human-centered design approach to design, develop, and evaluate a conversational agent
- develop conversational agents using state-of-the-art tools and frameworks
- apply qualitative and quantitative methods to evaluate conversational agent prototypes

Requirements

- Programming skills are beneficial
- Experience or general interest in human-computer interaction
- English communication skills

Literature

Relevant literature will be made available in the seminar.

**Adventures in Financial Machine Learning**
2530372, SS 2021, 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

14-tägig, tba

Literatur

Literatur wird in der ersten Vorlesung bekannt gegeben.

**Master Seminar in Data Science and Machine Learning**
2540510, SS 2021, 2 SWS, Language: German/English, [Open in study portal](#)

**Information Systems and Service Design Seminar**
2540557, SS 2021, 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

Digital Service Design Seminar
2540559, SS 2021, 3 SWS, Language: English, Open in study portal

Content
Description
In this seminar, a team of students addresses a real-world design challenge of an IISM cooperation partner. Students learn and apply design methods, techniques, and tools to explore the problem and deliver a solution in the form of an innovative prototype.

Learning objectives
The students
- explore a real-world digital service design challenge
- understand the human-centered design process and apply selected design techniques & tools
- deliver a digital service prototype as a potential solution for the challenge

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
Description
This blocked event contains 3 stages.
In Stage 1, students meet online for one day and experience recent economic psychology research as participants. The research topics will mainly consist of novel economic games with certain level of strategic depth (i.e., we will not play simple games like rock paper scissors, nor will we play games that many people are familiar with like the prisoner’s dilemma).
In Stage 2, students will receive the data from the games they played in Stage 1 along with a few journal articles assigned by the instructor on related topics. Based on reading, they choose one of the datasets from Stage 1 to write up a short report.
In Stage 3, students will try to design and conduct a study on a related topic themselves based on what they have learned in the previous stages. They will collect their own data and write a research report. The nature of this project is to be determined together by the students and instructor. It would either be ideas generated by the students themselves, or something assigned by the instructor.
English will be the language used in all discussions, course materials, and assessments.
Competence Certificate
The assessment is based on the short report in Stage 2 and the research report in Stage 3.
Workload
Students are expected to spend a total of 90 hours (30 hours per ECTS), including meeting and assignments, on this seminar.
Organizational issues
Blockveranstaltung, Termine werden bekanntgegeben

Entrepreneurship Research
2545002, SS 2021, 2 SWS, Language: German, Open in study portal

Organizational issues
Block am 21.04., 05.05., 14.07.

Literature
Wird im Seminar bekannt gegeben.

Hospital Management
2550493, SS 2021, 2 SWS, Language: German, Open in study portal

Content
The seminar 'Hospital Management' presents internal organization structures, work conditions and work environments at the example of hospitals and relates this to common and expected conditions of other service industries.
Covered topics include normative environment, intra-organizational structure, personnel management, quality, external networking and market appearance. The course consists of two full-day sessions.
The assessment consists of attendance and a presentation or a case study.

Organizational issues
von Montag, 17. Mai bis Samstag, 22. Mai jeweils von 7:30 bis 9:15 Uhr

Seminar Human Resource Management (Master)
2573012, SS 2021, 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 2021, 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 2021, 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 21/22, 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.

Advances in Financial Machine Learning
2530372, WS 21/22, 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
14-tägig, tba

Literature
Literatur wird in der ersten Vorlesung bekannt gegeben.

Data Science in Service Management
2540473, WS 21/22, 2 SWS, Language: German/English, Open in study portal

Content
wird auf deutsch und englisch gehalten

Organizational issues
Blockveranstaltung, siehe WWW

Masterseminar in Data Science and Machine Learning
2540510, WS 21/22, 2 SWS, Language: German, Open in study portal

Methoden im Innovationsmanagement
2545107, WS 21/22, 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)

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
Blockveranstaltung siehe Homepage

Seminar Human Resources and Organizations (Master)

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

Econmathematics M.Sc.
Module Handbook as of 30/09/2021
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.

Literature
Will be announced in the course.
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**Exams**

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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.

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Economathematics M.Sc.

Module Handbook as of 30/09/2021
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:

Collaborative Development of Conversational Agents
2500043, SS 2021, 3 SWS, Language: English, Open in study portal

Content
This course focuses on the design, development, deployment, and evaluation of conversational agents (e.g., chatbots or voice assistants) for a given problem domain (e.g., customer service, team collaboration). The aim of the course is to introduce conceptual and technical foundations of conversational agents, relevant theories of human-computer interaction, and design guidelines for different classes of conversational agents. In addition, the course will introduce the human-centered design approach adapted to the design of conversational agents, including several qualitative and quantitative evaluation approaches.

The entire course is held virtually with no physical meetings, providing a first experience for future workplace scenarios. The course is a joint offering together with Saarland University (Prof. Stefan Morana) and Technische Universität Dresden (Prof. Benedikt Brendel). Students will work collaboratively in virtual teams with students from other universities (i.e., one student per university in one team). Each student team will iteratively design, develop, and evaluate a conversational agent using contemporary technology tools (e.g., Google Dialogflow, Microsoft Bot Framework, Rasa). The teams document their activities and results in a project report. The project report as well as the conversational agent prototype are the basis for the grading of the course.

The entire course is limited to 15 participants (5 per university) and requires a short registration. More details will be made available on our website.

After completing this course, the course participants will be able to:

- explain conceptual and technical foundations of conversational agents
- perform the human-centered design approach to design, develop, and evaluate a conversational agent
- develop conversational agents using state-of-the-art tools and frameworks
- apply qualitative and quantitative methods to evaluate conversational agent prototypes

Requirements
- Programming skills are beneficial
- Experience or general interest in human-computer interaction
- English communication skills

Literature
Relevant literature will be made available in the seminar.

Advances in Financial Machine Learning
2530372, SS 2021, 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
14-tägig, tba

Literature
Literatur wird in der ersten Vorlesung bekannt gegeben.

**Master Seminar in Data Science and Machine Learning**
2540510, SS 2021, 2 SWS, Language: German/English, [Open in study portal]

**Information Systems and Service Design Seminar**
2540557, SS 2021, 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

**Digital Service Design Seminar**
2540559, SS 2021, 3 SWS, Language: English, [Open in study portal]
Content Description
In this seminar, a team of students addresses a real-world design challenge of an IISM cooperation partner. Students learn and apply design methods, techniques, and tools to explore the problem and deliver a solution in the form of an innovative prototype.

Learning Objectives
The students
- explore a real-world digital service design challenge
- understand the human-centered design process and apply selected design techniques & tools
- deliver a digital service prototype as a potential solution for the challenge

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 Description
This blocked event contains 3 stages.
In Stage 1, students meet online for one day and experience recent economic psychology research as participants. The research topics will mainly consist of novel economic games with certain level of strategic depth (i.e., we will not play simple games like rock paper scissors, nor we will play games that many people are familiar with like the prisoner’s dilemma).
In Stage 2, students will receive the data from the games they played in Stage 1 along with a few journal articles assigned by the instructor on related topics. Based on reading, they choose one of the datasets from Stage 1 to write up a short report.
In Stage 3, students will try to design and conduct a study on a related topic themselves based on what they have learned in the previous stages. They will collect their own data and write a research report. The nature of this project is to be determined together by the students and instructor. It would either be ideas generated by the students themselves, or something assigned by the instructor.

English will be the language used in all discussions, course materials, and assessments.

Competence Certificate
The assessment is based on the short report in Stage 2 and the research report in Stage 3.

Workload
Students are expected to spend a total of 90 hours (30 hours per ECTS), including meeting and assignments, on this seminar.

Organizational issues
Blockveranstaltung, Termine werden bekannt gegeben

Literature
Wird im Seminar bekannt gegeben.
Content
The seminar ‘Hospital Management' presents internal organization structures, work conditions and work environments at the example of hospitals and relates this to common and expected conditions of other service industries. Covered topics include normative environment, intra-organizational structure, personnel management, quality, external networking and market appearance. The course consists of two full-day sessions.

The assessment consists of attendance and a presentation or a case study.

Organizational issues
von Montag, 17. Mai bis Samstag, 22. Mai jeweils von 7:30 bis 9:15 Uhr

Seminar Human Resource Management (Master)
2573012, SS 2021, 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 2021, 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 2021, 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, Raum 2A-12.1; Termine werden bekannt gegeben

Literature
Will be announced in the course.

Seminar in Management Accounting - Special Topics
2579919, SS 2021, 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).

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 21/22, 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. Schelbhenne, Prof. Szech, Prof. Volkamer, Prof. Weinhardt and Prof. Woll.

**Advances in Financial Machine Learning**
2530372, WS 21/22, 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**
14-tägig, tba

**Data Science in Service Management**
2540473, WS 21/22, 2 SWS, Language: German/English, [Open in study portal](#)

**Content**
Methoden im Innovationsmanagement wird auf deutsch und englisch gehalten

**Organizational issues**
Blockveranstaltung, siehe WWW

**Masterseminar in Data Science and Machine Learning**
2540510, WS 21/22, 2 SWS, Language: German, [Open in study portal](#)

**Methoden im Innovationsmanagement**
2545107, WS 21/22, 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.
Seminar Human Resource Management (Master)
2573012, WS 21/22, 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
Blockveranstaltung siehe Homepage

Seminar Management Accounting - Special Topics
2579919, WS 21/22, 2 SWS, Language: English, 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
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.

Literature
Will be announced in the course.
# 8.223 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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### Events

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<td>2 SWS</td>
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<td>2 SWS</td>
<td>Seminar / 🖥</td>
<td>Schienle, Krüger, Görgen, Koster</td>
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<td>ST 2021 2560233</td>
<td>Seminar zur Luftverkehrs politik</td>
<td>Seminar / 🖥</td>
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<tr>
<td>ST 2021 2560282</td>
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<td>Seminar / 🖥</td>
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<td>Markets for Attention and the Digital Economy Seminar on Topics in Political Economy (Bachelor)</td>
<td>2 SWS</td>
<td>Seminar / 🖥</td>
<td>Szech, Huber</td>
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<td>Disruption and the Digital Economy - Topics in Political Economy (Master)</td>
<td>2 SWS</td>
<td>Seminar</td>
<td>Szech, Huber, Rosar</td>
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<td>2 SWS</td>
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<td>Szech, Zhao, Huber</td>
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<td>Wirtschaftspolitisches Seminar</td>
<td>2 SWS</td>
<td>Seminar</td>
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<td>WT 21/22 2561208</td>
<td>Selected aspects of European transport planning and -modelling</td>
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### Exams

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<td>ST 2021 7900272</td>
<td>Do Groups Make Better Decisions? The &quot;Wisdom of the Crowd&quot; in Theory and Practice</td>
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<td>Digital IT-Solutions and Services Transforming the Field of Public Transportation</td>
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<td>ST 2021 7900366</td>
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<td>ST 2021 79sefi2</td>
<td>Seminar Death, Mistake &amp; Fraud in Science A (Master)</td>
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<tr>
<td>WT 21/22 7900139</td>
<td>Seminar in Economics (Bachelor/Master)</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:

**Introduction to Statistical Machine Learning**
2500004, SS 2021, 2 SWS, Language: German/English, [Open in study portal]

**Advanced Topics in Econometrics**
2521310, SS 2021, 2 SWS, Language: German/English, [Open in study portal]

**Overcoming the Corona Crisis, Seminar Morals and Social Behavior (Master)**
2560552, SS 2021, 2 SWS, Language: English, [Open in study portal]

**Markets for Attention and the Digital Economy Seminar on Topics in Political Economy (Bachelor)**
2560555, SS 2021, 2 SWS, Language: English, [Open in study portal]

Content
Participation will be limited to 12 students.

Organizational issues
Blockveranstaltung

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

Disruption and the Digital Economy - Topics in Political Economy (Master)
2560142, WS 21/22, 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.

Overcoming the Corona Crisis - Morals & Social Behavior (Master)
2560143, WS 21/22, 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
### 8.224 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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#### Events

| ST 2021 | 2500004 | Introduction to Statistical Machine Learning | 2 SWS | Seminar | Schienle, Lerch |
| ST 2021 | 2521310 | Advanced Topics in Econometrics | 2 SWS | Seminar | Schienle, Krüger, Görgen, Koster |
| ST 2021 | 2560233 | Seminar zur Luftverkehrspolitik | | Seminar | Mitsch, Wisotzky |
| ST 2021 | 2560282 | Wirtschaftspolitisches Seminar | 2 SWS | Seminar | Ott, Assistenten |
| ST 2021 | 2560552 | Overcoming the Corona Crisis, Seminar Morals and Social Behavior (Master) | 2 SWS | Seminar | Szech, Zhao |
| ST 2021 | 2560555 | Markets for Attention and the Digital Economy Seminar on Topics in Political Economy (Bachelor) | 2 SWS | Seminar | Szech, Huber |
| ST 2021 | 2560556 | Social Preferences in Behavioral Economics / „Seminar on Topics in Political Economy“ | | Seminar | Szech, Rau |
| WT 21/22 | 2560142 | Disruption and the Digital Economy - Topics in Political Economy (Master) | 2 SWS | Seminar | Szech, Huber, Rosar |
| WT 21/22 | 2560282 | Wirtschaftspolitisches Seminar | 2 SWS | Seminar | Ott, Assistenten |
| WT 21/22 | 2561208 | Selected aspects of European transport planning and -modelling | 1 SWS | Seminar | Szimba |

#### Exams

| ST 2021 | 7900033 | Introduction to Statistical Machine Learning | | | Schienle |
| ST 2021 | 7900051 | Seminar in Economic Policy | | | Ott |
| ST 2021 | 7900059 | Markets for Attention and the Digital Economy (Master) | | | Szech |
| ST 2021 | 7900065 | Seminar in Macroeconomics I | | | Brumm |
| ST 2021 | 7900131 | Overcoming the Corona Crisis (Master) | | | Szech |
| ST 2021 | 7900221 | Seminar in Macroeconomics II | | | Brumm |
| ST 2021 | 7900248 | Social Preferences in Behavioral Economics | | | Szech |
| ST 2021 | 7900282 | Digital IT-Solutions and Services Transforming the Field of Public Transportation | | | Mitusch |
| ST 2021 | 7900364 | Seminar zur Luftverkehrspolitik | | | Mitusch |
| ST 2021 | 7900367 | Seminar Strategic Decisions B (Master) | | | Ehrhart |
| ST 2021 | 79sefi3 | Seminar Death, Mistake & Fraud in Science B (Master) | | | Wigger |
| WT 21/22 | 7900281 | Seminar in Economics B (Master), Seminar in Economics A (Bachelor) | | | Mitusch |

**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:

V Introduction to Statistical Machine Learning
2500004, SS 2021, 2 SWS, Language: German/English, Open in study portal

Organizational issues
Blockveranstaltung, Termine werden bekannt gegeben

V Advanced Topics in Econometrics
2521310, SS 2021, 2 SWS, Language: German/English, Open in study portal

Organizational issues
Blockveranstaltung, Termine werden bekannt gegeben

V Overcoming the Corona Crisis, Seminar Morals and Social Behavior (Master)
2560552, SS 2021, 2 SWS, Language: English, Open in study portal

Content
Participation will be limited to 12 students.

Organizational issues
Blockveranstaltung

V Markets for Attention and the Digital Economy Seminar on Topics in Political Economy (Bachelor)
2560555, SS 2021, 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

Disruption and the Digital Economy - Topics in Political Economy (Master)
2560142, WS 21/22, 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.
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Responsible: Professorenschaft des Instituts AIFB
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-102973 - Seminar
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:

Seminar Knowledge Discovery and Data Mining (Master)
2513309, SS 2021, 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

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.

Literature
Detaillierte Referenzen werden zusammen mit den jeweiligen Themen angegeben. Allgemeine Hintergrundinformationen ergeben sich z.B. aus den folgenden Lehrbüchern:

- Mitchell, T.: Machine Learning
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:
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Questions are answered via the e-mail address sem-ep@fzi.de.

| V | Cognitive Automobiles and Robots |
|   | 2513500, SS 2021, 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.

| V | Security and Privacy Awareness |
|   | 2400125, WS 21/22, 2 SWS, Open in study portal |
**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!

<table>
<thead>
<tr>
<th>Seminar</th>
<th>Linked Data and the Semantic Web (Master)</th>
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<tbody>
<tr>
<td>Code</td>
<td>2513313, WS 21/22, 3 SWS, Language: German/English, <a href="#">Open in study portal</a></td>
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**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.

<table>
<thead>
<tr>
<th>Seminar</th>
<th>Real-World Challenges in Data Science and Analytics (Bachelor)</th>
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<tbody>
<tr>
<td>Code</td>
<td>2513314, WS 21/22, 3 SWS, Language: German/English, <a href="#">Open in study portal</a></td>
</tr>
</tbody>
</table>

**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 21/22, 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 21/22, 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
Data representation or feature representation plays a key role in the performance of machine learning algorithms. In recent years, rapid growth has been observed in Representation Learning (RL) of words and Knowledge Graphs (KG) into low dimensional vector spaces and its applications to many real-world scenarios. Word embeddings are a low dimensional vector representation of words that are capable of capturing the context of a word in a document, semantic similarity as well as its relation with other words. Similarly, KG embeddings are a low dimensional vector representation of entities and relations from a KG preserving its inherent structure and capturing the semantic similarity between the entities.

KG representation learning algorithms (a.k.a. KG embedding models) could be either unimodal where a single source is used or multimodal where multiple sources are explored. The sources of information could be relations between entities, text literals, numeric literals, images, and etc. It is important to capture the information present in each of these sources in order to learn representations which are rich in semantics. Multimodal KG embeddings learn either multiple representations simultaneously based on each source of information in a non-unified space or learn a single representation for each element of the KG in a unified space. Representation of entities and relations learnt using both unimodal and multimodal KG embedding models could be used in various downstream applications such as clustering, classification, and so on. On the other hand, language models such as BERT, ELMo, GPT, etc. learn the probability of word occurrence based on text corpus and learn representation of words in a low-dimensional embedding space. Representation of the words generated by the language models are often used for various KG completion tasks such as link prediction, entity classification, and so on.

In this seminar, we would like to study the different state of the art algorithms for multimodal embeddings, applications of KG embeddings, or the use of language models for KG representation.

Contributions of the students:
Each student will be assigned 1 paper on the topic. The student will have to

1. give a seminar presentation,
2. write a seminar report paper of 15 pages explaining the method from the assigned paper, in their own words, and
3. implementation. If code is available from the authors, then re-implementation of it for small scale experiments using Google Colab or make it available via GitHub.
# 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

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## Events

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<th>SWS</th>
<th>Type</th>
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<td>ST 2021</td>
<td>2513211</td>
<td>Seminar Business Information Systems (Master)</td>
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<td>Seminar</td>
<td>Oberweis, Fritsch, Frister, Schreiber, Schüler, Ullrich</td>
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<tr>
<td>ST 2021</td>
<td>2513309</td>
<td>Seminar Knowledge Discovery and Data Mining (Master)</td>
<td>3</td>
<td>Seminar</td>
<td>Färber, Nguyen, Noullet, Saier, Bartscherer</td>
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<td>ST 2021</td>
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<td>Seminar Data Science &amp; Real-time Big Data Analytics (Master)</td>
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<td>ST 2021</td>
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<td>ST 2021</td>
<td>2513500</td>
<td>Cognitive Automobiles and Robots</td>
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<td>Seminar</td>
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<tr>
<td>WT 21/22</td>
<td>2400125</td>
<td>Security and Privacy Awareness</td>
<td>2</td>
<td>Seminar</td>
<td>Boehm, Seidel-Saul, Volkamer, Aldag</td>
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<tr>
<td>WT 21/22</td>
<td>2513313</td>
<td>Seminar Linked Data and the Semantic Web (Master)</td>
<td>3</td>
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<td>Färber, Käfer</td>
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<tr>
<td>WT 21/22</td>
<td>2513314</td>
<td>Seminar Real-World Challenges in Data Science and Analytics (Bachelor)</td>
<td>3</td>
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<td>WT 21/22</td>
<td>2513315</td>
<td>Seminar Real-World Challenges in Data Science and Analytics (Master)</td>
<td>3</td>
<td>Seminar</td>
<td>Nickel, Weinhardt, Färber, Brandt, Kulbach</td>
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<td>WT 21/22</td>
<td>2513500</td>
<td>Seminar Cognitive Automobiles and Robots (Master)</td>
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<td>Seminar</td>
<td>Zöllner, Daaboul</td>
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<tr>
<td>WT 21/22</td>
<td>2513605</td>
<td>Seminar Representation Learning on Knowledge Graphs (Master)</td>
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<td>Sack, Alam, Biswas</td>
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## Exams

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<td>Seminar Advanced Methods in Natural Language Processing: Metaphors</td>
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<td>WT 21/22</td>
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<td>Seminar Ubiquitous Computing</td>
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<td>WT 21/22</td>
<td>7900094</td>
<td>Seminar Selected Issues in Critical Information Infrastructures (Master)</td>
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<td>WT 21/22</td>
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<td>Seminar Linked Data and the Semantic Web (Master)</td>
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</tbody>
</table>
### Seminar Representation Learning on Knowledge Graphs (Master)

**Sack**

#### 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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**Below you will find excerpts from events related to this course:**

#### Seminar Knowledge Discovery and Data Mining (Master)

**2513309, SS 2021, 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

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.

**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 2021, 2 SWS, Language: English, Open in study portal**

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Economathematics M.Sc.

Module Handbook as of 30/09/2021
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.

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Cognitive Automobiles and Robots
2513500, SS 2021, 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:
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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
Anmeldung und weitere Informationen sind im WiWi-Portal zu finden.
Registration and further information can be found in the WiWi-portal.

Security and Privacy Awareness
2400125, WS 21/22, 2 SWS, Open in study portal
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 Linked Data and the Semantic Web (Master)
2513313, WS 21/22, 3 SWS, Language: German/English, Open in study portal

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 21/22, 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 21/22, 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 21/22, 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
Data representation or feature representation plays a key role in the performance of machine learning algorithms. In recent years, rapid growth has been observed in Representation Learning (RL) of words and Knowledge Graphs (KG) into low dimensional vector spaces and its applications to many real-world scenarios. Word embeddings are a low dimensional vector representation of words that are capable of capturing the context of a word in a document, semantic similarity as well as its relation with other words. Similarly, KG embeddings are a low dimensional vector representation of entities and relations from a KG preserving its inherent structure and capturing the semantic similarity between the entities.

KG representation learning algorithms (a.k.a. KG embedding models) could be either unimodal where a single source is used or multimodal where multiple sources are explored. The sources of information could be relations between entities, text literals, numeric literals, images, and etc. It is important to capture the information present in each of these sources in order to learn representations which are rich in semantics. Multimodal KG embeddings learn either multiple representations simultaneously based on each source of information in a non-unified space or learn a single representation for each element of the KG in a unified space. Representation of entities and relations learnt using both unimodal and multimodal KG embedding models could be used in various downstream applications such as clustering, classification, and so on. On the other hand, language models such as BERT, ELMo, GPT, etc. learn the probability of word occurrence based on text corpus and learn representation of words in a low-dimensional embedding space. Representation of the words generated by the language models are often used for various KG completion tasks such as link prediction, entity classification, and so on.

In this seminar, we would like to study the different state of the art algorithms for multimodal embeddings, applications of KG embeddings, or the use of language models for KG representation.

Contributions of the students:
Each student will be assigned 1 paper on the topic. The student will have to

1. give a seminar presentation,
2. write a seminar report paper of 15 pages explaining the method from the assigned paper, in their own words, and
3. implementation. If code is available from the authors, then re-implementation of it for small scale experiments using Google Colab or make it available via GitHub.
8.227 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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<td>Grade to a third</td>
<td>Each term</td>
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**Events**

| ST 2021 | 2550132 | Seminar zur Mathematischen Optimierung (MA) | 2 SWS | Seminar / Online | Stein, Beck, Neumann, Schwarze |
| ST 2021 | 2550473 | Seminar on Power Systems Optimization (Master) | 2 SWS | Seminar / Online | Rebennack, Warwicker, Sinske |
| ST 2021 | 2550491 | Seminar: Modern OR and Innovative Logistics | 2 SWS | Seminar / Online | Nickel, Mitarbeiter |
| WT 21/22 | 2550131 | Seminar on Methodical Foundations of Operations Research (B) | 2 SWS | Seminar | Stein, Beck, Neumann, Schwarze |
| WT 21/22 | 2550491 | Seminar: Modern OR and Innovative Logistics | 2 SWS | Seminar | Nickel, Mitarbeiter |

**Exams**

| ST 2021 | 7900017_SS2021 | Seminar in Operations Research (Bachelor) | Stein |
| ST 2021 | 7900018_SS2021 | Seminar in Operations Research A (Master) | Stein |
| ST 2021 | 7900271 | Digitization in the Steel Industry | Nickel |
| ST 2021 | 7900331 | Seminar in Operations Research A (Master) | Nickel |
| ST 2021 | 7900348 | Seminar on Power Systems Optimization (Master) | Rebennack |

**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:**

<table>
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<th>Seminar: Modern OR and Innovative Logistics</th>
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<td>2550491, SS 2021, 2 SWS, Language: German, Open in study portal</td>
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Course: Seminar in Operations Research A (Master) [T-WIWI-103481]

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.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 21/22, 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 21/22, 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.

Organizational issues
wird auf der Homepage bekannt gegeben

Literature
Die Literatur und die relevanten Quellen werden zu Beginn des Seminars bekannt gegeben.
### 8.228 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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**Exams**

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<td>Digitization in the Steel Industry</td>
<td>Seminar</td>
<td>Nickel</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:**

**Seminar: Modern OR and Innovative Logistics**

2550491, SS 2021, 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 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),
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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 21/22, 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 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 Seminarvorbetreitung 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 21/22, 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.

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]

8.229 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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Events

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<td>2 SWS</td>
<td>Seminar / Online</td>
<td>Schienle, Krüger, Görgen, Koster</td>
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<td>Seminar / Online</td>
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Exams

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<th>Type</th>
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<th>Recurrence</th>
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<td>Data Mining and Applications (Projectseminar)</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:

**Introduction to Statistical Machine Learning**
2500004, SS 2021, 2 SWS, Language: German/English, Open in study portal

**Advanced Topics in Econometrics**
2521310, SS 2021, 2 SWS, Language: German/English, Open in study portal

Economathematics M.Sc.
Module Handbook as of 30/09/2021
8.230 Course: Seminar in Statistics B (Master) [T-WIWI-103484]

**Responsible:** 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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<td>Each term</td>
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**Events**

| ST 2021 | 2500004 | Introduction to Statistical Machine Learning | 2 SWS | Seminar / 📲 | Schienle, Lerch |
| ST 2021 | 2521310 | Advanced Topics in Econometrics | 2 SWS | Seminar / 📲 | Schienle, Krüger, Görgen, Koster |
| ST 2021 | 2550561 | Spezielle fortgeschrittene Themen der Datenanalyse und Statistik | 2 SWS | Seminar / 📲 | Grothe, Kaplan, Kächele |

**Exams**

| ST 2021 | 7900033 | Introduction to Statistical Machine Learning | Seminar |
| ST 2021 | 7900250 | Data Mining and Applications (Projectseminar) | Nakhaeizadeh |

**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:**

**Introduction to Statistical Machine Learning**

2500004, SS 2021, 2 SWS, Language: German/English, Open in study portal

**Advanced Topics in Econometrics**

2521310, SS 2021, 2 SWS, Language: German/English, Open in study portal
## 8.231 Course: Seminar Mathematics [T-MATH-105686]

**Organisation:** KIT Department of Mathematics  
**Part of:** M-MATH-102730 - Seminar

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<td>WT 21/22</td>
<td>7700048</td>
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8.232 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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**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:

**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
8.233 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>2 SWS</td>
<td>Lecture</td>
<td>Staudt, van Dinther</td>
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<tr>
<td>WT 21/22 2540453</td>
<td>Übung zu Smart Grid Applications</td>
<td>1 SWS</td>
<td>Lecture</td>
<td>Staudt, Henni</td>
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</table>

**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.
# 8.234 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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### Exams

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<td>ST 2021 7700104</td>
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Legend: 🌐 Online, 🧩 Blended (On-Site/Online), 🔉 On-Site, ❌ Cancelled


8 COURSES

Course: Social Choice Theory [T-WIWI-102859]

8.235 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**

| ST 2021  | 2520537 | Social Choice Theory | 2 SWS | Lecture / Online | Puppe, Kretz |
| ST 2021  | 2520539 | Übung zu Social Choice Theory | 1 SWS | Practice / Online | Kretz, Puppe |

**Exams**

| ST 2021  | 7900292 | Social Choice Theory | Puppe |
| ST 2021  | 7900293 | Social Choice Theory | Puppe |

**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 2021, 2 SWS, Language: English, [Open in study portal](#)

**Lecture (V) Online**

**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:

8.236 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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<td>ST 2021</td>
<td>2512401</td>
<td>Development of Sociotechnical Information Systems (Master)</td>
<td>3 SWS</td>
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**Exams**

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<td>Sunyaev</td>
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**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 2021, 3 SWS, Language: German/English, [Open in study portal](#)  
Type: Practical course (P)  
Location: Online

*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.

**Development of Sociotechnical Information Systems (Master)**  
2512401, SS 2021, 3 SWS, Language: German/English, [Open in study portal](#)  
Type: Practical course (P)  
Location: Online

*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.
8.237 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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<td>1 SWS</td>
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**Exams**

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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 2021, 2 SWS, Language: German, [Open in study portal] (Online)

**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.
8.238 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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**Legend:** 🖥 Online, 🧩 Blended (On-Site/Online), 🗣 On-Site, ✗ Cancelled

**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 21/22, 2 SWS, Language: English, [Open in study portal]

**Lecture (V)**
Cancelled
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).

Organizational issues
Die Vorlesung wird im WiSe 2021 aufgrund eines Forschungssemesters nicht gelesen. Die Prüfung findet statt. Vorbereitungsmaterialien finden Sie im ILIAS.

Literature

Weitere Literatur wird in der Vorlesung bekanntgegeben.
(Further literature will be announced in the lecture.)
8.239 Course: Spatial Stochastics [T-MATH-105867]

Responsible: Prof. Dr. Daniel Hug  
Prof. Dr. Günter Last

Organisation: KIT Department of Mathematics  
Part of: M-MATH-102903 - Spatial Stochastics

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Prerequisites
none

8.240 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

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**Prerequisites**
None
8.241 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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**Exams**

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**Competence 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 (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 final mark is based on the graded and weighted attainments (such as the written documentation, presentation, practical work and an active participation in class).

**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](http://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.
### 8.242 Course: Special Topics of Numerical Linear Algebra [T-MATH-105891]

**Responsible:** Prof. Dr. Marlis Hochbruck  
**Organisation:** KIT Department of Mathematics  
**Part of:** M-MATH-102920 - Special Topics of Numerical Linear Algebra

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<th>Exam</th>
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**Prerequisites**  
none

Legend: 📘 Online, 📧 Blended (On-Site/Online), 🗣 On-Site, 🗑 Cancelled
8.243 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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<td>ST 2021 0163700 Spectral Theory</td>
<td>4 SWS</td>
<td>Lecturer / 🏫</td>
</tr>
<tr>
<td>ST 2021 0163710 Tutorial for 0163700 (Spectral Theory)</td>
<td>2 SWS</td>
<td>Tutor / 📚</td>
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<th>Grade to a third</th>
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<tbody>
<tr>
<td>ST 2021 0100035 Spectral Theory - Exam</td>
<td></td>
<td>Lamm, Kunstmann, Frey, Hundertmark</td>
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</tbody>
</table>

Below you will find excerpts from events related to this course:

Spectral Theory 0163700, SS 2021, 4 SWS, Language: English, Open in study portal

Organizational issues
Die Vorlesung wird online abgehalten. Nähere Informationen dazu finden Sie im Ilias.

Literature
- J.B. Conway: A Course in Functional Analysis.
- D. Werner: Funktionalanalyse.
8.244 Course: Spin Manifolds, Alpha Invariant and Positive Scalar Curvature [T-MATH-105932]

**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

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<tr>
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<td>Grade to a third</td>
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Economathematics M.Sc.  
Module Handbook as of 30/09/2021
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

<table>
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<tr>
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</table>

**Exams**

| ST 2021   | 7700073 | Splitting Methods for Evolution Equations | Jahnke |

**Prerequisites**

none
8.246 Course: Statistical Learning [T-MATH-111726]

**Responsible:** Prof. Dr. Daniel Hug  
**Organisation:** KIT Department of Mathematics  
**Part of:** M-MATH-105840 - Statistical Learning

<table>
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<tr>
<td>Oral exam</td>
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<td>Grade to a third</td>
<td>1</td>
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</tbody>
</table>

**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.
Course: Statistical Modeling of Generalized Regression Models [T-WIWI-103065]

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

<table>
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<td>Each winter term</td>
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Events

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<td>2521350</td>
<td>Statistical Modeling of Generalized Regression Models</td>
<td>2 SWS</td>
<td>Lecture</td>
<td>Heller</td>
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</tbody>
</table>

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]

Below you will find excerpts from events related to this course:

Statistical Modeling of Generalized Regression Models

2521350, WS 21/22, 2 SWS, Open in study portal

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
### 8.248 Course: Stein's Method [T-MATH-105914]

<table>
<thead>
<tr>
<th><strong>Responsible:</strong></th>
<th>Dr. Matthias Schulte</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Organisation:</strong></td>
<td>KIT Department of Mathematics</td>
</tr>
<tr>
<td><strong>Part of:</strong></td>
<td>M-MATH-102946 - Stein's Method</td>
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<td>Oral examination</td>
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<td>Grade to a third</td>
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</tr>
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</table>

**Prerequisites**

none
8.249 Course: Steins Method with Applications in Statistics [T-MATH-111187]

**Responsible:** Dr. rer. nat. Bruno Ebner

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-105579 - Steins Method with Applications in Statistics

<table>
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**Prerequisites**
none
8.250 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

<table>
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<td>Each winter term</td>
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**Events**

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<th>Course</th>
<th>SWS</th>
<th>Type</th>
<th>Responsible</th>
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<tbody>
<tr>
<td>WT 21/22</td>
<td>2521331</td>
<td>Stochastic Calculus and Finance</td>
<td>2</td>
<td>Lecture</td>
<td>Safarian</td>
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</tbody>
</table>

**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/](http://statistik.econ.kit.edu/)

Below you will find excerpts from events related to this course:

**Stochastic Calculus and Finance**  
2521331, WS 21/22, 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 we 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
8.251 Course: Stochastic Control [T-MATH-105871]

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

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-102908 - Stochastic Control

<table>
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**Prerequisites**
none
# 8.252 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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<td><strong>Credits</strong></td>
<td><strong>Grading scale</strong></td>
<td><strong>Version</strong></td>
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<tr>
<td>Oral examination</td>
<td>8</td>
<td>Grade to a third</td>
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</table>
8.253 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

<table>
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<td>Grade to a third</td>
<td>1</td>
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**Prerequisites**

none
8 COURSES

Course: Stochastic Geometry [T-MATH-105840]

Responsible: Prof. Dr. Daniel Hug
Prof. Dr. Günter Last

Organisation: KIT Department of Mathematics

Part of: M-MATH-102865 - Stochastic Geometry

<table>
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<tr>
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Events

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<tr>
<th>Events</th>
<th>Credits</th>
<th>Grading scale</th>
<th>Version</th>
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<tbody>
<tr>
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<td>4 SWS</td>
<td>Lecture / 🖥</td>
<td>Last</td>
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<tr>
<td>ST 2021 0152610 Übungen zu 0152600 (Stochastische Geometrie)</td>
<td>2 SWS</td>
<td>Practice / 🖥</td>
<td>Last</td>
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</table>

Exams

<table>
<thead>
<tr>
<th>Events</th>
<th>Credits</th>
<th>Grading scale</th>
<th>Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>ST 2021 7700113 Stochastic Geometry</td>
<td></td>
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Legend: Online, Blended (On-Site/Online), On-Site, Cancelled
8.255 Course: Strategic Finance and Technology Change [T-WIWI-110511]

<table>
<thead>
<tr>
<th>Responsible</th>
<th>Prof. Dr. Martin Ruckes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organisation</td>
<td>KIT Department of Economics and Management</td>
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| Part of             | M-WIWI-101480 - Finance 3  
|                     | M-WIWI-101483 - Finance 2 |

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<tr>
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<td>Grade to a third</td>
<td>Each summer term</td>
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<th>Credits</th>
<th>Exam Title</th>
<th>Examiner</th>
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<tbody>
<tr>
<td>ST 2021</td>
<td>1.5</td>
<td>Strategic Finance and Technology Change</td>
<td>Ruckes</td>
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<tr>
<td>WT 21/22</td>
<td>1.5</td>
<td>Strategic Finance and Technology Change</td>
<td>Ruckes</td>
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</tbody>
</table>

**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.
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

<table>
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<tbody>
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**Events**

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<th>Course Title</th>
<th>SWS</th>
<th>Type</th>
<th>Instructor</th>
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<tbody>
<tr>
<td>ST 2021</td>
<td>2577921</td>
<td>Strategy and Management Theory: Developments and &quot;Classics&quot; (Master)</td>
<td>2</td>
<td>Seminar / Online</td>
<td>Lindstädt</td>
</tr>
<tr>
<td>WT 21/22</td>
<td>2577921</td>
<td>Strategy and Management Theory: Developments and &quot;Classics&quot; (Master)</td>
<td>2</td>
<td>Seminar</td>
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**Exams**

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<th>Term</th>
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<tr>
<td>ST 2021</td>
<td>7900126</td>
<td>Strategy and Management Theory: Developments and &quot;Classics&quot;</td>
<td>Lindstädt</td>
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</table>

**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:
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

Strategy and Management Theory: Developments and "Classics" (Master)
2577921, WS 21/22, 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 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
### 8.257 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

<table>
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<th>Recurrence</th>
<th>Version</th>
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<td>4</td>
<td>Grade to a third</td>
<td>Irregular</td>
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</table>

**Prerequisites:**  
none
8.258 Course: Supplement Enterprise Information Systems [T-WIWI-110346]

**Responsible:** Prof. Dr. Andreas Oberweis
**Organisation:** KIT Department of Economics and Management
**Part of:** M-WIWI-101472 - Informatics

<table>
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<th>Recurrence</th>
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<td>4.5</td>
<td>Grade to a third</td>
<td>Each term</td>
<td>1</td>
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</table>

**Competence Certificate**
The assessment of this course is a written or (if necessary) oral examination.
Depending on the particular course associated with this placeholder a bonus on the examination grade is possible.

**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.
Course: Supplement Software- and Systemsengineering [T-WIWI-110372]

**8.259 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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<td>4.5</td>
<td>Grade to a third</td>
<td>Each term</td>
<td>1</td>
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**Competence Certificate**
The assessment of this course is a written or (if necessary) oral examination.
Depending on the particular course associated with this placeholder a bonus on the examination grade is possible.

**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 assigned to another course of this topic.
8.260 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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<tr>
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<th>Grading scale</th>
<th>Recurrence</th>
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<tbody>
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<td>Written examination</td>
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<td>Grade to a third</td>
<td>Each summer term</td>
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Events

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<tr>
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<th>Code</th>
<th>Title</th>
<th>SWS</th>
<th>Type</th>
<th>Lecturer</th>
<th>Grade</th>
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</thead>
<tbody>
<tr>
<td>ST 2021</td>
<td>2550486</td>
<td>Taktisches und operatives SCM</td>
<td>2</td>
<td>Lecture</td>
<td>Nickel</td>
<td></td>
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<tr>
<td>ST 2021</td>
<td>2550487</td>
<td>Übungen zu Taktisches und operatives SCM</td>
<td>1</td>
<td>Practice</td>
<td>Pomes, Bakker</td>
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Exams

<table>
<thead>
<tr>
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<th>Code</th>
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<th>SWS</th>
<th>Type</th>
<th>Lecturer</th>
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<tbody>
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<td>7900312</td>
<td>Tactical and Operational Supply Chain Management</td>
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<td>WT 21/22</td>
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<td>Practice</td>
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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:

**Taktisches und operatives SCM**

2550486, SS 2021, 2 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 timeslot. 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
- Ghiani, Laporte, Musmanno: Introduction to Logistics Systems Planning and Control, Wiley, 2004
- Gudehus: Logistik, 3. Auflage, Springer, 2005
8.261 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

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### 8.262 Course: Time Series Analysis [T-MATH-105874]

**Responsible:** Prof. Dr. Norbert Henze  
PD Dr. Bernhard Klar  

**Organisation:** KIT Department of Mathematics  
**Part of:** M-MATH-102911 - Time Series Analysis  

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<td>Lecture</td>
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<td>Klar</td>
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Legend: 🌐 Online, 🧩 Blended (On-Site/Online), 🔔 On-Site, ✗ Cancelled
8.263 Course: Topics in Experimental Economics [T-WIWI-102863]

**Responsible:** Prof. Dr. Johannes Philipp Reiß

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

**Part of:** M-WIWI-101505 - Experimental Economics

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**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.
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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**Exams**

| ST 2021 | 7700083 | Topological Data Analysis | Ott |

**Prerequisites**

none
### 8.265 Course: Topological Groups [T-MATH-110802]

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<td>Irregular</td>
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**Responsible:** Dr. rer. nat. Rafael Dahmen  
Prof. Dr. Wilderich Tuschmann

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-105323 - Topological Groups

**Prerequisites**
none
Module: Traveling Waves [T-MATH-105897]

**Responsible:** Prof. Dr. Jens Rottmann-Matthes

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-102927 - Traveling Waves

**Type:** Oral examination

**Credits:** 6

**Grading scale:** Grade to a third

**Version:** 1
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

| ST 2021 | 0164400 | Uncertainty Quantification | 2 SWS | Lecture / Online | Kusch |
| ST 2021 | 0164410 | Tutorial for 0164400      | 1 SWS | Practice / Online| Kusch |

Exams

| ST 2021 | 7700045 | Uncertainty Quantification | Frank, Kusch |

Prerequisites
none

Below you will find excerpts from events related to this course:

Uncertainty Quantification
0164400, SS 2021, 2 SWS, Language: English, Open in study portal

Literature

### 8.268 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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#### Events

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<tbody>
<tr>
<td>WT 21/22</td>
<td>2530212</td>
<td>Valuation</td>
<td>2</td>
<td>Lecture</td>
<td>Ruckes</td>
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<td>WT 21/22</td>
<td>2530213</td>
<td>Übungen zu Valuation</td>
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<td>Practice</td>
<td>Ruckes, Luedecke</td>
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#### Exams

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<td>WT 21/22</td>
<td>7900057</td>
<td>Valuation</td>
<td>Ruckes</td>
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</table>

#### Competence Certificate

See German version.

#### Prerequisites

None

#### Recommendation

None

**Below you will find excerpts from events related to this course:**

**Valuation**  
2530212, WS 21/22, 2 SWS, Language: English, [Open in study portal](#)

**Literature**

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

**Organisation:** KIT Department of Mathematics

**Part of:** M-MATH-105093 - Variational Methods
8.270 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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<td>Irregular</td>
<td>1</td>
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**Prerequisites**
none
### 8.271 Course: Wavelets [T-MATH-105838]

| Responsible: | Prof. Dr. Andreas Rieder |
| Organisation: | KIT Department of Mathematics |
| Part of: | M-MATH-102895 - Wavelets |

<table>
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<td>Irregular</td>
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#### Exams

| ST 2021 | 7700106 | Wavelets | Rieder |

**Competence Certificate**

Mündliche Prüfung im Umfang von ca. 30 Minuten.

**Prerequisites**

none
8.272 Course: Web App Programming for Finance [T-WIWI-110933]

**Responsible:** Jun.-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>
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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.
8.273 Course: Web Science [T-WIWI-103112]

Responsible: Michael Färber
Organisation: KIT Department of Economics and Management
Part of: M-WIWI-101472 - Informatics

<table>
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Exams

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<td>WT 21/22</td>
<td>7900031</td>
<td>Web Science</td>
<td>Sure-Vetter</td>
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</table>

Competence Certificate
The exam will be offered for the last time for first-time takers in the summer semester 2021. The last opportunity to take the exam (for repeaters only) is in the winter semester 2021/22.

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

Annotation
The lecture is no longer offered.
8.274 Course: Workshop Business Wargaming – Analyzing Strategic Interactions [T-WIWI-106189]

**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**

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**Exams**

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Legend: 🕵️ Online, 🎧 Blended (On-Site/Online), 🕵️ On-Site, ✗ 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 2021, 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.

Organizational issues
4 Blöcke mittwochs nachmittags
siehe Institutshomepage
8.275 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>Irregular</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.